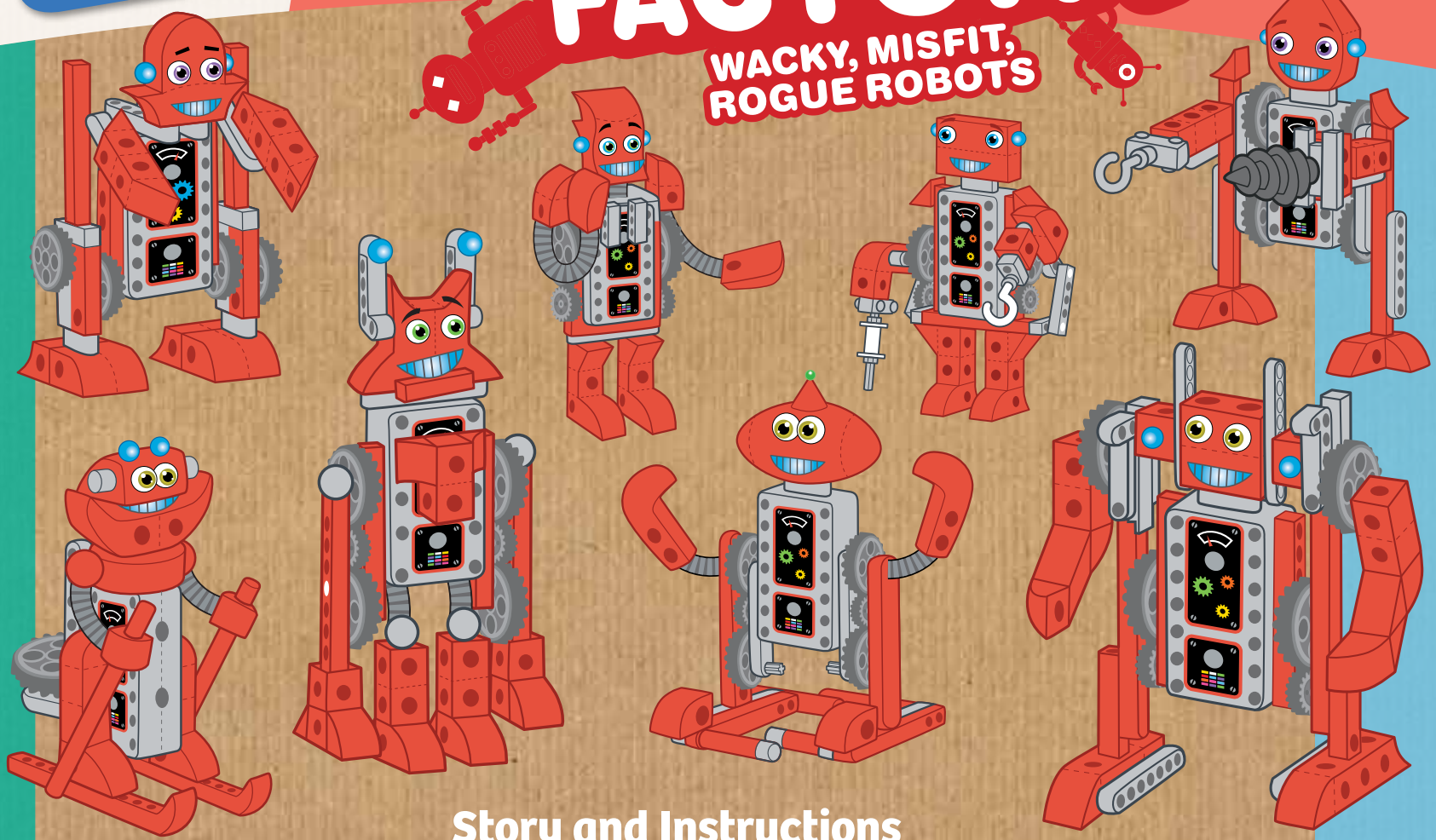
KIDS FIRST

ROBOT FACTORY

WACKY, MISFIT, ROGUE ROBOTS



Story and Instructions

THAMES & KOSMOS

Dear Adult Helpers,

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- and kindergarten-age kids.

Read the story with your child and build simple models of the wacky robots that the characters encounter in the robot factory. As you follow the story, your child can build models of the eight robots in the story with your help. The primary functional components of the robot models are motorized gears that make the robots move. Your child will be introduced to simple mechanical assemblies and motorized gear trains while building the models.

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! 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.

⚠ WARNING:

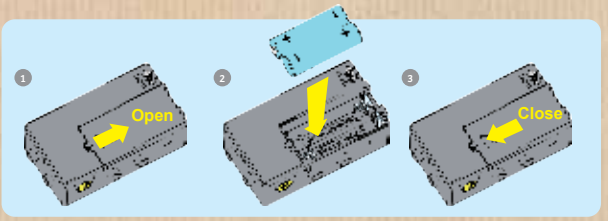
CHOKING HAZARD — Small parts.

Not for children under 3 yrs.

Batteries

How to insert and remove the batteries

Open the battery compartment by sliding the lid open. Insert two AA 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.



Notes on Environmental Protection / Notes on Disposal of Electrical and Electronic Components:
The electronic components of this product are recyclable. For the sake of the environment, do not throw them into the household trash at the end of their lifespan. They must be delivered to a collection location for electronic waste, as indicated by the following symbol:

Please contact your local authorities for the appropriate disposal location.

