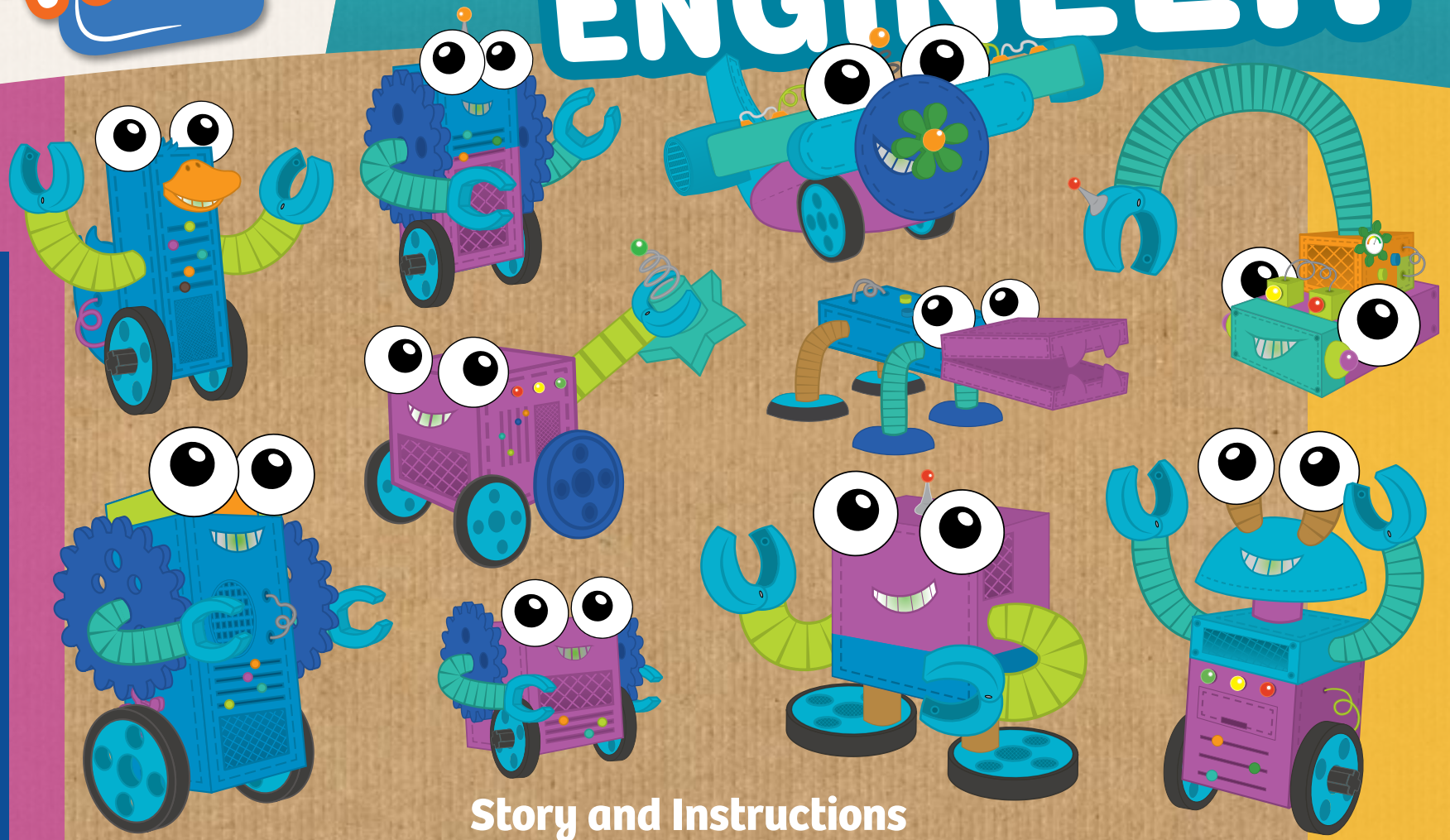
KIDS FIRST

ROBOT ENGINEER



Story and Instructions

THAMES & KOSMOS

Dear Parents,

Engineering is an extremely exciting and vast field. This kit, along with its illustrated storybook and instruction manual, provides an engaging way to teach simple engineering concepts to preschool-age kids.

Read the story with your child and build simple models of the fantastic robots that the main characters encounter on their educational robotics field trip. Along this roundabout journey, the characters meet various robots that solve problems and complete tasks in the story. As you follow the story, your child can build models of the ten robots in the story with your help. The primary functional components of the robot models are gears and wheels. Your child will be introduced to gear trains, gear ratios, and wheel-and-axle simple machines while building the models. Large, colorful plastic building pieces make it easy for small hands to put the models together.

The models are assembled step by step using a construction system. It will require a little practice and patience at first. Please assist your children when they need your help, but also let them try to build the models by themselves. Your children will be happy to have your help with the models or assembly steps that pose particular difficulties.

We wish you and your child lots of fun building, discovering, and learning!

Safety Information

⚠ WARNING:

CHOKING HAZARD — Small parts.
Not for children under 3 yrs.

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

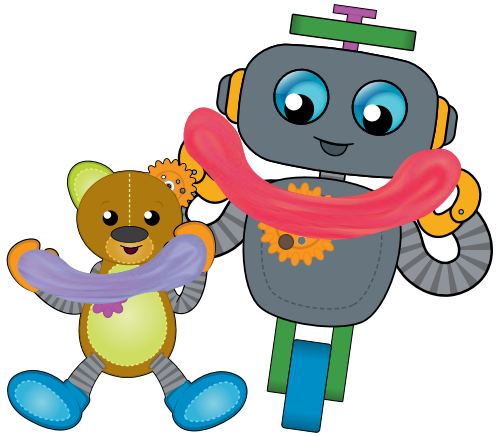
››› Keep the packaging and instructions as they contain important information.

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

ROBOT ENGINEER

Story by
Ashley Greenleaf and Ted McGuire

Illustrations by
Dan Freitas and Ashley Greenleaf



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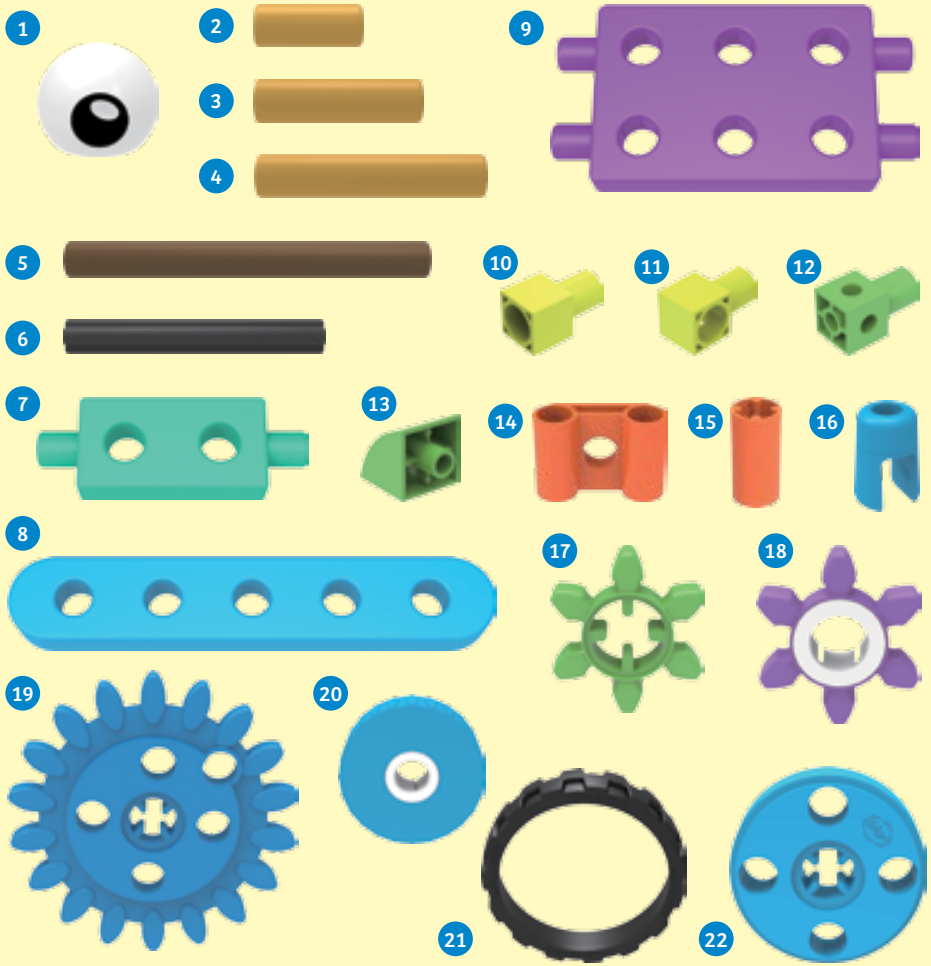
››› KIT CONTENTS

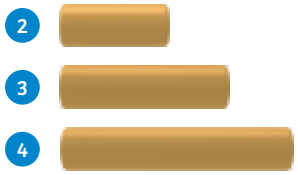
GOOD TO KNOW !
If you are missing any parts, please contact Thames & Kosmos customer service.

What's inside your kit:



Checklist: Find – Inspect – Check off

✔	No.	Description	Qty.	Item No.
❍	1	Eye	2	7261-W85-A
❍	2	Dowel, 4 cm	6	7268-W11-B1T
❍	3	Dowel, 6 cm	2	7330-W11-X1T
❍	4	Dowel, 8 cm	2	7330-W11-A1T
❍	5	Long Dowel	1	7330-W11-B1D
❍	6	Axle	4	7268-W11-A1D
❍	7	2-hole rod	2	7330-W11-H1G
❍	8	5-hole rod	2	7330-W11-D1B1
❍	9	6-hole panel	2	7330-W11-C1P
❍	10	Dowel block with top hole	4	7331-W10-D1G
❍	11	Dowel block with side hole	6	7331-W10-D2G
❍	12	Cube block with peg	1	7331-W10-D3G1
❍	13	Convex block	2	880-W10-R1G4
❍	14	Straight track connector	1	7331-W10-A1O
❍	15	Axle connector	2	7268-W10-C1O
❍	16	Connector clip	2	7261-W85-B1B
❍	17	Small gear, green	3	7331-W10-L2G1
❍	18	Small gear with adapter	2	7331-W85-L1P
❍	19	Jumbo gear	2	8060-W10-A2B
❍	20	Small wheel	1	8036-W85-I1B1
❍	21	Tire	2	7268-W10-E1D
❍	22	Wheel	2	7268-W10-D1B



NOTE !
The three lengths of short dowels can be difficult to tell apart in the building instructions. They are numbered in the instructions so you know which one to use.

Actual Length:

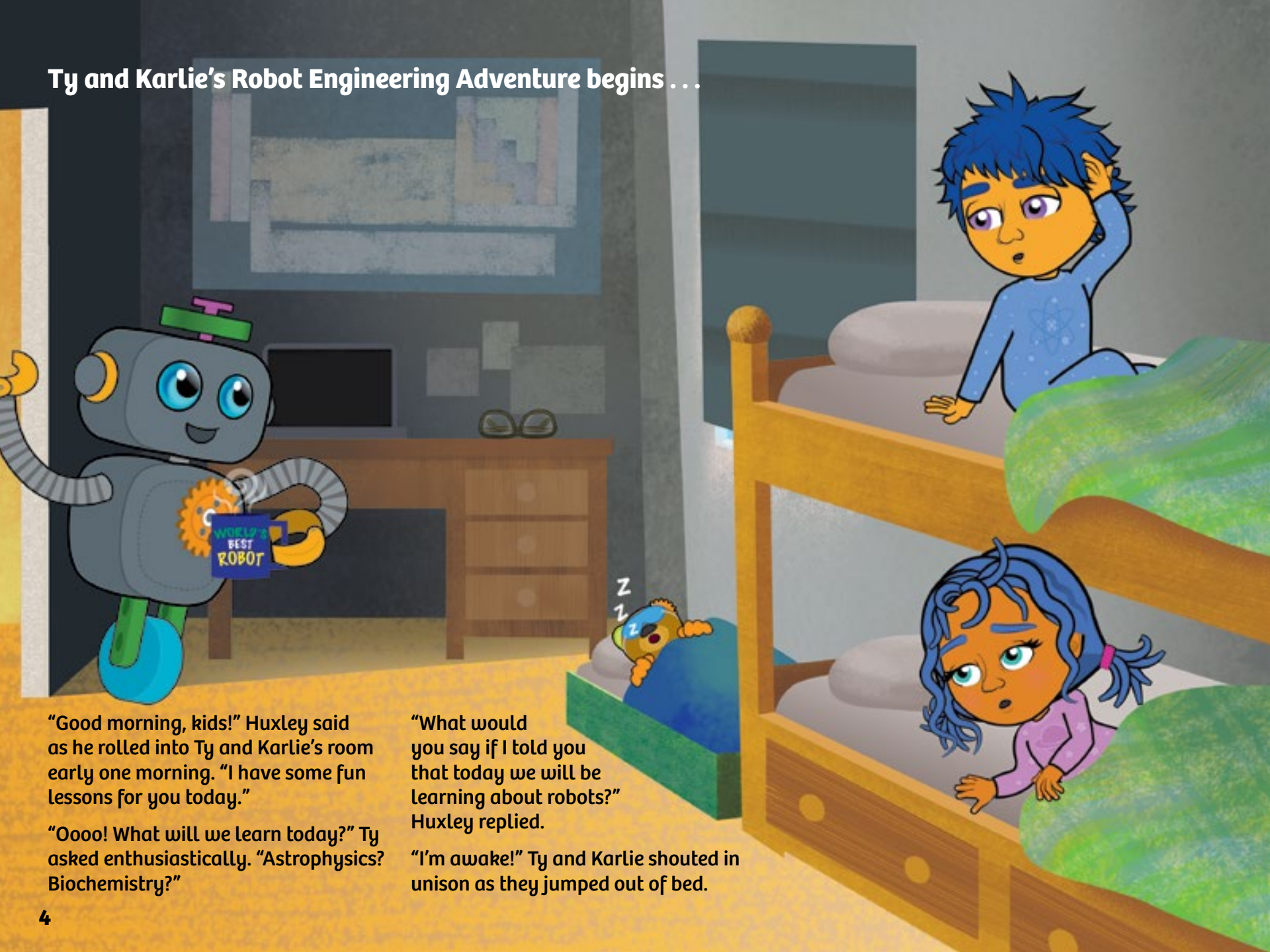
Meet the Omega Family!

Ty and Karlie Omega are siblings. They live in a small city called Makersville. Ty and Karlie's dad is a writer. He writes science fiction stories. Their mom is a mechanical engineer. She designs big machines used in factories.

They live in an awesome warehouse filled with tools, equipment, and building materials. There are always a number of projects going on in the warehouse.

Ty loves figuring out how things work. Karlie loves building things.

When Ty and Karlie were little, Ms. O designed Huxley, a robot that can build just about anything. For one of his first projects Huxley converted Karlie's teddy bear, Remus, into a walking, talking science bear. Now Huxley and Remus are like members of the Omega family.