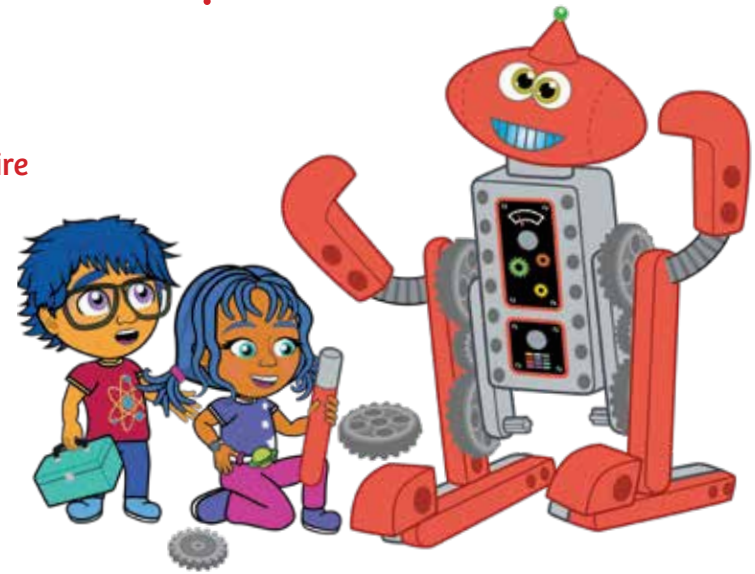
Safety for Experiments with Batteries
››› To operate the models, you will need two AA batteries (1.5-volt, type LR6), which could not be included in the kit due to their limited shelf life.
››› Different types of batteries or new and used batteries are not to be mixed.
››› Do not mix old and new batteries.
››› Do not mix alkaline, standard (carbon-zinc), or rechargeable (nickel-cadmium) batteries.
››› Batteries are to be inserted with the correct polarity. Press them gently into the battery compartments. See instructions above.
››› Always close battery compartments with the lid.
››› Non-rechargeable batteries are not to be recharged. They could explode!
››› Rechargeable batteries are only to be charged under adult supervision.
››› Rechargeable batteries are to be removed from the toy before being charged.
››› Exhausted batteries are to be removed from the toy.
››› The supply terminals are not to be short-circuited.
››› Avoid a short circuit of the batteries. A short circuit can cause the wires to overheat and the batteries to explode.
››› 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. As all of the experiments use batteries, have an adult check the experiments or models before use to make sure they are assembled properly. Always operate the motorized models under adult supervision. After you are done experimenting, remove the batteries from the battery compartments.
››› Note the safety information accompanying the individual experiments or models!
››› The toy is not to be connected to more than the recommended number of power supplies.

ROBOT FACTORY

WACKY, MISFIT, ROGUE ROBOTS

Story by
Dan Freitas and Ted McGuire

Illustrations by
James Harmon



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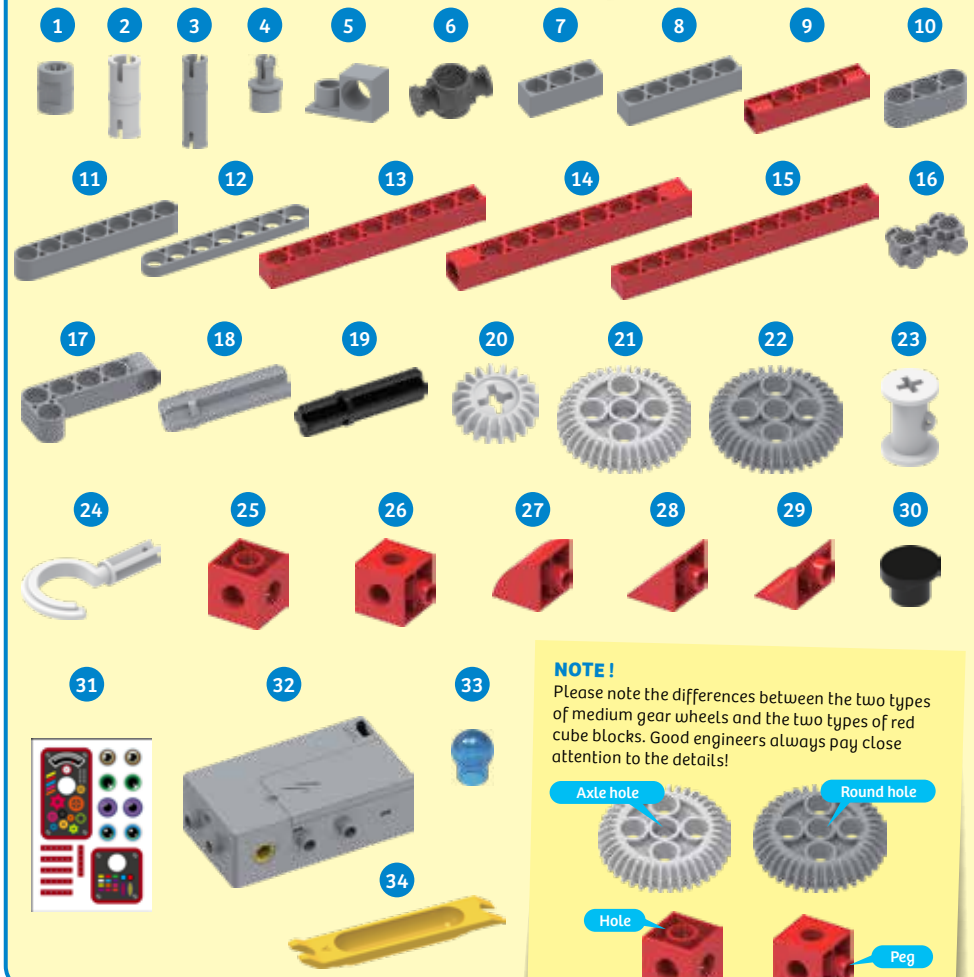
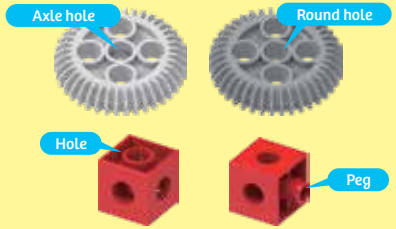
››› KIT CONTENTS

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

What's inside your kit:



NOTE !
Please note the differences between the two types of medium gear wheels and the two types of red cube blocks. Good engineers always pay close attention to the details!