"Good morning, kids!" Huxley said as he rolled into Ty and Karlie's room early one morning. "I have some fun lessons for you today."

"Oooo! What will we learn today?" Ty asked enthusiastically. "Astrophysics? Biochemistry?"

"What would you say if I told you that today we will be learning about robots?" Huxley replied.

"I'm awake!" Ty and Karlie shouted in unison as they jumped out of bed.

Huxley took the kids to the park to begin the first robotics lesson.

"I want to show you some robots that are programmed to do helpful tasks," Huxley said. "You can find robots in all sorts of places, even this park. This is Debby the Duckbot. Did you know that one of the first robots ever built was designed to act like a duck?"

"Cool! A duckbot! Can we take her to the pond?" asked Karlie.

"I'm afraid not. This model isn't made to go in the water. She has wheels and electronic circuits that would short out in water," replied Huxley.

"What can the duckbot do?" asked Ty.

"She can move around on her wheels, see objects with her light sensors, and pick up objects with her grippers. She is picking blueberries from that bush," Huxley said and pointed to Debby. "Now follow me. Let's take a look at another robot."

DEBBY THE DUCKBOT

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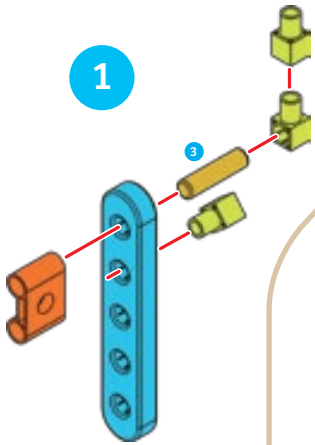

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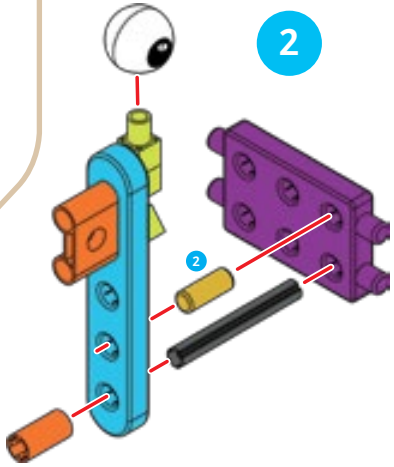

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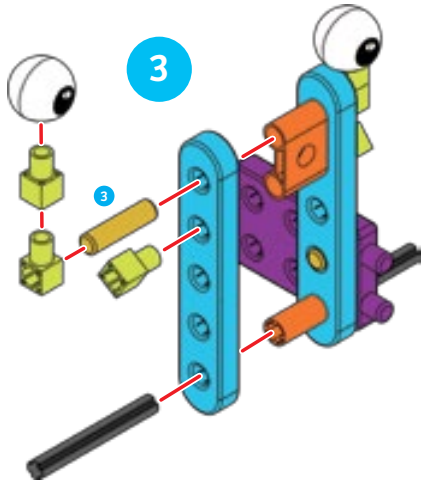

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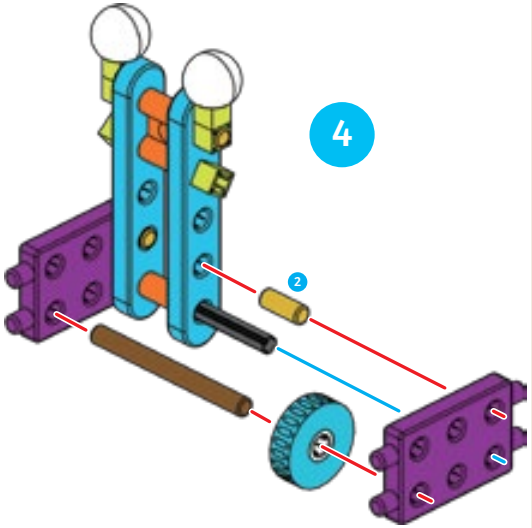

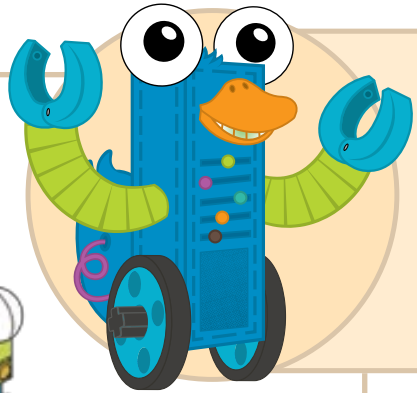

"Hi, I'm Debby. I look like a duck but I'm a robot. Robots are machines that are given a series of orders, called a program. The program tells the robot what to do in different situations. For example, when my blueberry sensors detect a blueberry, they tell my gripper claw to pick it!"

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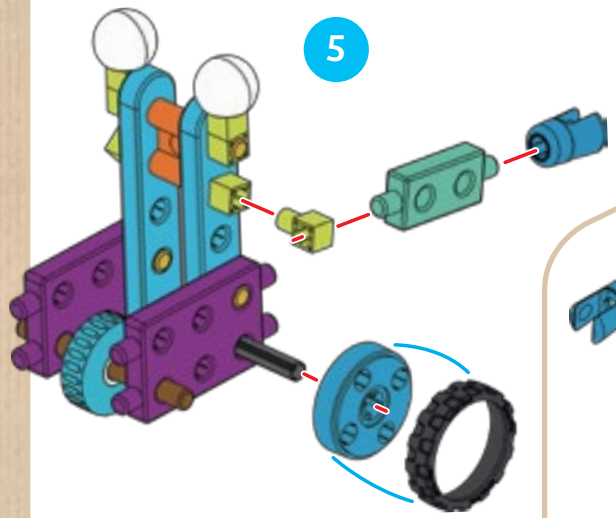

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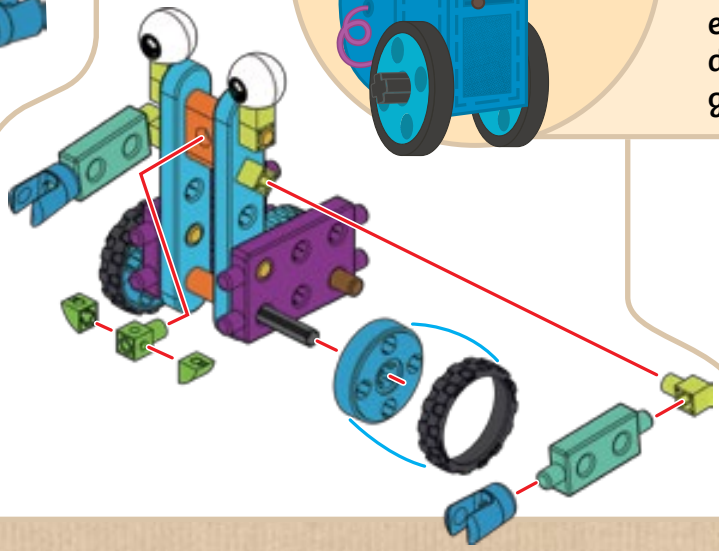

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Done!

"This is Toro, a gardening robot. His arms move when his gears turn, and his gears turn when his wheels spin," said Huxley. "It's a good thing we found him because we need to upgrade his code. He is programmed to detect colorful flowers and weed around them, but he only seems to detect candy! We have to rewrite the code to improve this."

Just then, Remus pointed to something in the sky.

"Look! A blimp!" Karlie announced. Everyone looked up. There was a huge blimp in the sky with a giant candy printed on its side.

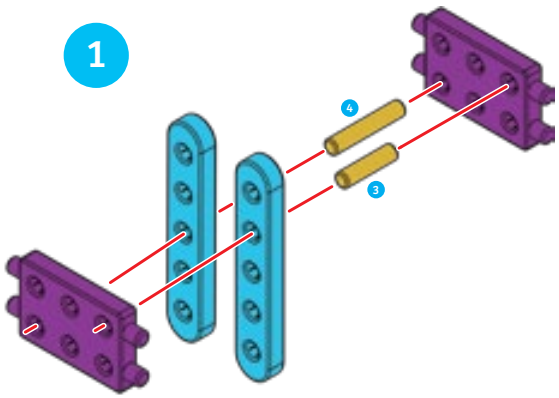
They were distracted looking at the blimp so they didn't notice that Toro had started racing down the street.

"Oh no, we need to catch him!" yelled Ty. "He's chasing the blimp because of the candy printed on it. He might run into a tree or a river or a busy road."

They all ran fast to chase after the runaway robot.

TORO THE THREE-WHEELED ROBOT

1



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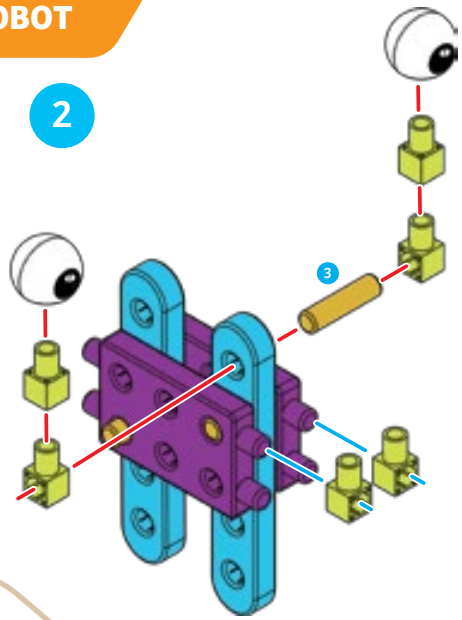

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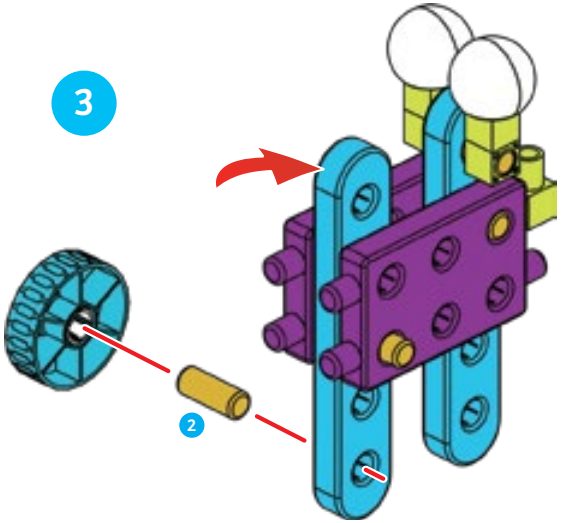

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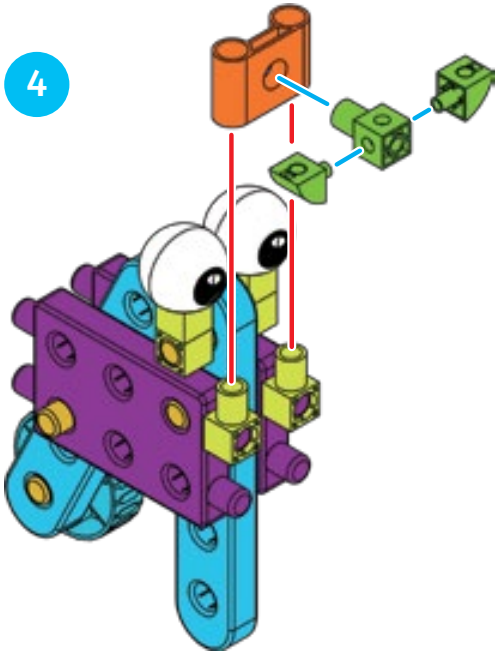

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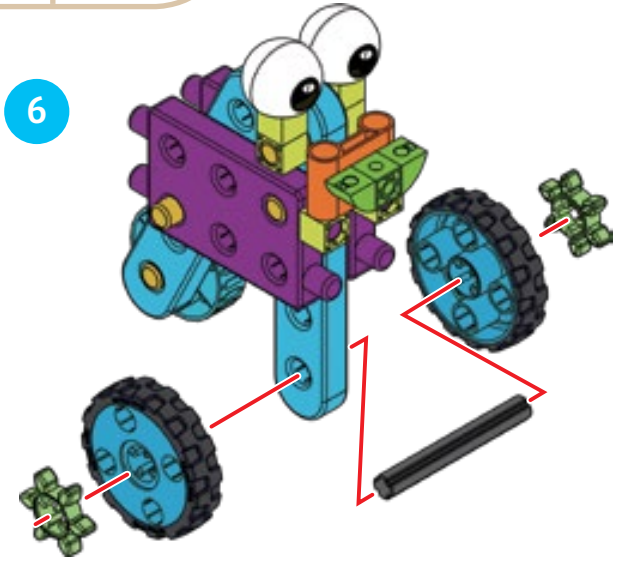

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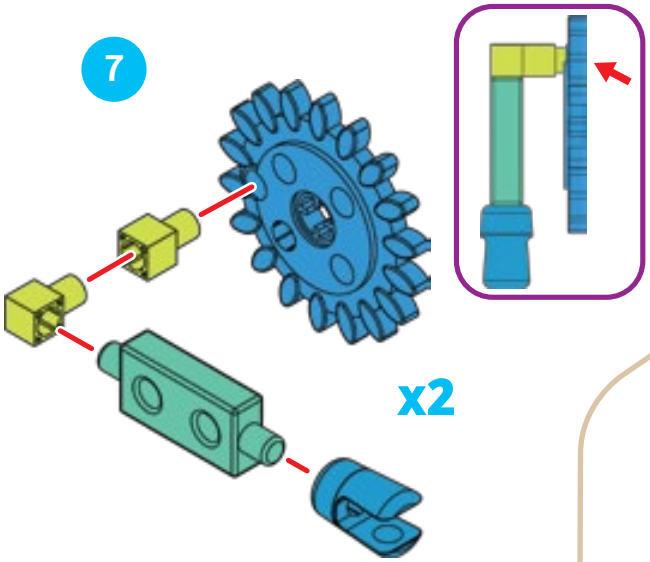

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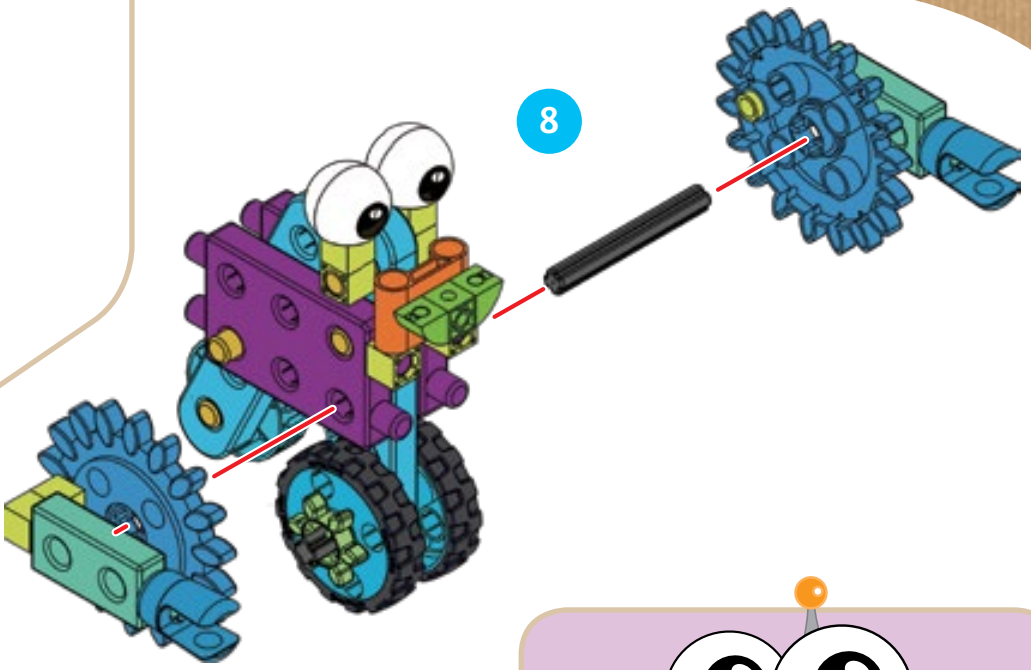

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Done!

"Hi, I'm Toro. When my wheels turn, they spin their axle. The axle has a small gear on it. That gear spins the large gear. My arms are attached to the large gear. So when my wheels turn, my arms turn too! I was designed to roll through a garden and pick weeds as I go, but my program has a bug in it, so I would rather look for and pick up candy."

They chased Toro into town.

"He turned down this street, but now I don't see him anywhere!" Karlie shouted.

"We should ask if any of the neighbors saw him," replied Ty. He pointed to a funny building shaped like a gumdrop. "Maybe he went there!"

Before they could knock, an elderly woman opened the door. The kids introduced themselves.

"Nice to meet you all. This is my lookout robot, Sol. He spotted you while he was watching for my grandkids to arrive. My name is Ruby. Welcome to Bots and BonBons, the only candy factory run by robots."

"Candy and robots?! Can we take a peek?" asked Karlie. "Toro might have seen all the candy and come in here."

Ruby agreed to show them around the candy factory.

SOL THE LOOKOUT ROBOT

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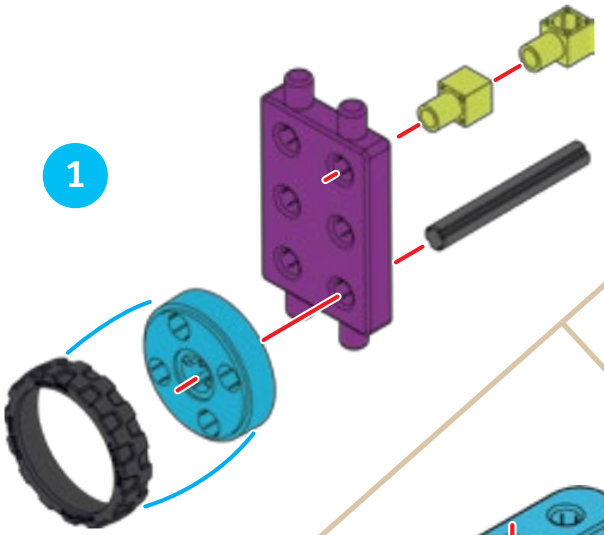

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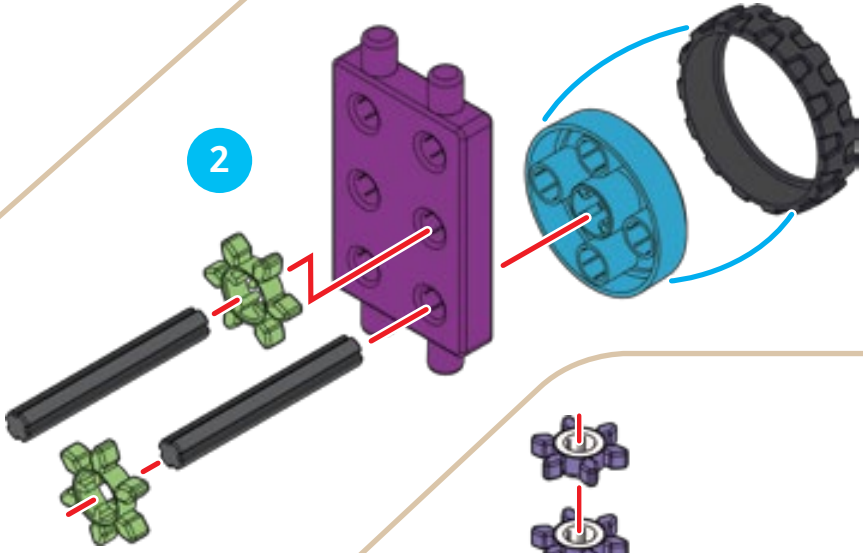

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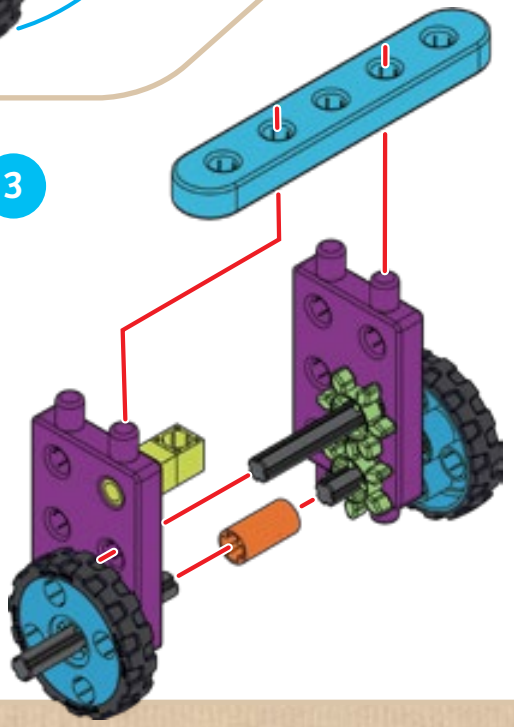

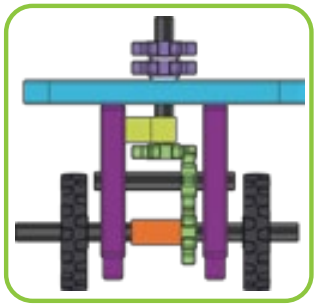

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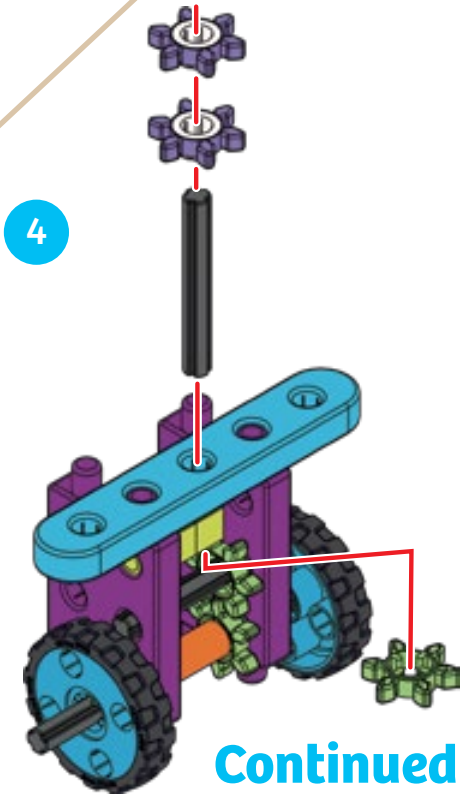

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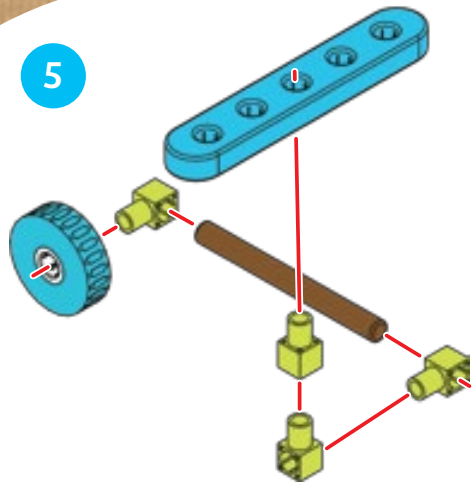

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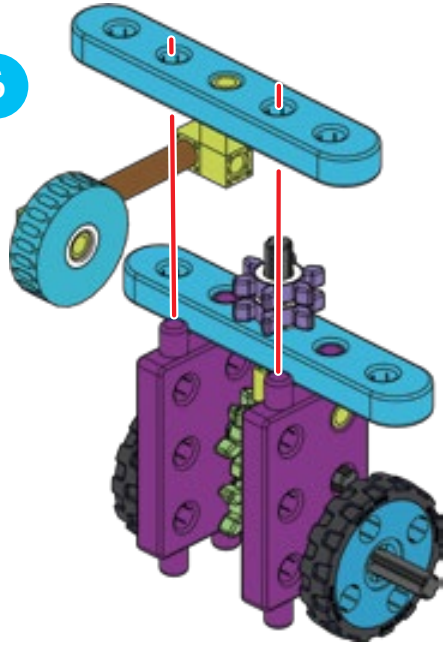

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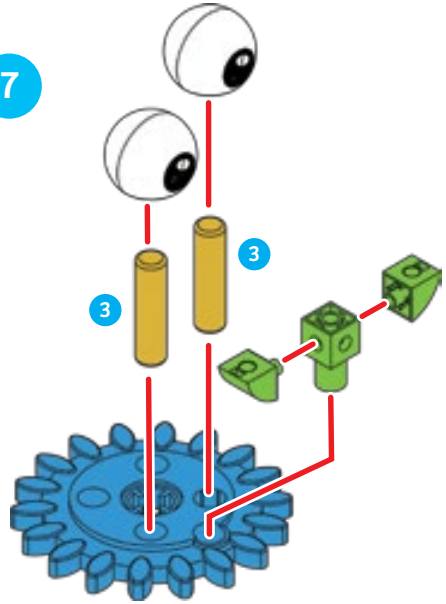

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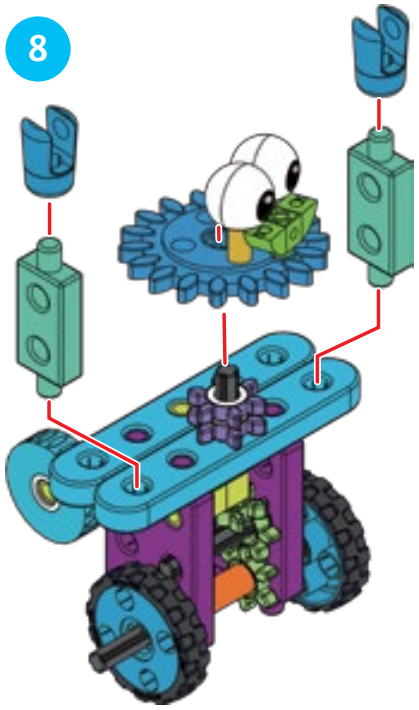
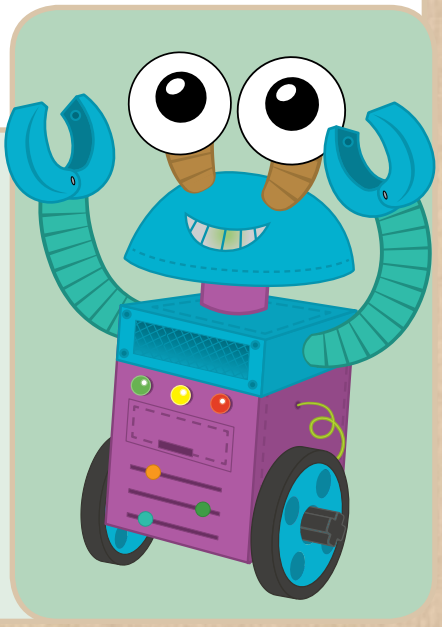


9 Done!

"Who goes there? Hi, I'm Sol. My motion and color sensors act as my eyes. My wheels are connected to gears that are ultimately connected to my head. So when my wheels turn, my head spins around. This way, I can see in all directions around me."



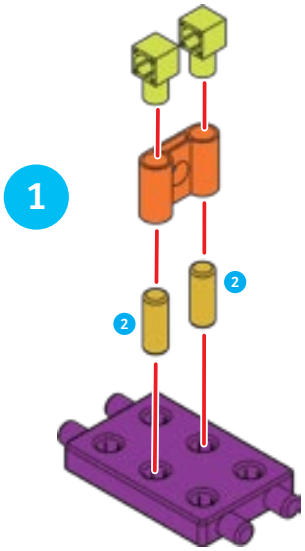
"Meet Adam. He is using his long robotic arm to gently place chocolate truffles on the conveyor belt so they can be decorated with sugar and sprinkles," said Ruby.

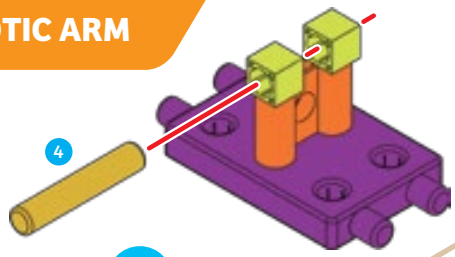
Remus climbed onto the conveyor belt and tried to pick up one of the truffles, but it was too gooey and it stuck to his paw.

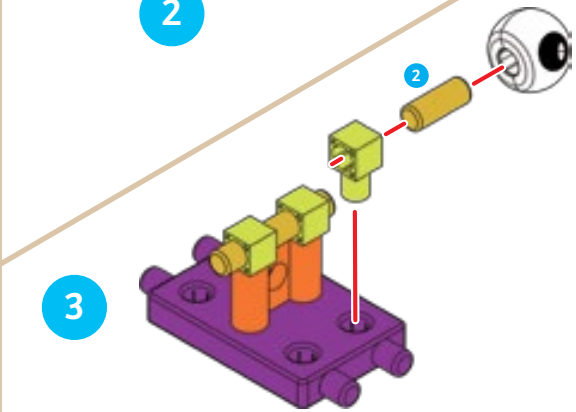
"Adam's arm is specially designed for picking up gooey chocolates without squishing them," explained Ruby.

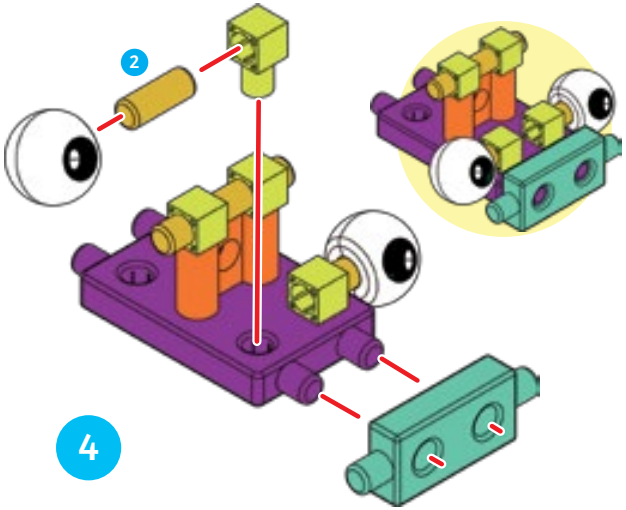
"Let's follow the conveyor belt and see what happens next," said Ty.