Checklist: Find – Inspect – Check off

✔	No.	Description	Qty.	Item No.
❍	1	Short anchor pin	20	7344-W10-C2S
❍	2	Joint pin	14	7413-W10-T1S2
❍	3	Long joint pin	4	7413-W10-U1S
❍	4	Shaft plug	2	7026-W10-H1S1
❍	5	90-degree converter X	2	7061-W10-X1S2
❍	6	1-hole connector	2	7430-W10-B1S
❍	7	3-hole rod	2	7026-W10-Q2S1
❍	8	5-hole rod	2	7413-W10-K2S1
❍	9	5-hole cross rod	2	7413-W10-R1R
❍	10	3-hole wide rounded rod	2	7404-W10-C1S
❍	11	7-hole wide rounded rod	2	7404-W10-C2S
❍	12	7-hole flat rounded rod	2	7404-W10-C3S
❍	13	9-hole rod	2	7407-W10-C1R
❍	14	9-hole cross rod	2	7407-W10-C2R
❍	15	11-hole rod	2	7413-W10-P1R
❍	16	3-hole bolt rod	2	7406-W10-B1S
❍	17	5-hole L rod	2	7406-W10-B2S
❍	18	Motor shaft	2	7026-W10-L1S1
❍	19	Axle, 30 mm	2	7413-W10-N1D
❍	20	Small gear	2	7026-W10-D2S
❍	21	Medium gear, axle hole	2	7408-W10-D2S
❍	22	Medium gear, round hole	2	7408-W10-D1S
❍	23	String spool	1	7900-W10-H1SK
❍	24	Hook	1	7900-W10-H2SK
❍	25	6-hole cube block	4	880-W10-N1R
❍	26	Cube block	12	880-W10-A1R
❍	27	Convex block, red	6	880-W10-R1R
❍	28	Triangle bock, red	6	880-W10-S1R
❍	29	Concave block, red	4	880-W10-D1R
❍	30	Button pin	2	7061-W10-W1D
❍	31	Sticker sheet	1	R20#7449-US
❍	32	Motor and battery box	1	7450-W85-A
❍	33	Ball pin	2	7128-W10-E1TB
❍	34	Part separator tool	1	7061-W10-B1Y

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.

Ty and Karlie's Robot Factory Adventure Began Here . . .

It was a beautiful day in Makersville, and Ty and Karlie were especially excited. Ms. Omega had arranged for them to visit a real robot factory where robots of all shapes and sizes were built.

Just as Ty and Karlie were walking up to the factory, a robot burst out of the front door, wobbling around uncontrollably. A man came running behind the robot, frantically waving his arms.

"Oh, hi there! You must be Karlie and Ty. I'm Milton, the Robot Factory Manager," said Milton. "Your mom said you would be coming today. I'm sorry to say that all our robots are malfunctioning right now, and the robot engineers are having trouble keeping them under control."

Ty and Karlie looked at each other. They were thinking the same thing.

"We can help you fix these robots," said Karlie. "We have lots of experience building and repairing robots. It's one of our favorite things to do!"

"That would be wonderful," replied Milton. "This robot here is supposed to walk on two legs but it's missing the rods on its feet that keep it balanced."

The robot was wobbling around the yard outside the factory. The kids got to work fixing the robot.

WALKER-BOT

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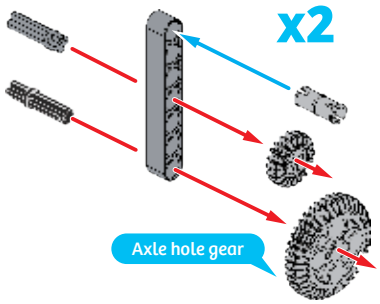

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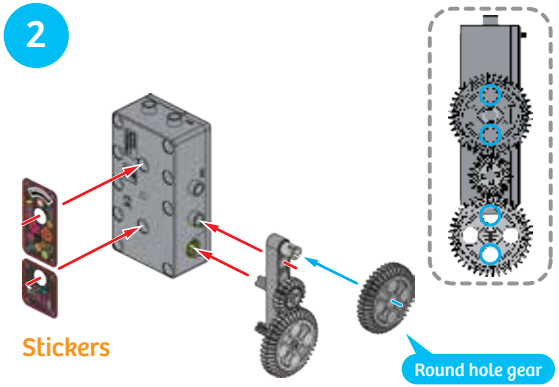

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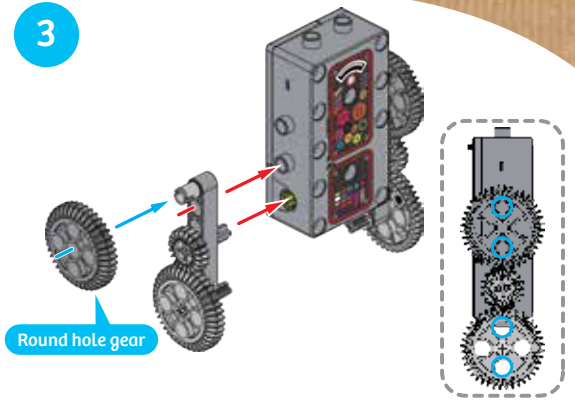

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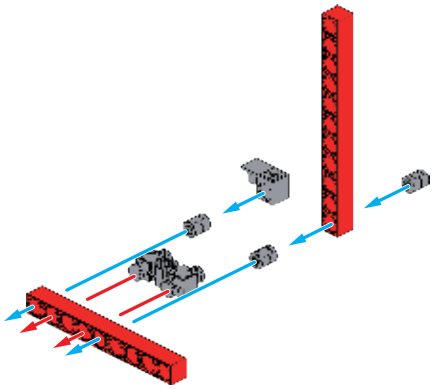

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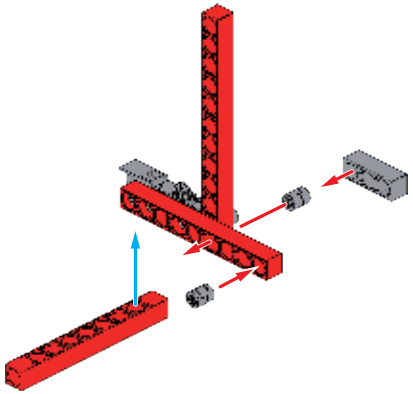

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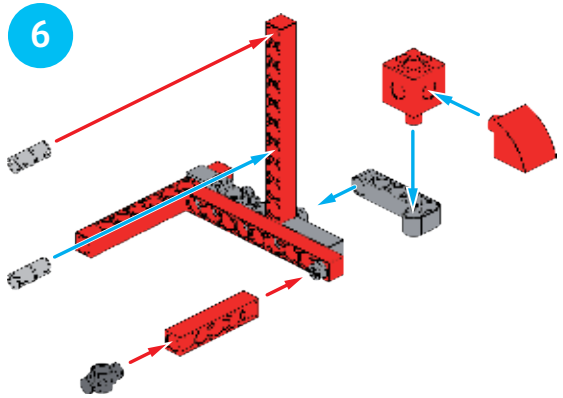

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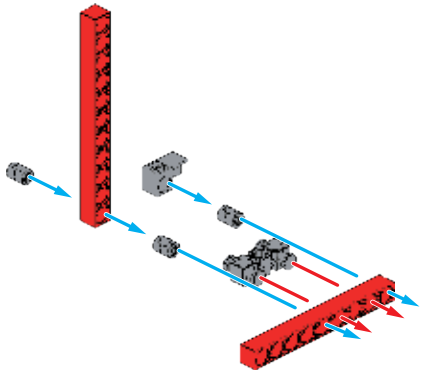

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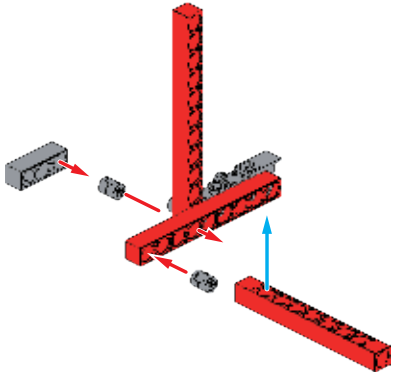

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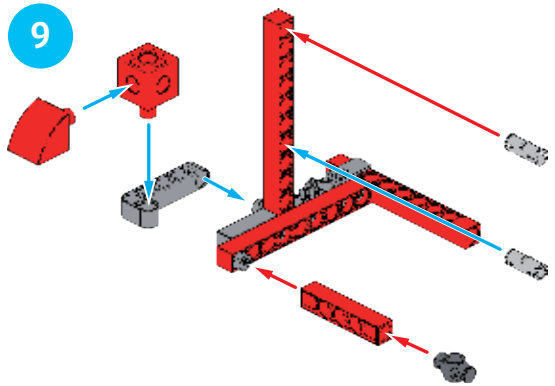

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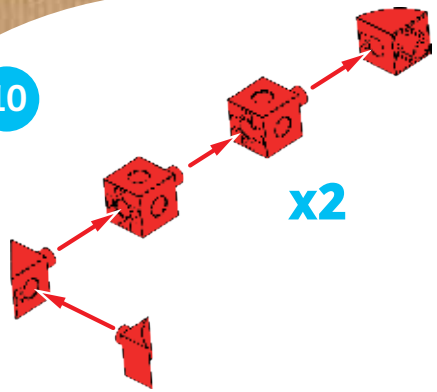

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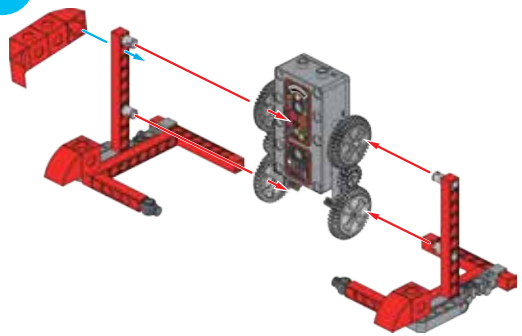

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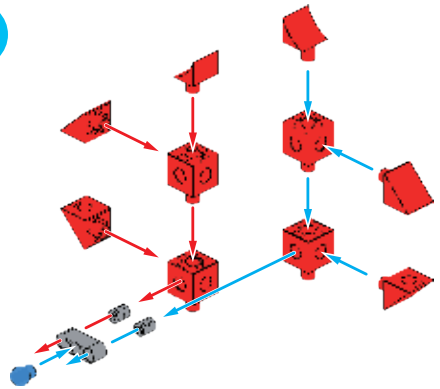

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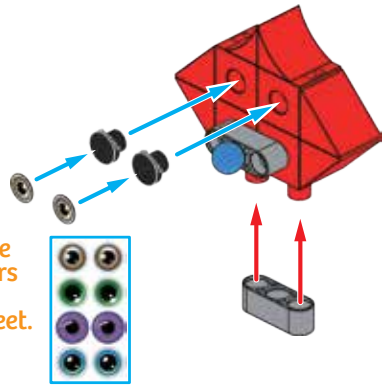

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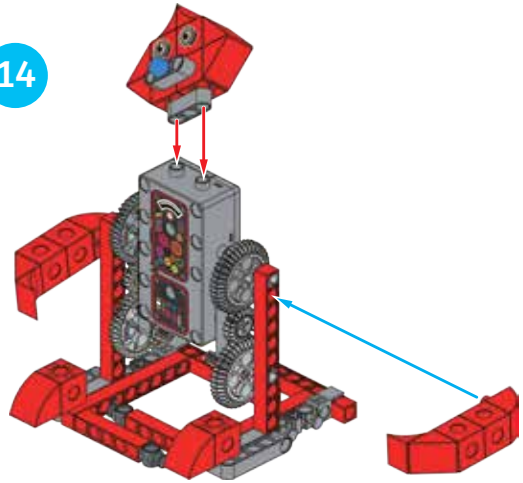
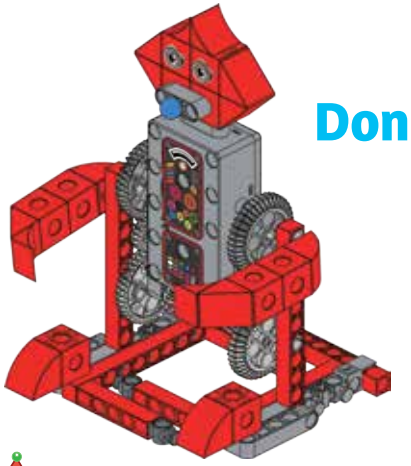
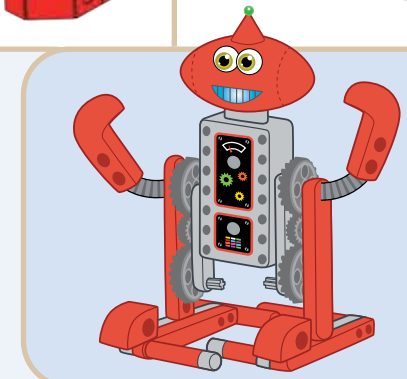