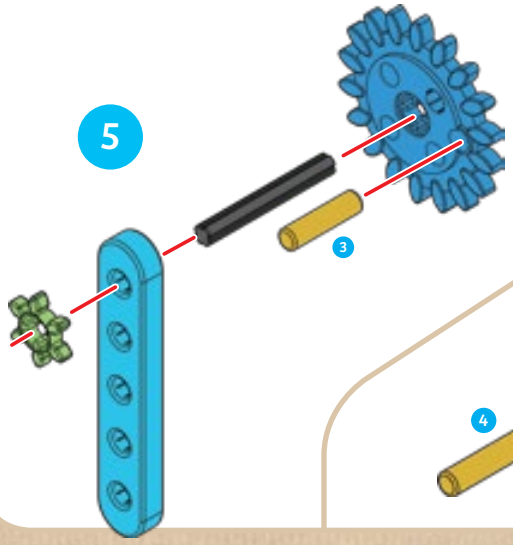
ADAM THE ROBOTIC ARM

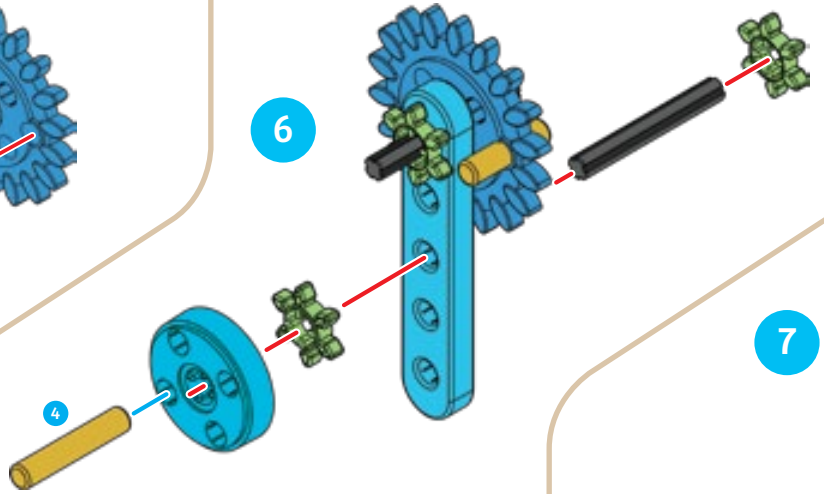


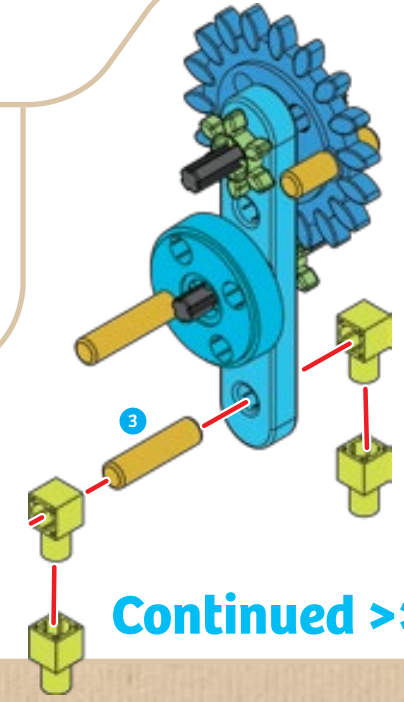












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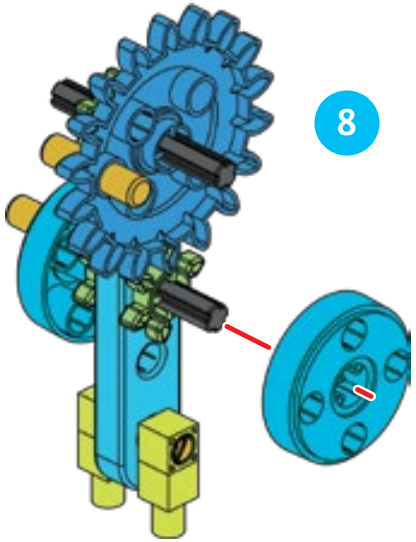

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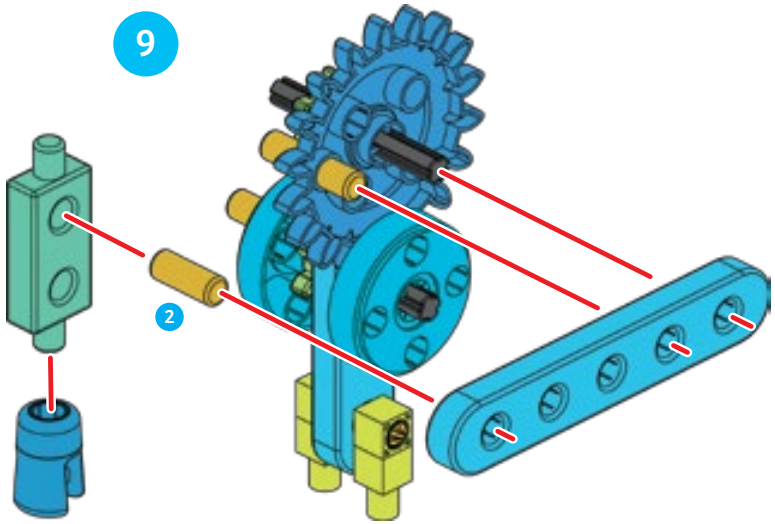

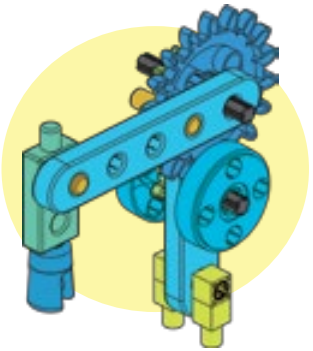

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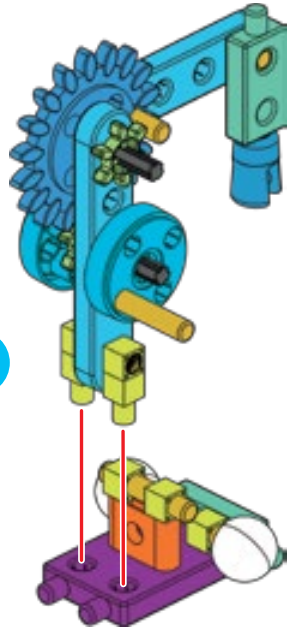

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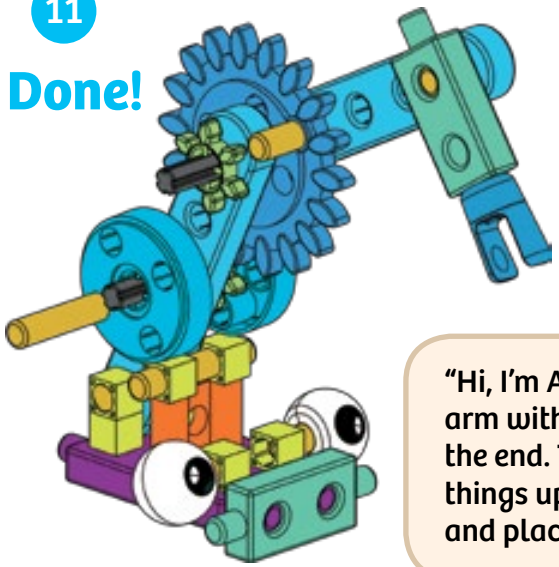
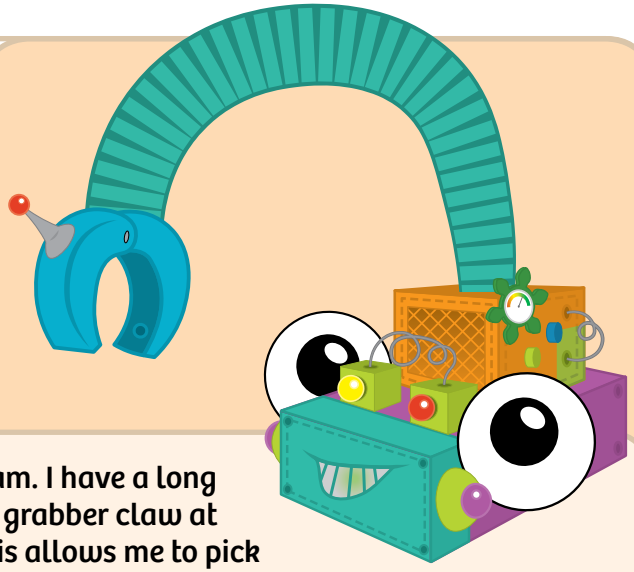
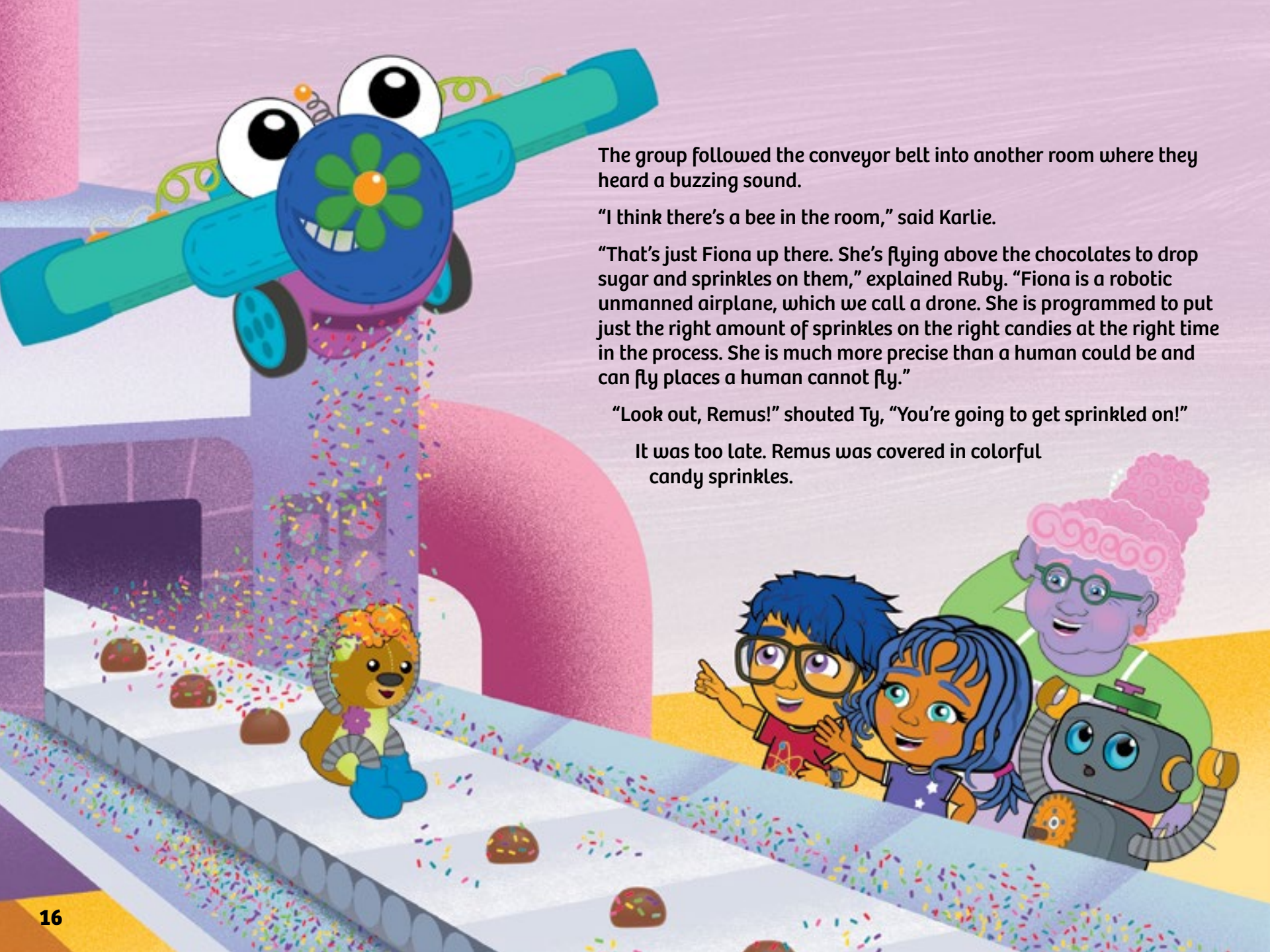
Done!





"Hi, I'm Adam. I have a long arm with a grabber claw at the end. This allows me to pick things up, move them around, and place them down again."



The group followed the conveyor belt into another room where they heard a buzzing sound.

"I think there's a bee in the room," said Karlie.

"That's just Fiona up there. She's flying above the chocolates to drop sugar and sprinkles on them," explained Ruby. "Fiona is a robotic unmanned airplane, which we call a drone. She is programmed to put just the right amount of sprinkles on the right candies at the right time in the process. She is much more precise than a human could be and can fly places a human cannot fly."

"Look out, Remus!" shouted Ty, "You're going to get sprinkled on!"

It was too late. Remus was covered in colorful candy sprinkles.