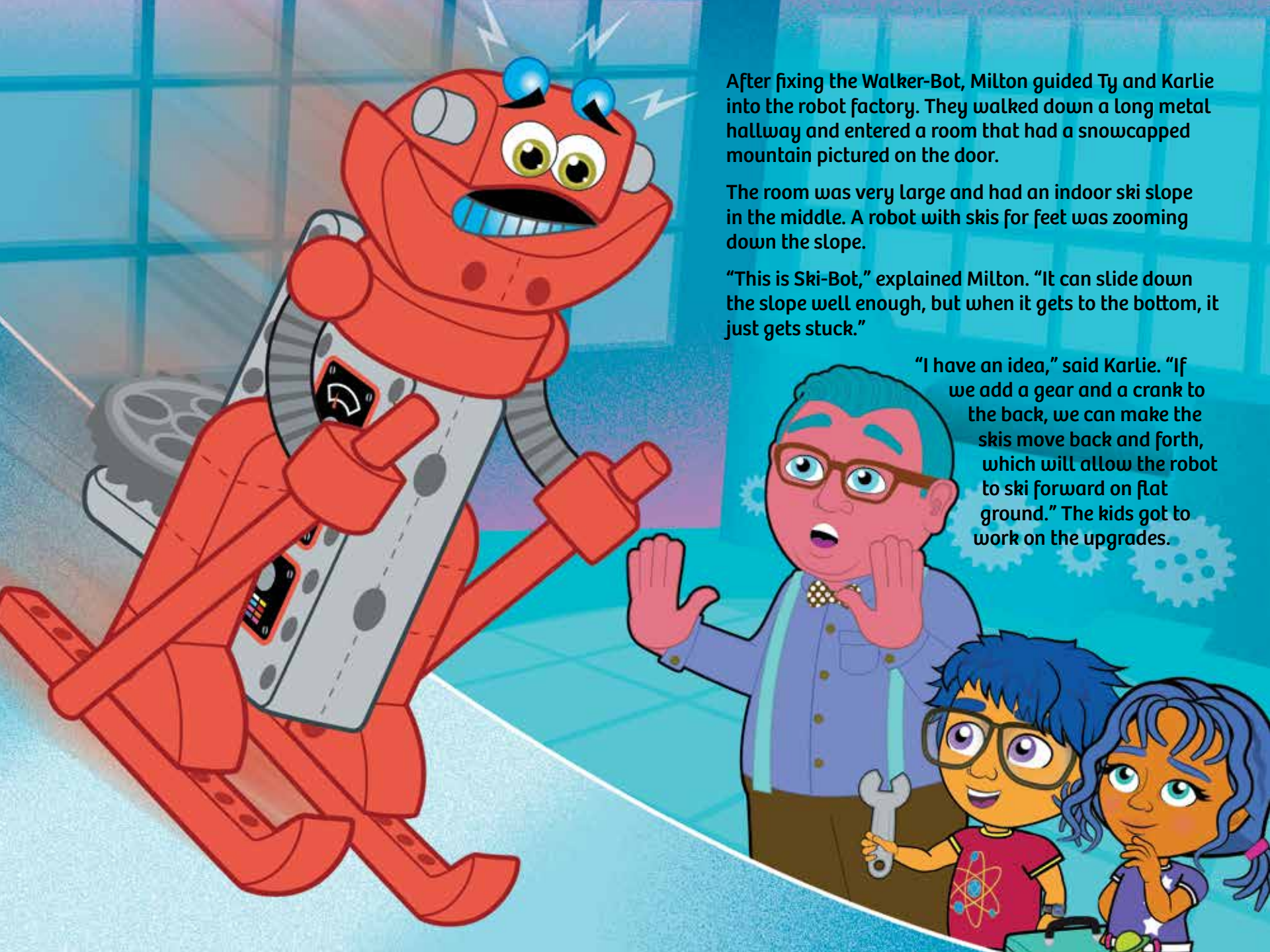


Done!

Use the model on a flat surface.

The model of the Walker-Bot has two rods that project inward from each foot. The rods give each foot a large, rectangular surface area. These large feet enable the robot to lift itself up and balance on one foot at a time. The center of gravity of the robot must be centered above the foot in order to balance on it. Without the rods, the robot will not walk forward. Many classic walking wind-up toys have feet like this.





After fixing the Walker-Bot, Milton guided Ty and Karlie into the robot factory. They walked down a long metal hallway and entered a room that had a snowcapped mountain pictured on the door.

The room was very large and had an indoor ski slope in the middle. A robot with skis for feet was zooming down the slope.

"This is Ski-Bot," explained Milton. "It can slide down the slope well enough, but when it gets to the bottom, it just gets stuck."

"I have an idea," said Karlie. "If we add a gear and a crank to the back, we can make the skis move back and forth, which will allow the robot to ski forward on flat ground." The kids got to work on the upgrades.

SKI-BOT

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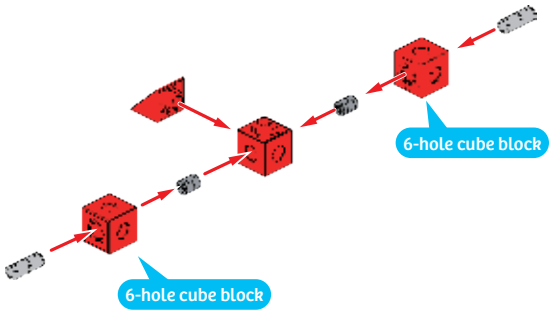

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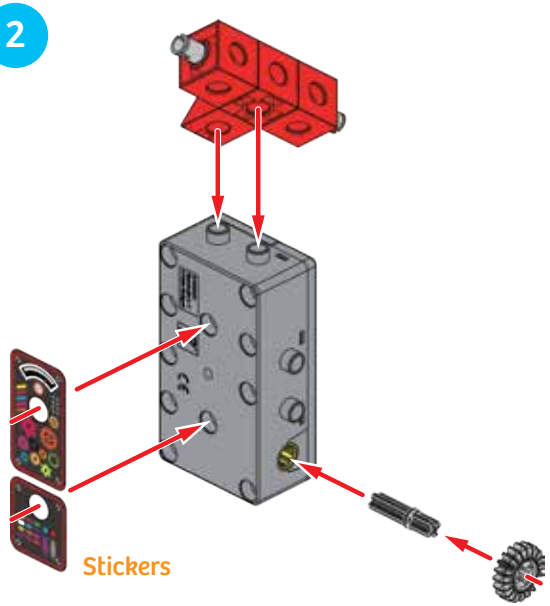

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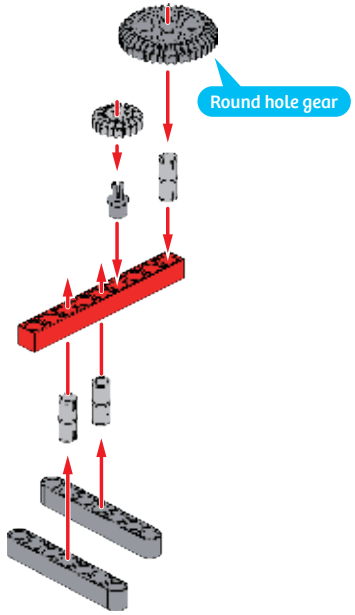

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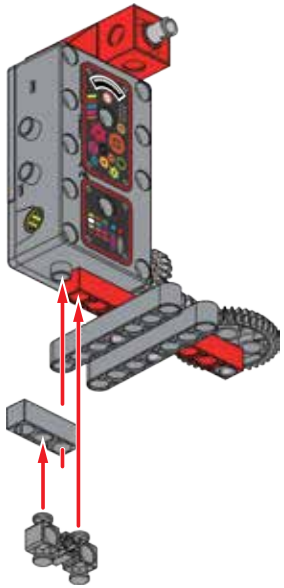

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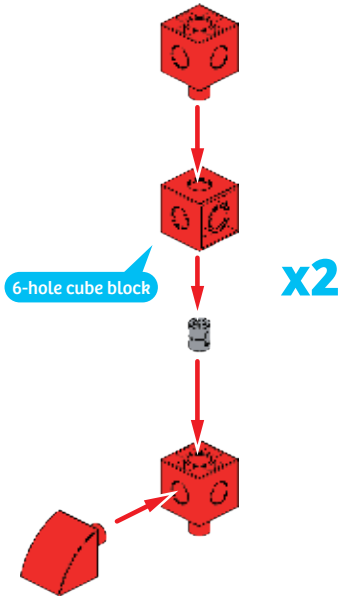

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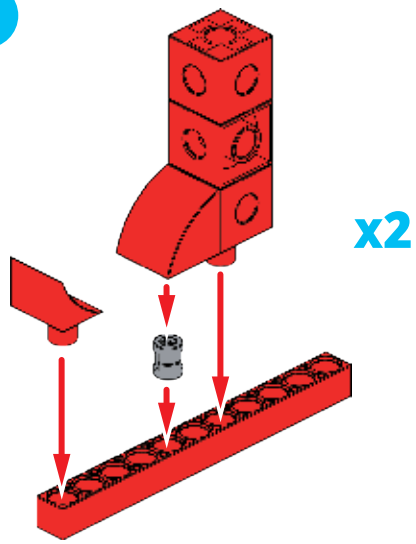

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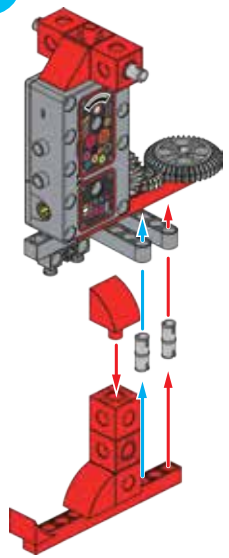

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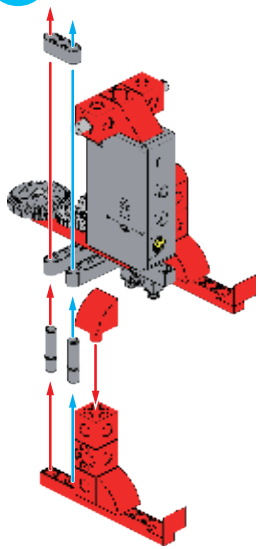

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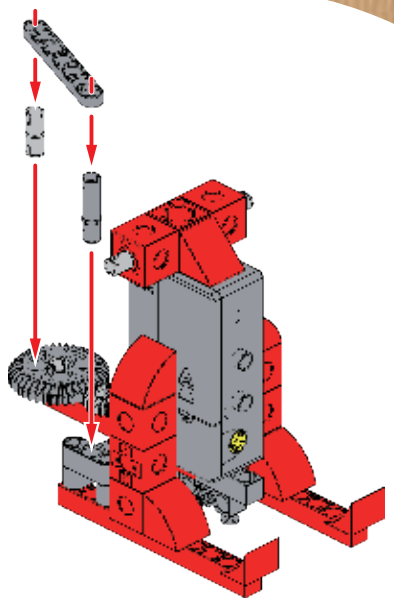

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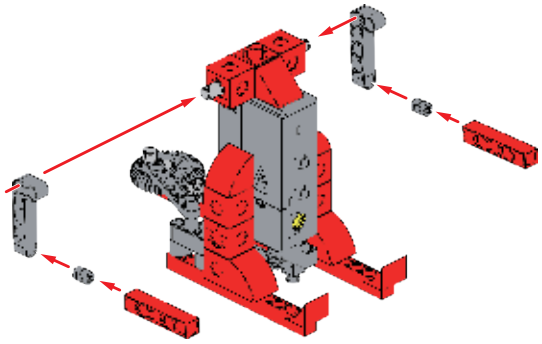

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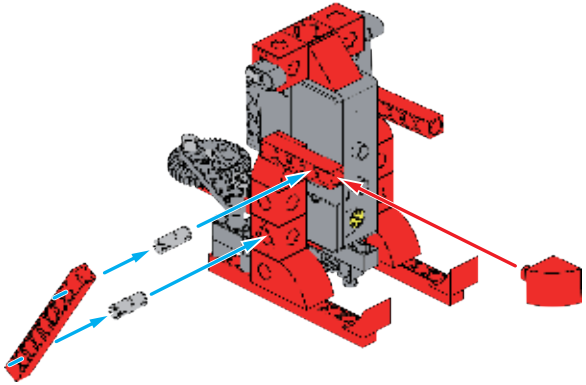

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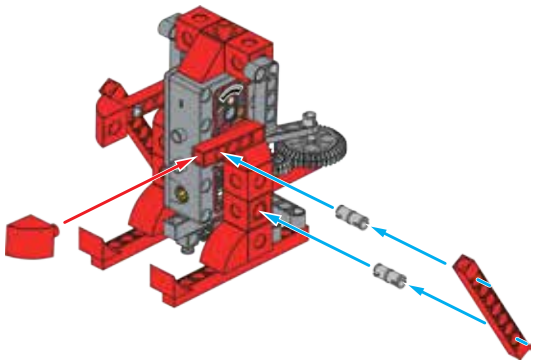