FIONA THE FLYING ROBOT

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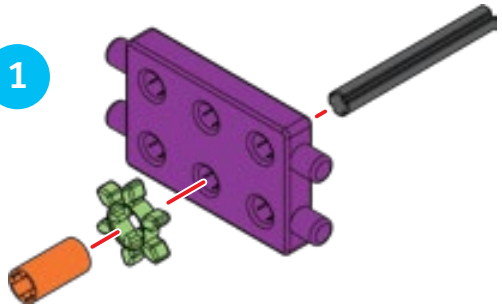

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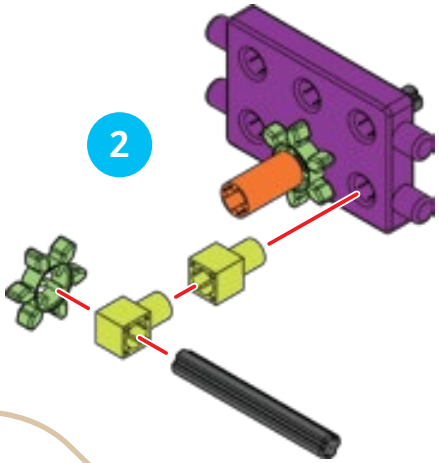

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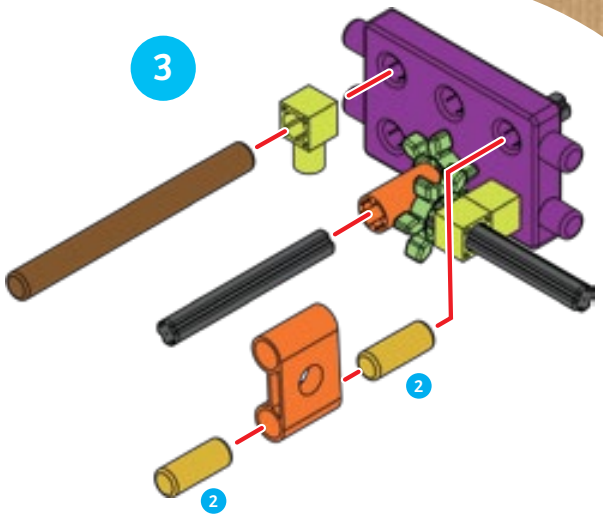

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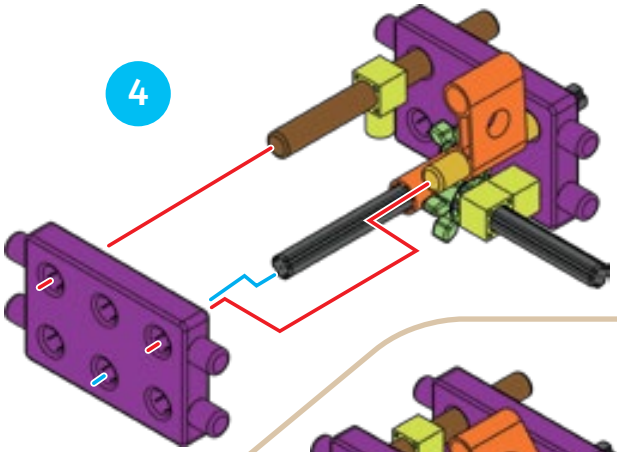

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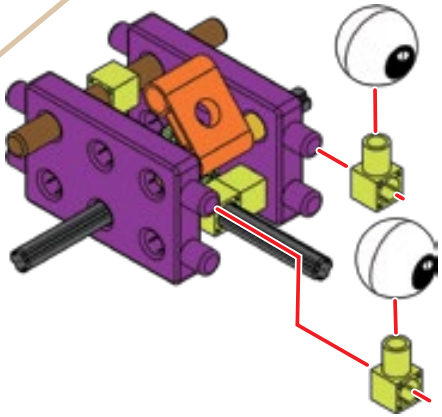

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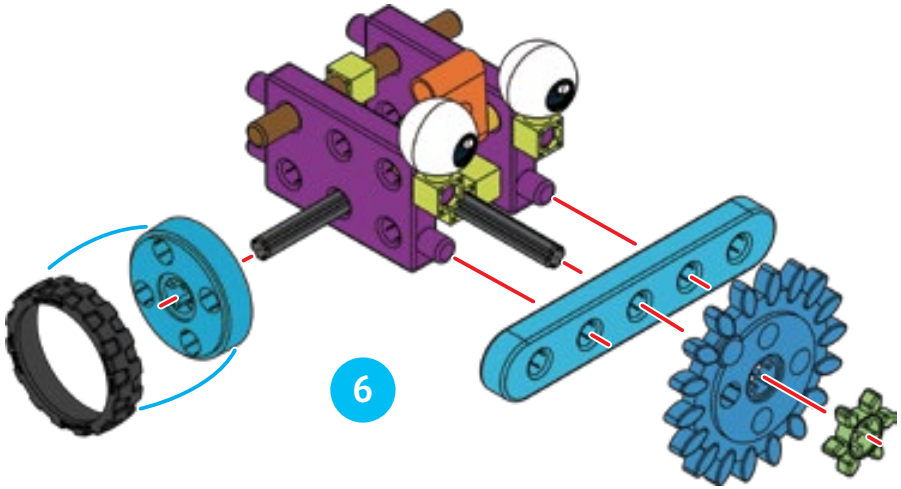

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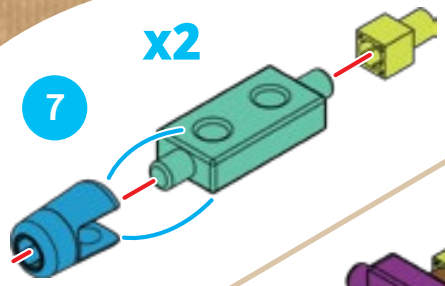

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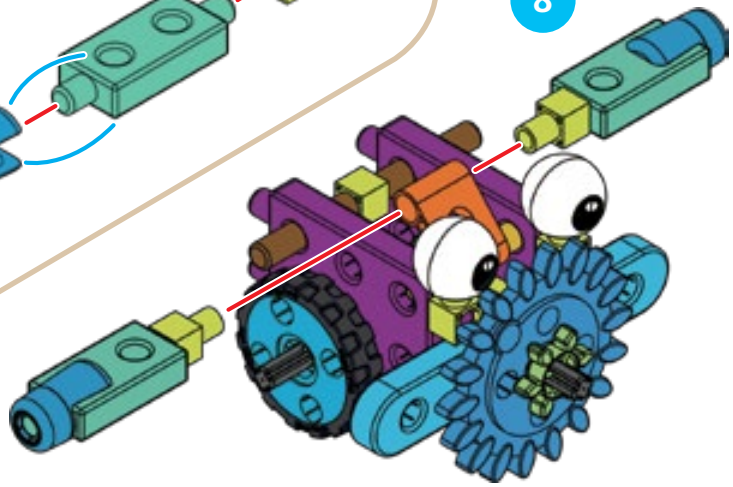

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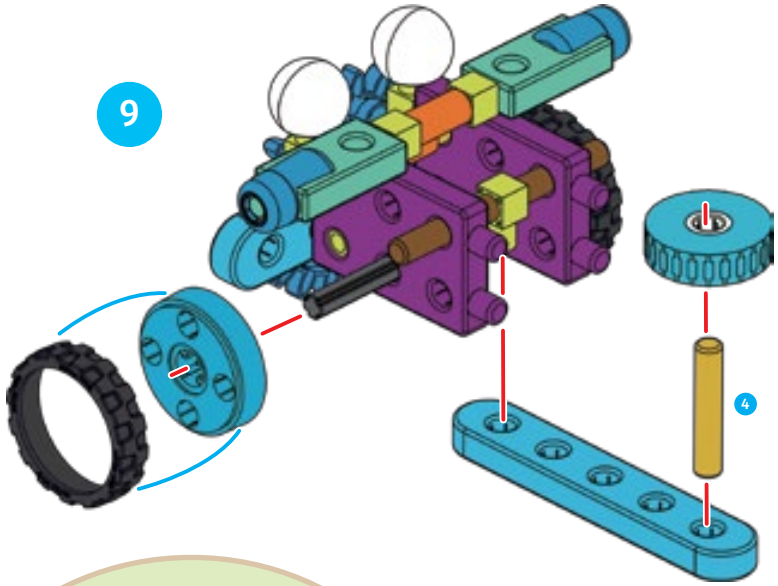

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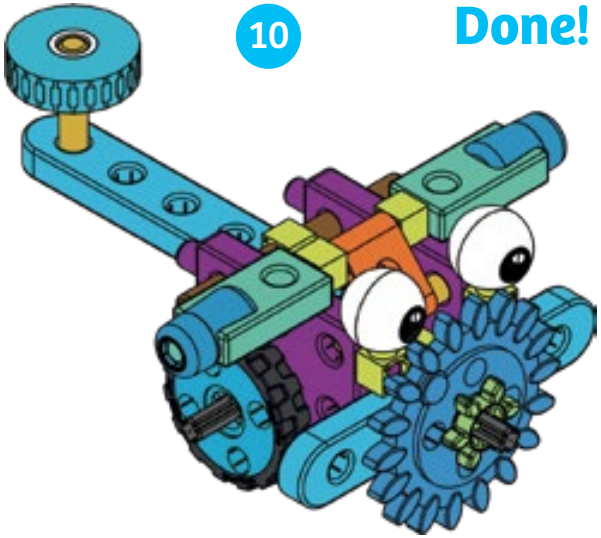

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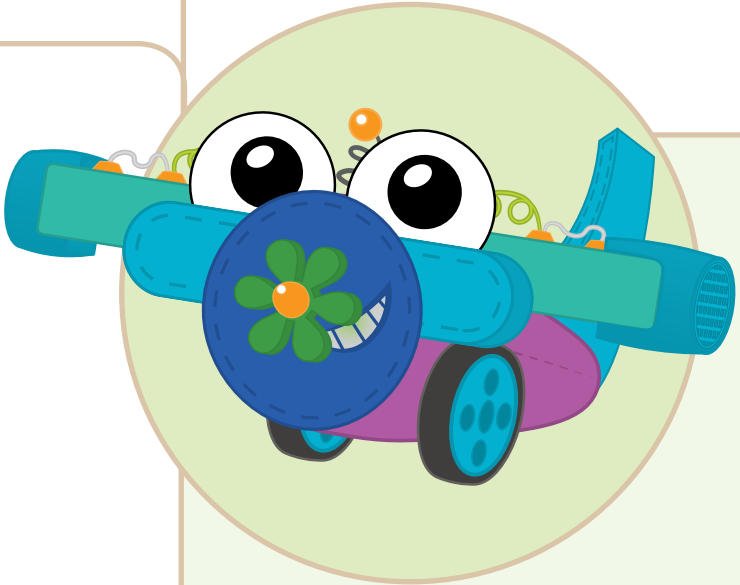


"Hi, I'm Fiona. I'm a flying robot. I have complex programs that control my propellers and wings to keep me in the air in the perfect position to sprinkle coatings onto candies."

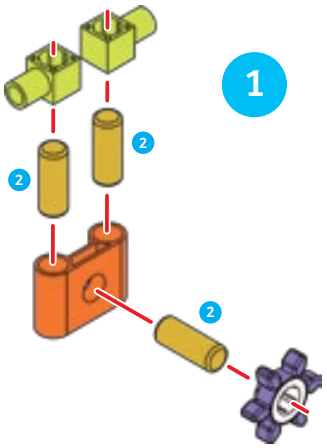
"Let's check out the taffy room. Here is Toby. His powerful arms move up and down to stretch our taffy and make it soft and chewy," said Ruby as she handed the kids some taffy. "He can handle so much more taffy than a single person could ever manage."

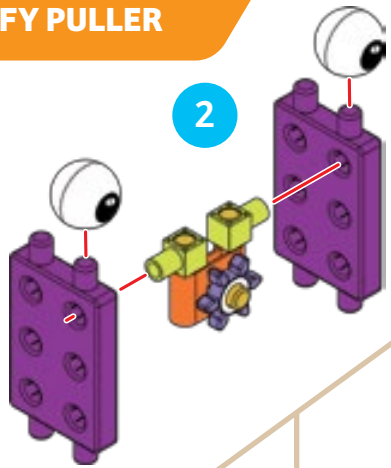
"Wow!" said Karlie, "Taffy pulling looks like a lot of work!"

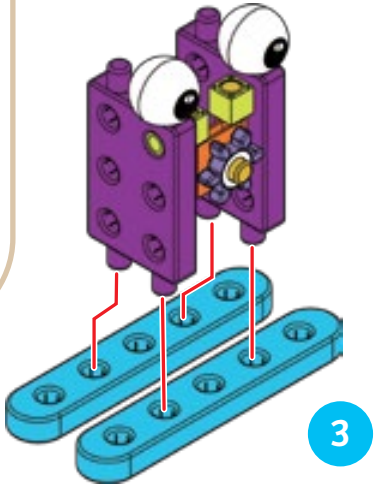
"It is for us, but not for Toby," replied Ruby.

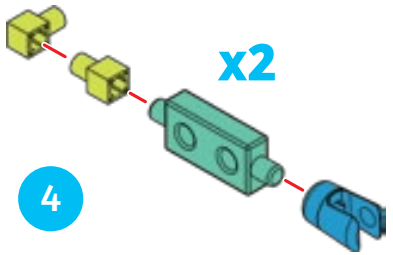
There was still no sign of Toro.

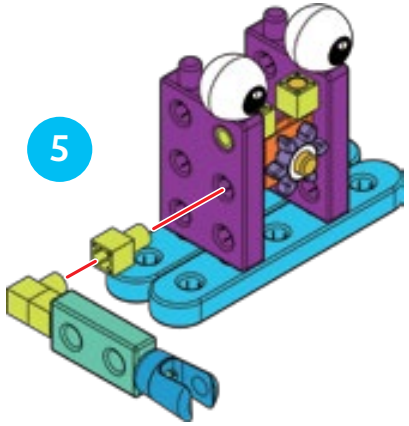
TOBY THE TAFFY PULLER

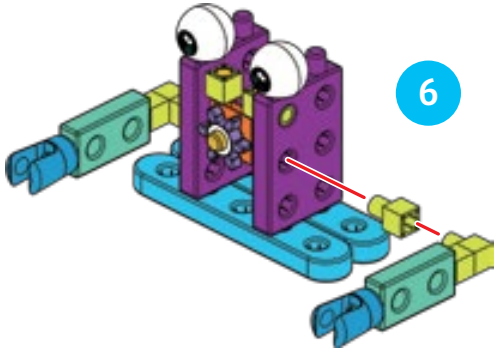


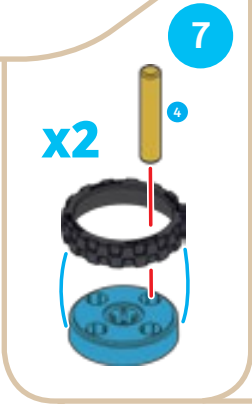


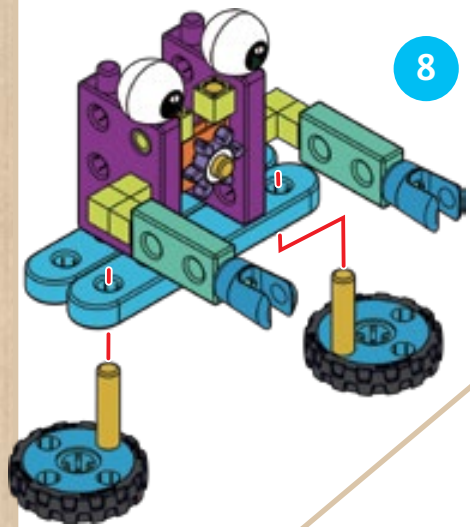


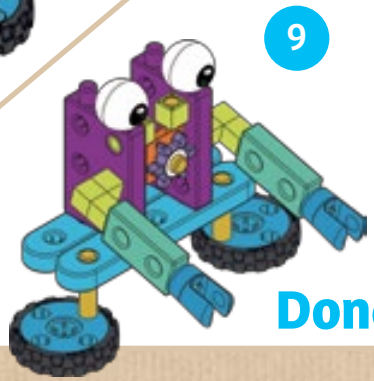




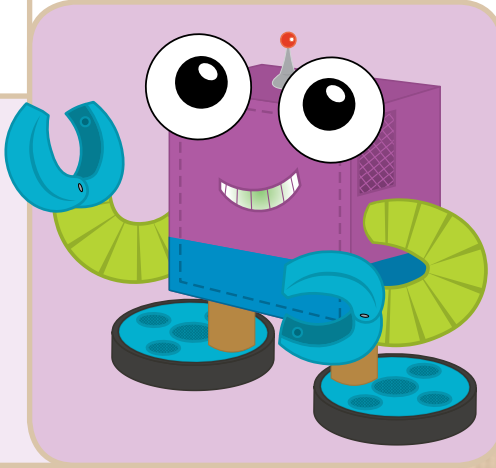








"Hi, I'm Toby. I use my arms with powerful pneumatic cylinders to stretch large ribbons of taffy. I have huge pads on my feet to keep me stable while I do my job."