SKI-BOT

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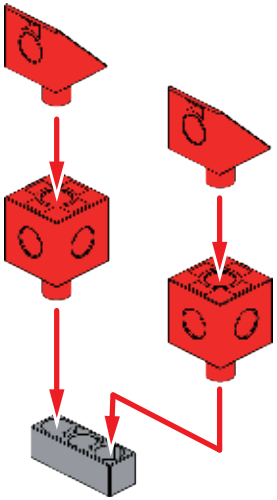

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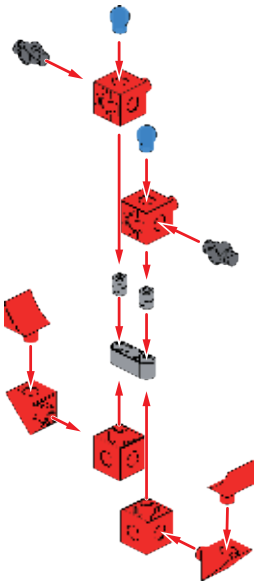

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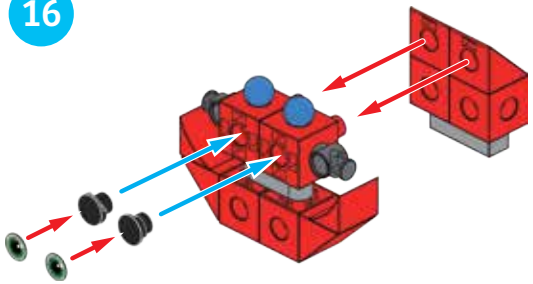

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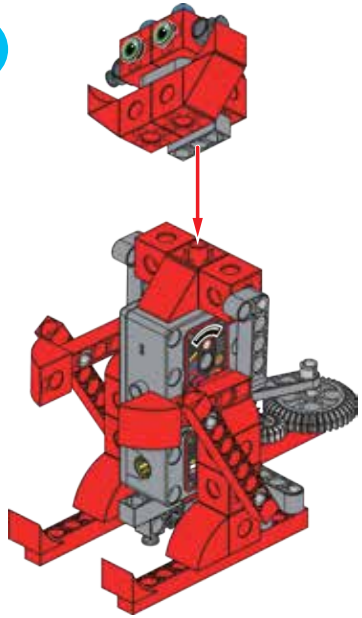
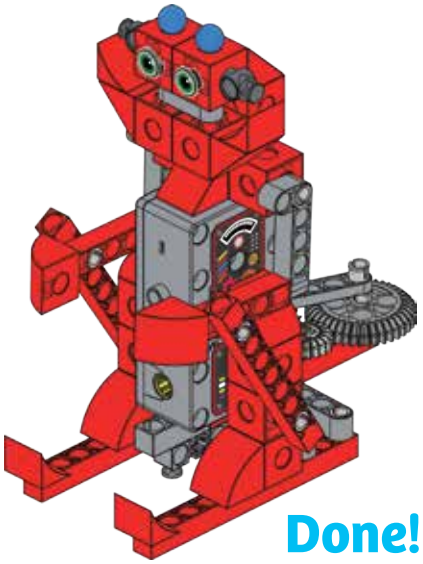
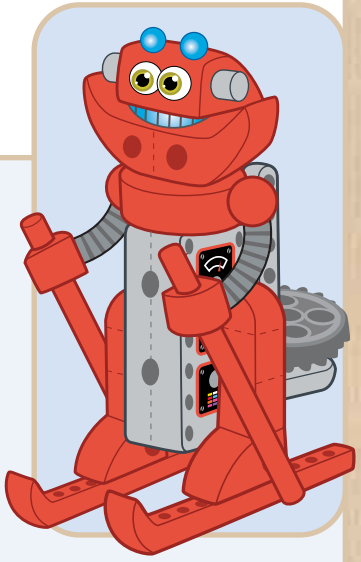