"Here is Nell. She kneads flavors, colors, and sweeteners into a gum base to make bubblegum," explained Ruby.

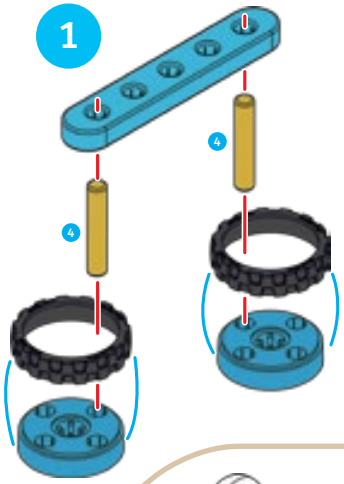
She offered a bowl full of chewing gum to the kids.

"Green apple, my favorite!" Ty said as he tossed a piece in his mouth.

"I have one more robot to show you. Follow me," Ruby said.

NELL THE KNEADING ROBOT

1



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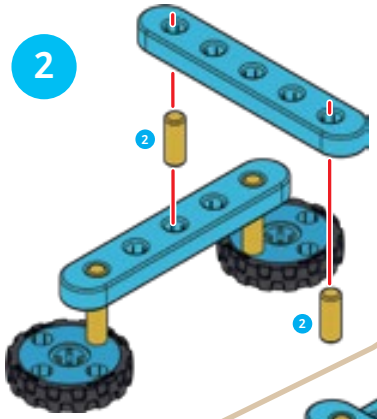

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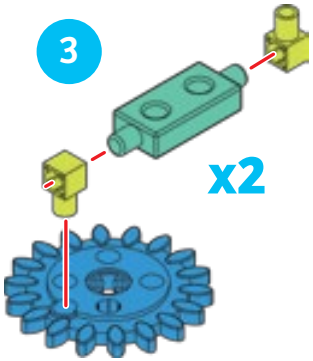

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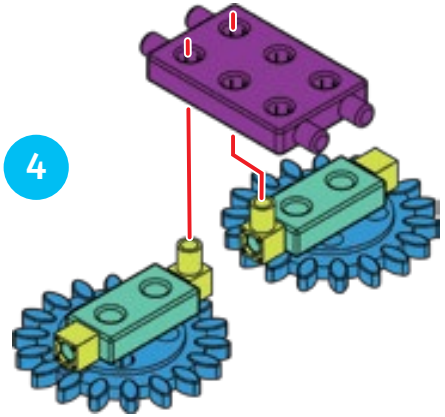

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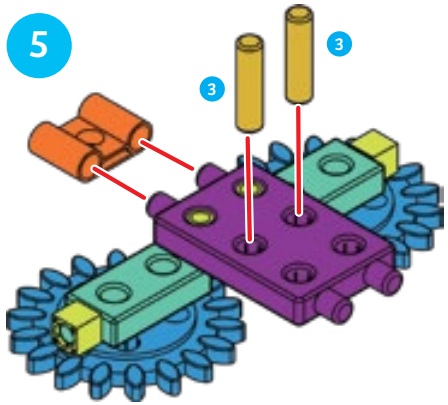

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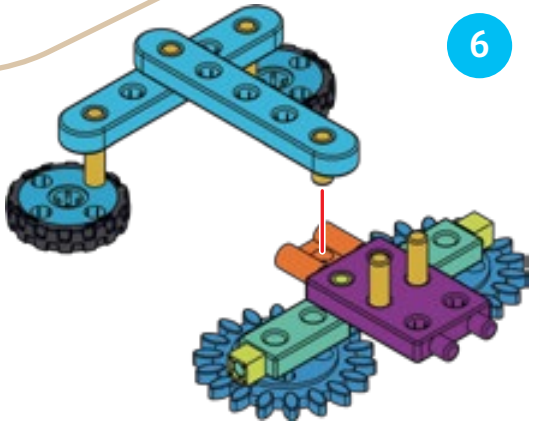

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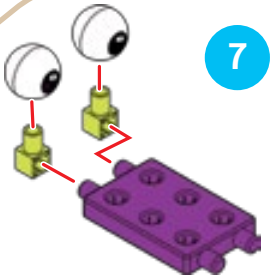

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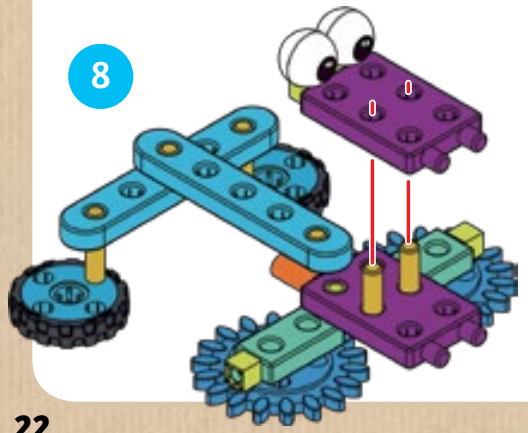

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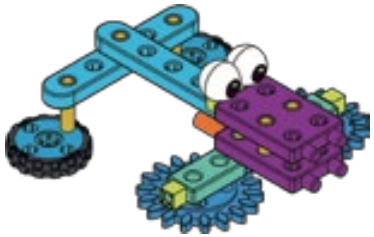
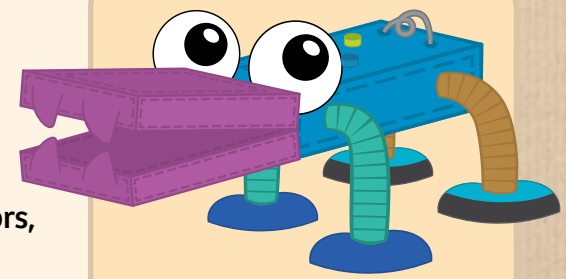


"Hi, I'm Nell. My computer tells my kneading mechanism when to chomp down on the gum to mix it together with the flavors, colors, and sugars."



"Here is Kyle, the candy stamper. He stamps different shapes out of large sheets of candy," announced Ruby.

"Wow, robots really can be designed to do a lot of different things!" Ty observed.

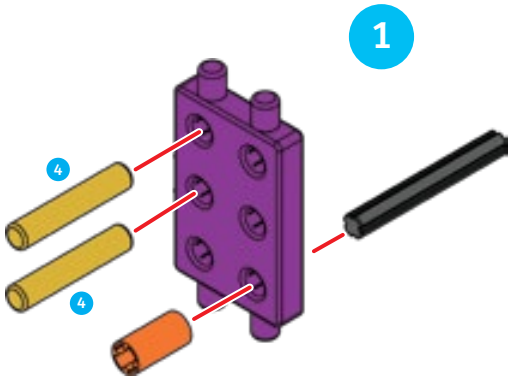
Just then, Sol rolled into the room. "Ms. Ruby! My visual sensors have recorded a new event to report," said the robot. "Your grandkids have returned from their candy delivery trip in the Bots and Bonbons Blimp. They just landed in Makersville Park. A three-wheeled robot was circling the blimp and making a lot of beeping sounds."

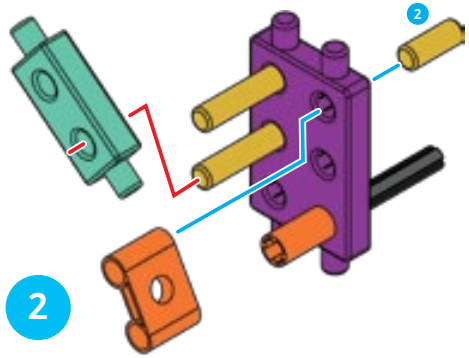
Ty and Karlie looked at each other with excitement and said, "It's Toro!"

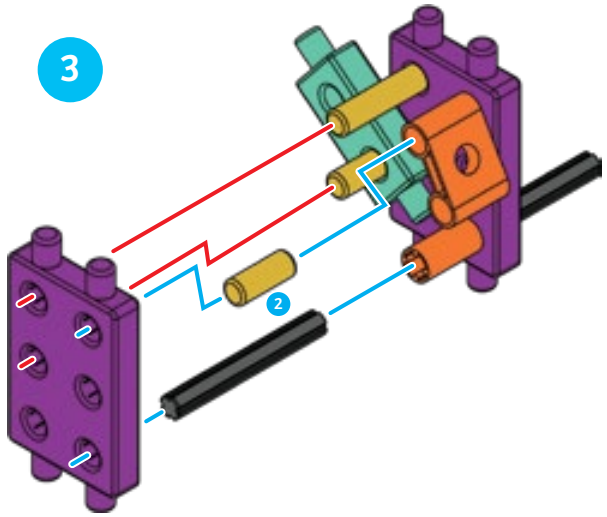
"Thank you, Ruby, for the tour, and Sol, for the good news," said Huxley, "We must be going now — we have a robot to catch up with. Let's go find that blimp."

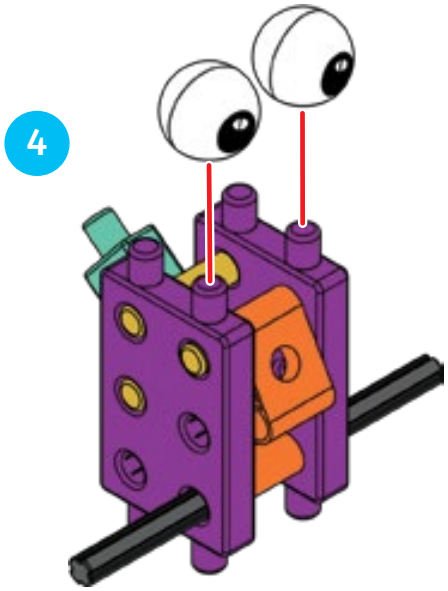
"My pleasure," Ruby responded. "Please tell my grandkids I'll be waiting for them here at the factory."

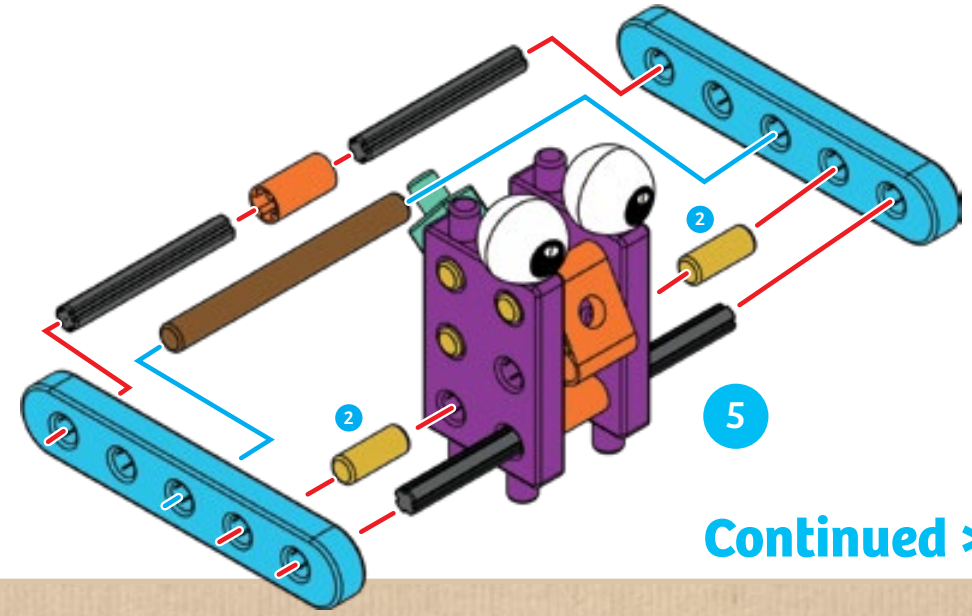
KYLE THE CANDY STAMPER











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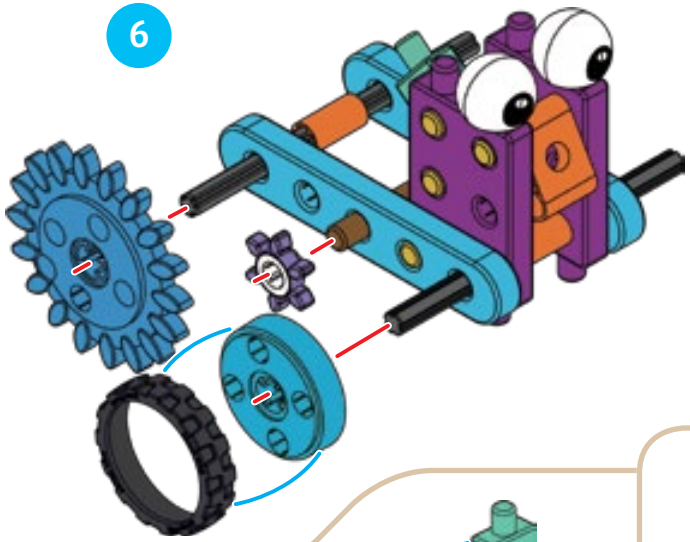

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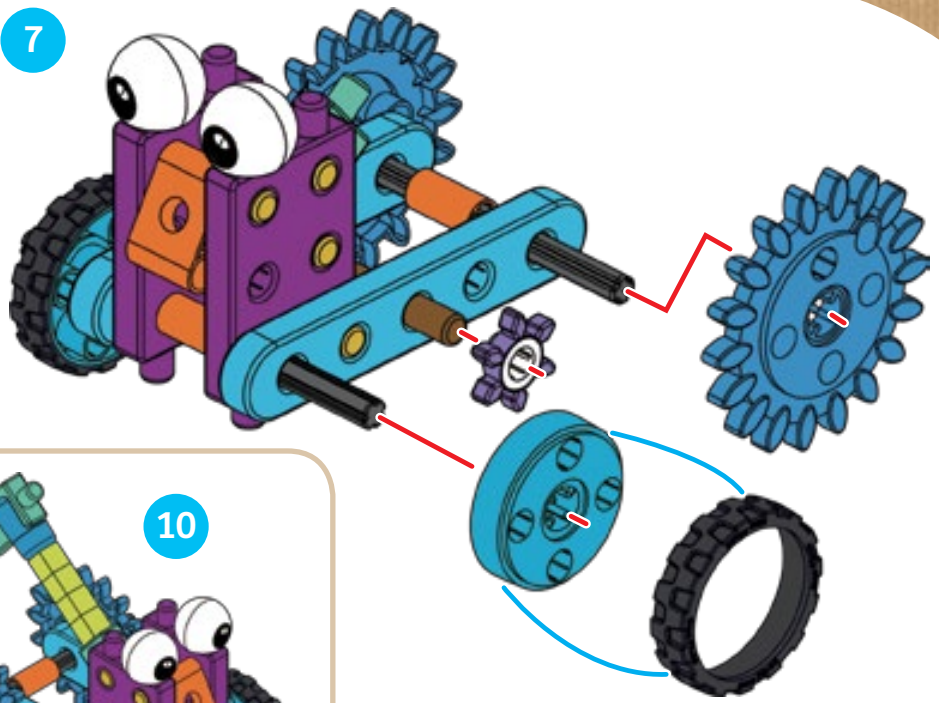

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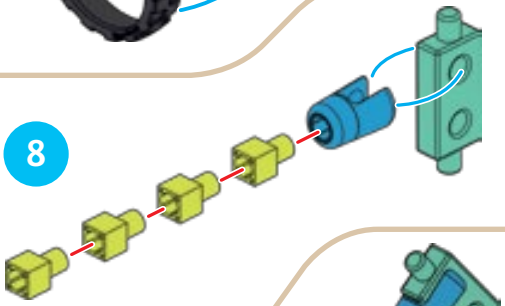

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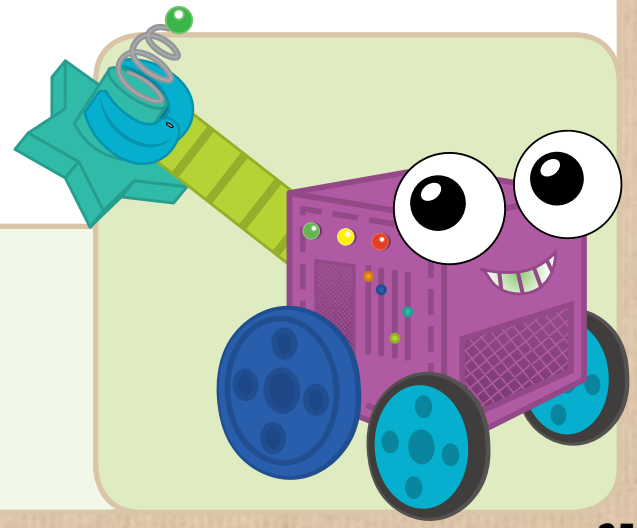
Done!

"Hi, I'm Kyle. I use my stamper arm to make lots of different shapes and sizes of candies. I am programmed to move forward and stamp shapes as I go."



In the park, Huxley, Ty, and Karlie found Toro standing by the blimp with Ruby's grandchildren, Derek and Daniella.

"Toro, we found you!" shouted Karlie. "And you must be Ruby's grandkids."

"Yes we are. This little robot was following our blimp and saying 'candy' over and over, so we landed to see if he was lost," said Derek. "We thought he might be one of gran's bots."

"This is Toro. He loves candy. Thank you for finding him," said Huxley. "He has a glitch in his program that causes him to only detect candy."

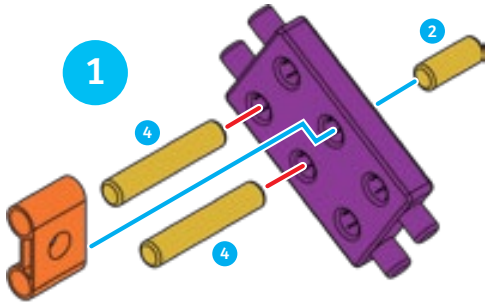
"Maybe that glitch could come in handy. Grandma could use a robot like this! We could program him to help us pack and deliver candy," said Daniella. "Would you like to work at Bots and BonBons, Toro?"

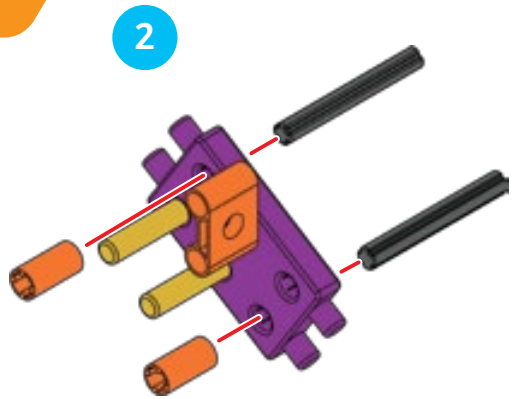
Toro beeped excitedly and spun around in circles.

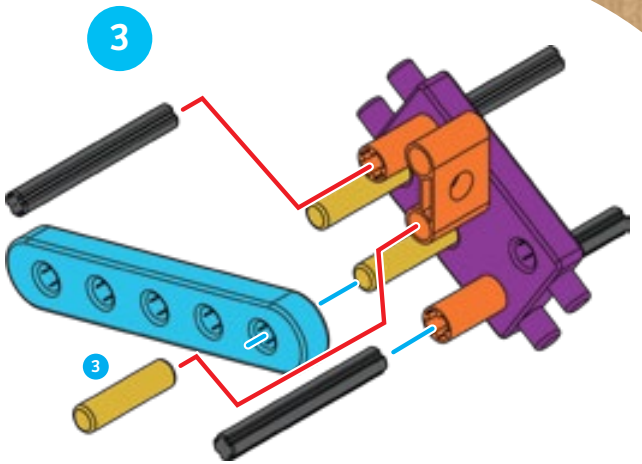
"I'll take that as a 'yes'," Daniella laughed.

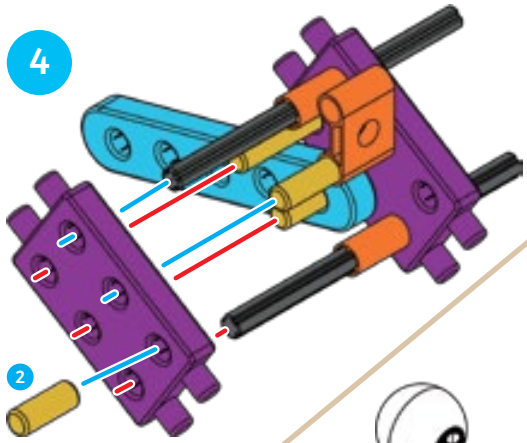
"Great idea!" said Huxley. "Some bugs are actually useful features! But now kids, let's build our own robots using what we have learned today."

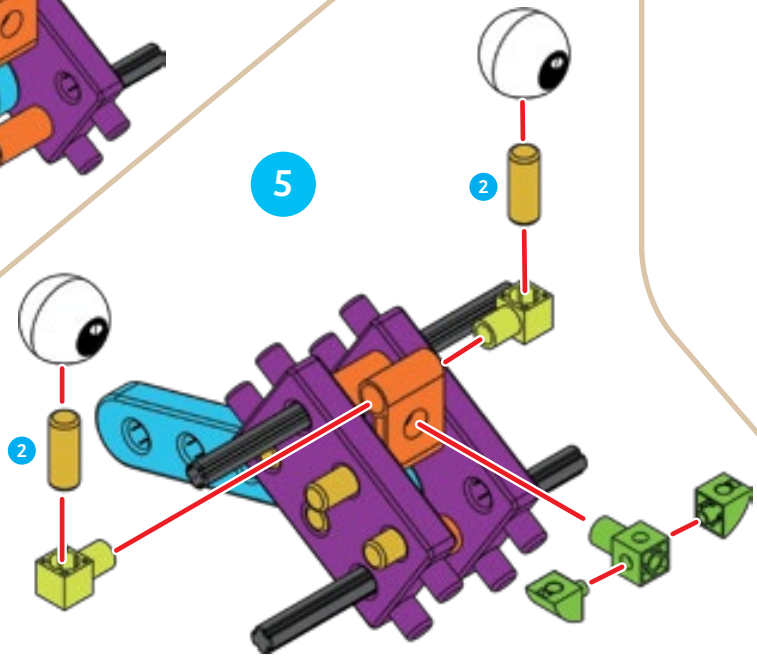
LOLA THE LONG TAIL ROBOT

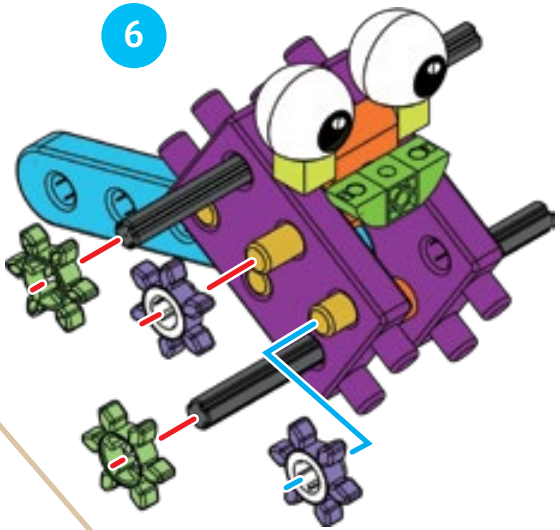












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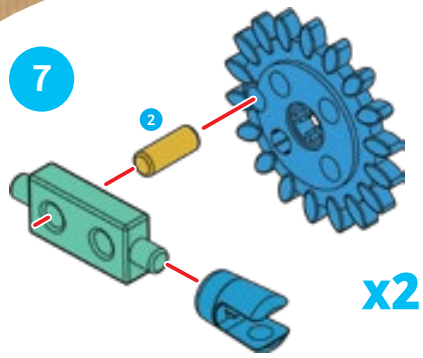

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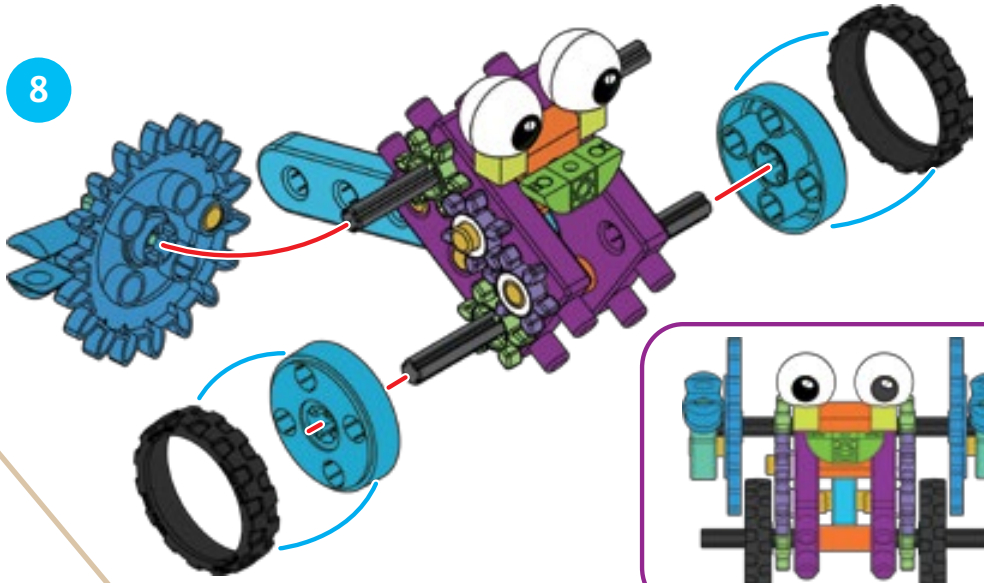

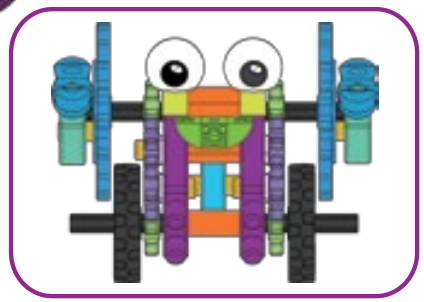

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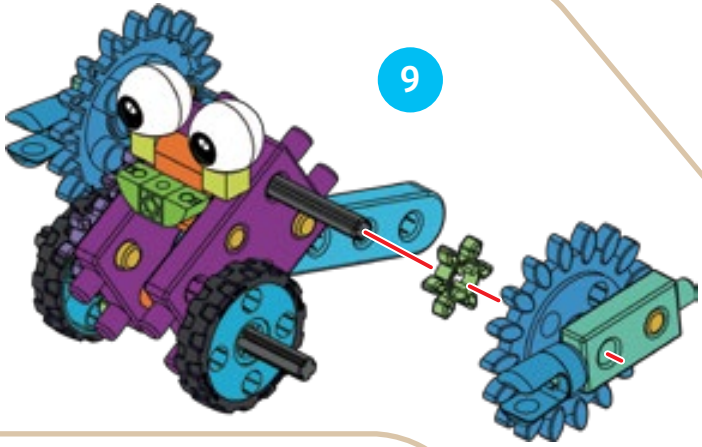

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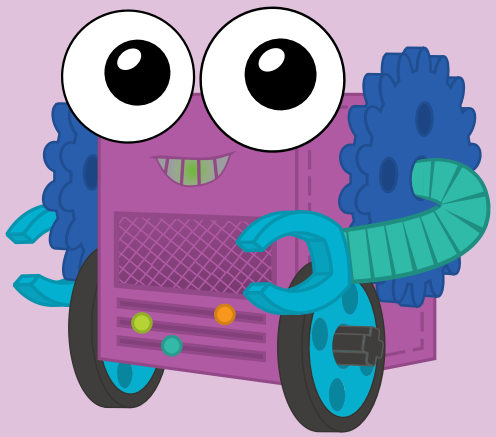
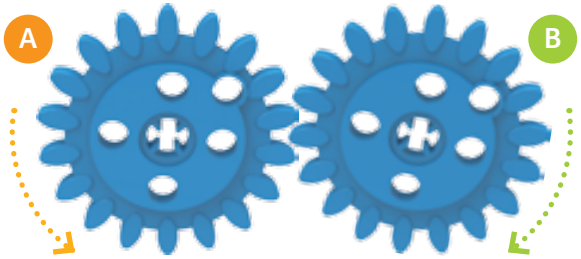
Done!

"Hi, I'm Lola. Three gears connect my wheels to my arms. Take note of the different sizes of gears and the placement of those gears. Which direction does each gear turn when you turn my wheels? Which direction does my arm turn?"

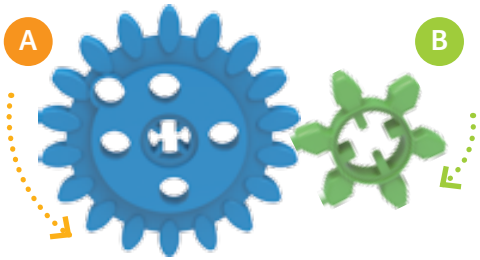




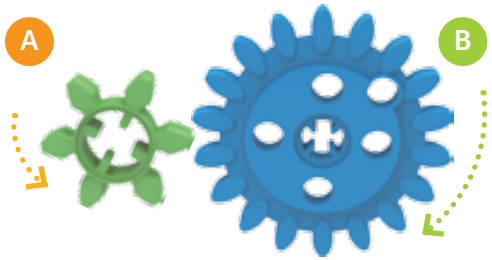
When gear A turns around once, gear B turns around once. They both have 18 teeth.

When gear A turns around once, gear B turns around once. They both have six teeth.

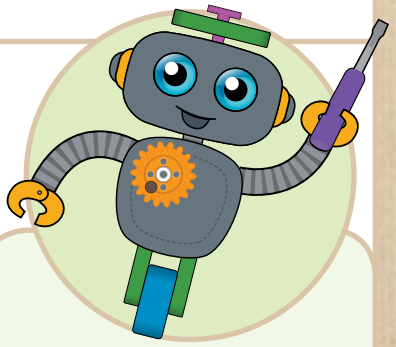
When gear A turns around once, gear B turns around once. They both have six teeth. This gear spins freely on a dowel.



When gear A turns around once, gear B turns around three times. This increases the axle speed three times!

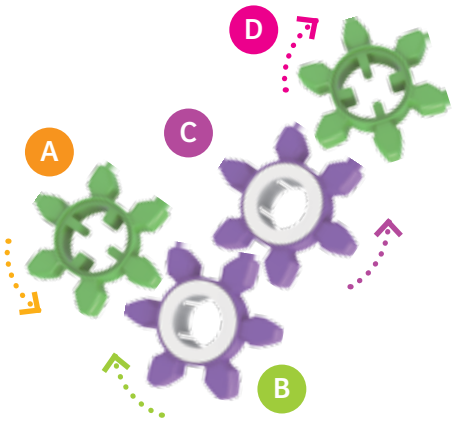


When gear A turns around three times, gear B turns around only one time. This decreases the axle speed three times. But the force gear B can exert on its axle is three times stronger!

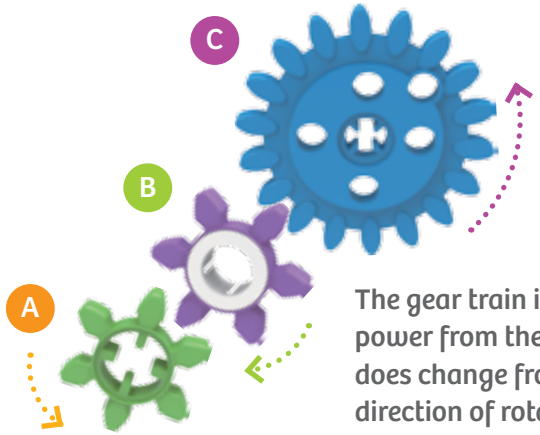


ALL ABOUT GEARS

Let's learn about gears! Read about all these gear trains, or series of gears, to learn how gears change speed, direction, and power.

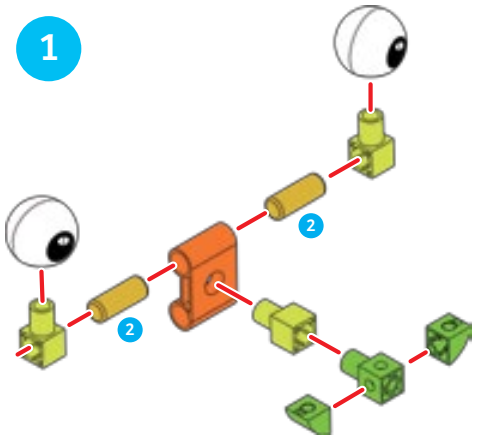


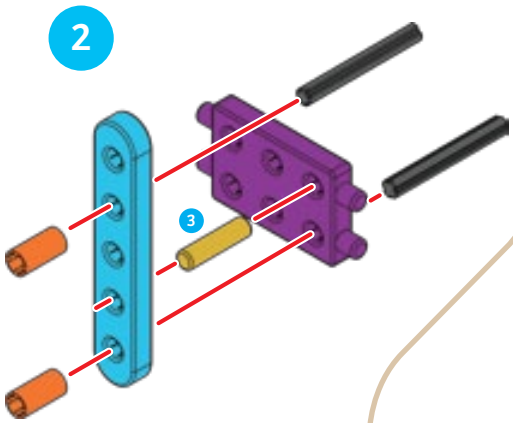
The gear train in Lola transmits power from the wheels to the arms. The speed does not change from gear A to gear D, but the direction of rotation does.

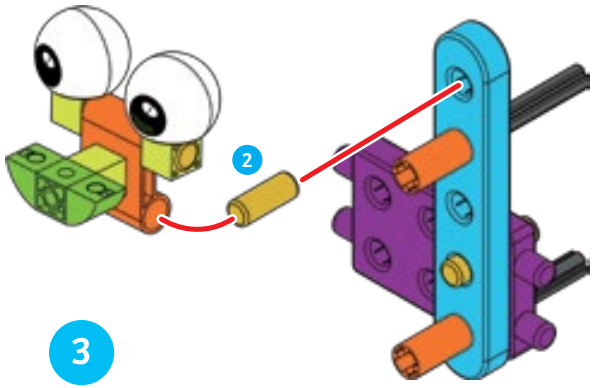


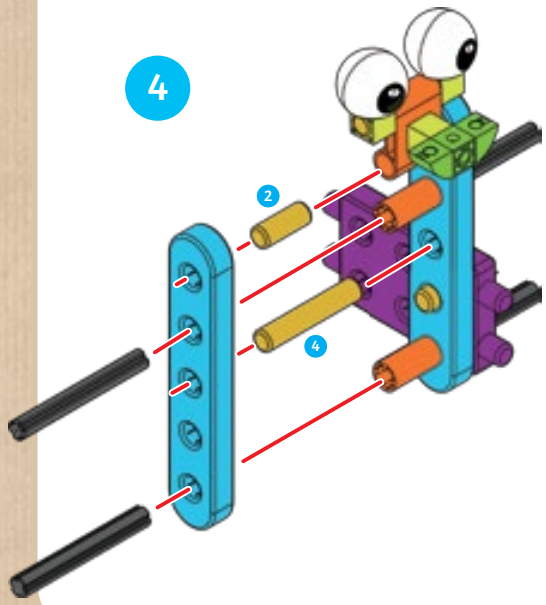
The gear train in the next robot, Reggie, transmits power from the wheels to the arms. The speed does change from gear A to gear C, but the direction of rotation does not.

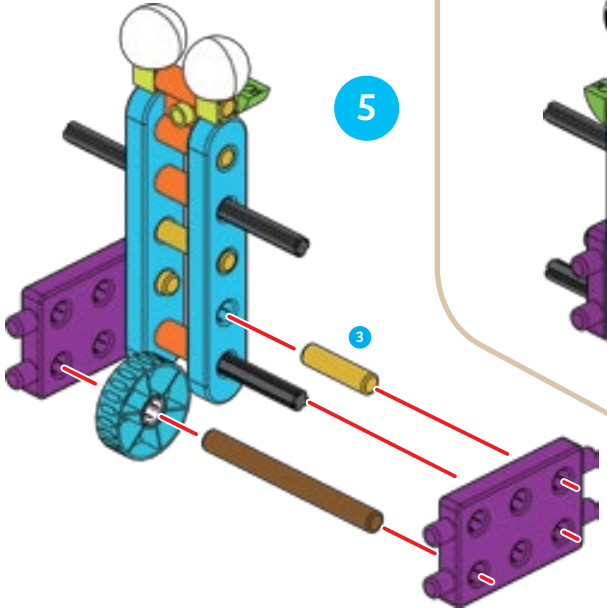
REGGIE THE ROBOT

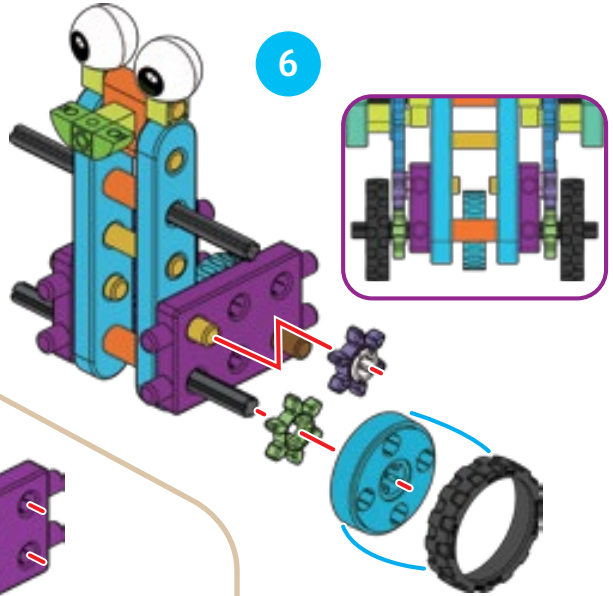












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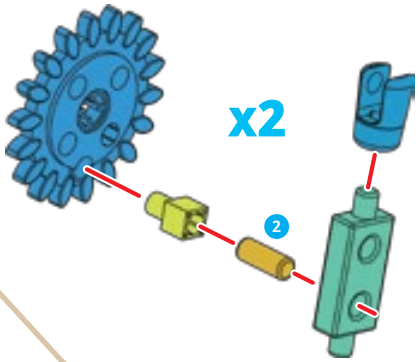

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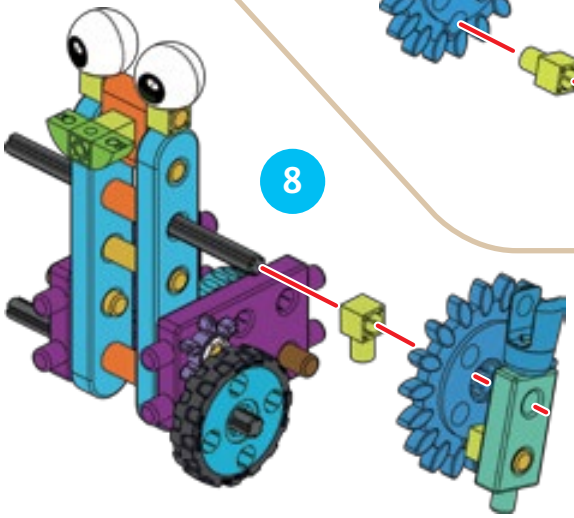

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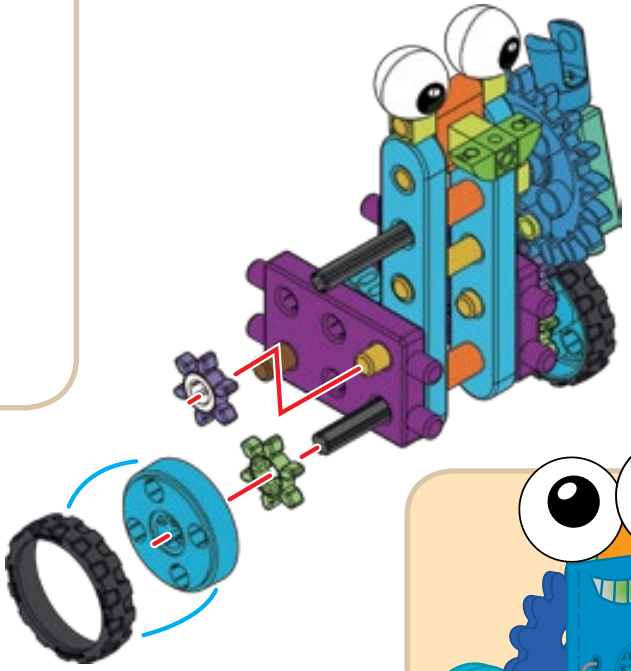

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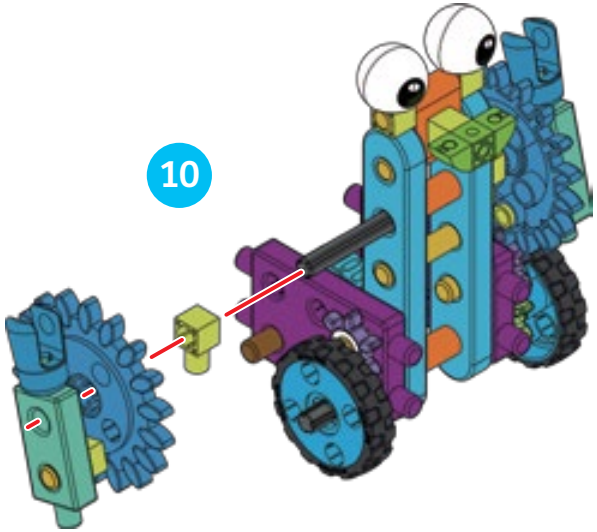

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Done!

"Hi, I'm Reggie! Count how many times my arm spins around each time my wheel spins around once. Does my arm even spin all the way around? Try the reverse: If you spin my arm around once completely, how many times does my wheel spin around? And what do you notice about the direction each gear spins?"

"Good job. You have built the robots Lola and Reggie," Huxley said. "Reggie's arms turn more slowly than Lola's when their wheels are turning at the same speed. Do you know why that is?"

"Reggie has small gears connected to a large gear, while Lola has only small gears. The large gear only turns part of the way around each time the small gear turns all the way around," answered Ty.

"Correct!" said Huxley. "The big gear has more teeth. The smaller gear with fewer teeth must turn around three times to turn the big gear around once."

"Very cool!" said Derek, "Looks like the sun is about to set. Do you guys need a ride home?"

"In the blimp!? Yes, please!" shouted Karlie.

The kids made it home just in time for dinner. Ty and Karlie politely excused themselves from dessert. They had had enough sweets for one day!

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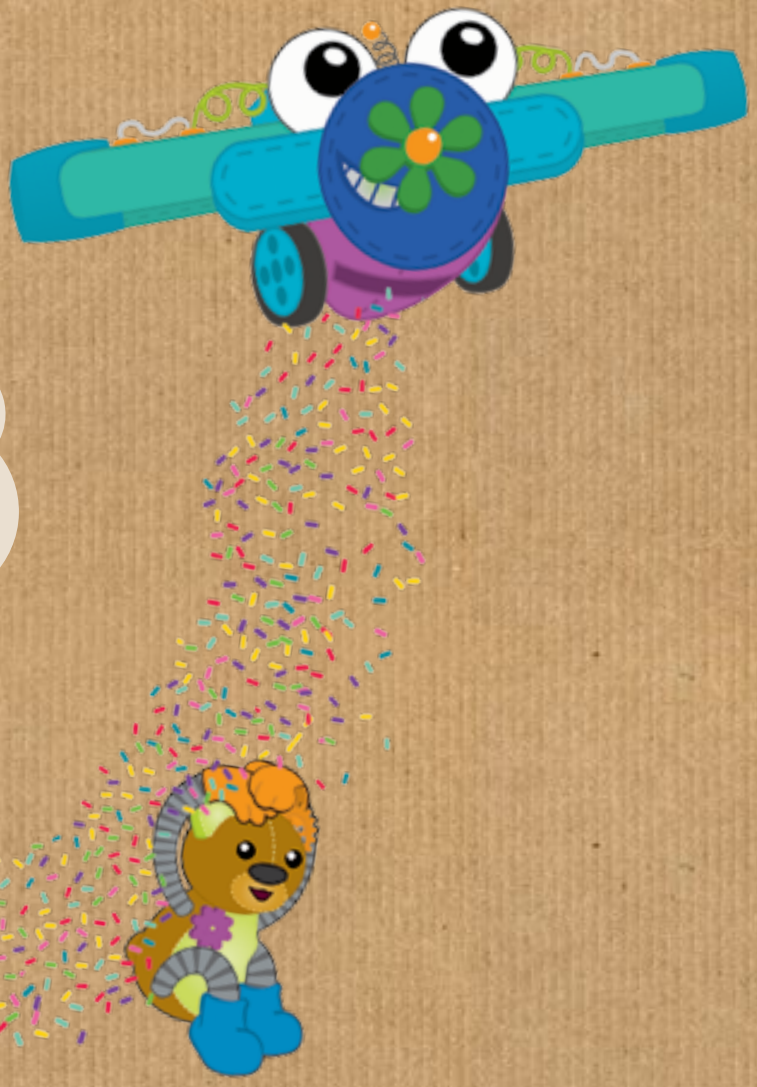

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