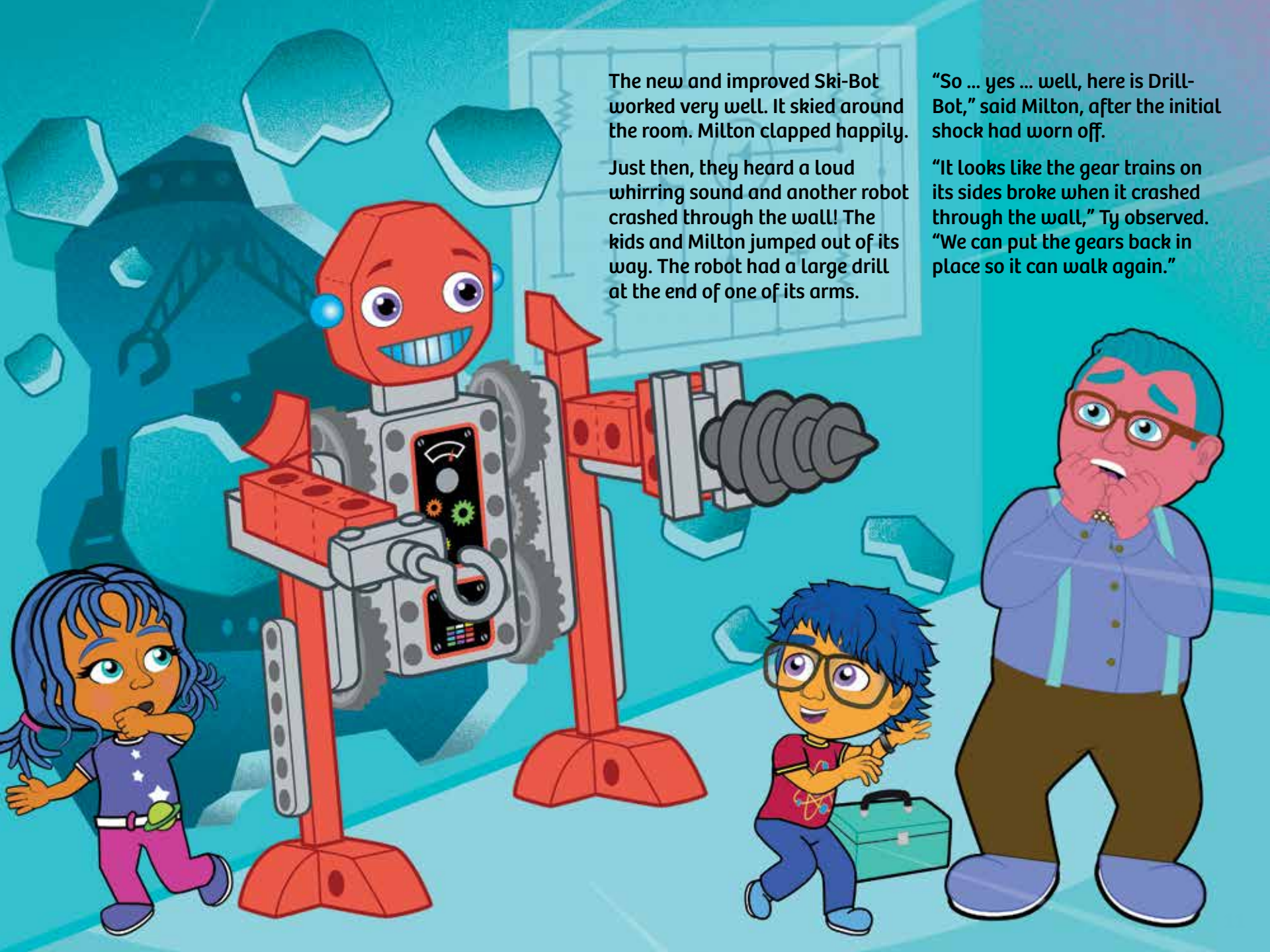


Done!

Use on a slightly sloped surface.



The model of the Ski-Bot has two cool features that enable its skis to slide back and forth in a linear motion. The first is a gear train with bevel gears which change the direction of motion of the motor shaft. The second is a crank mechanism attached to the medium gear in the back, which converts the circular rotating motion of the gear to a back-and-forth motion of the skis. Look closely at the model in action to see how this works.



The new and improved Ski-Bot worked very well. It skied around the room. Milton clapped happily.

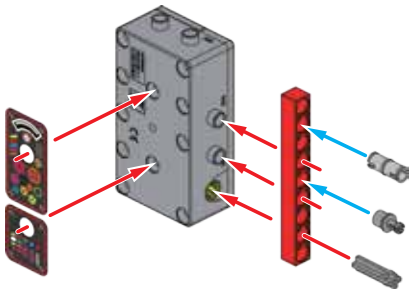
Just then, they heard a loud whirring sound and another robot crashed through the wall! The kids and Milton jumped out of its way. The robot had a large drill at the end of one of its arms.

"So ... yes ... well, here is Drill-Bot," said Milton, after the initial shock had worn off.

"It looks like the gear trains on its sides broke when it crashed through the wall," Ty observed. "We can put the gears back in place so it can walk again."

DRILL-BOT

1



Stickers

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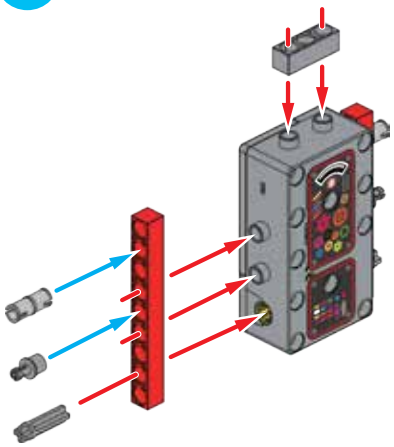

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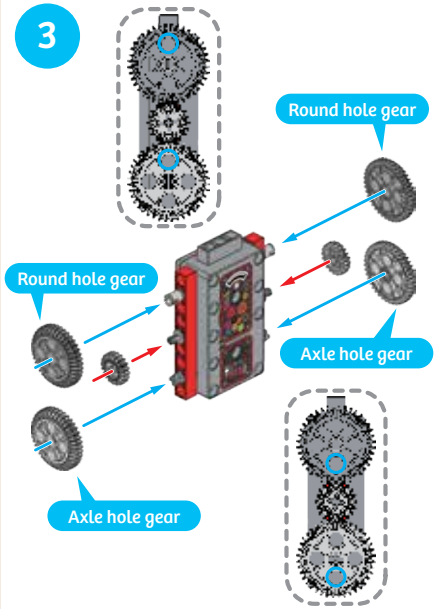

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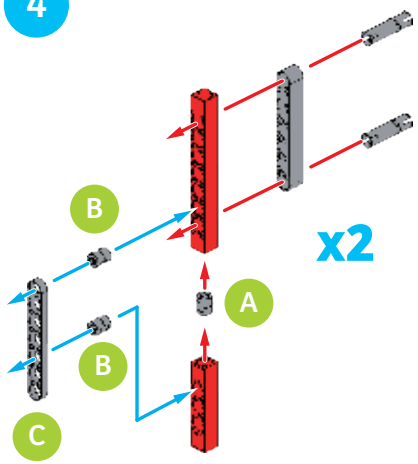
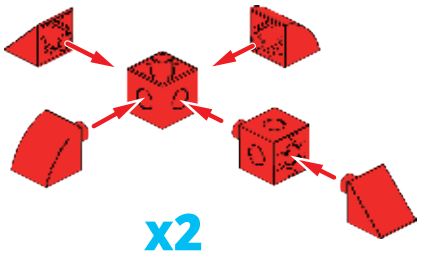


The green circles denote the order of assembly.

5



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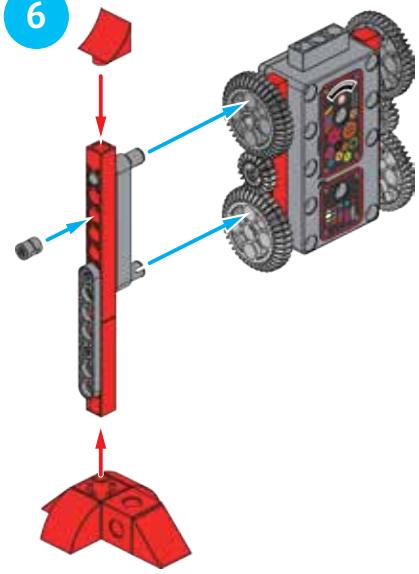

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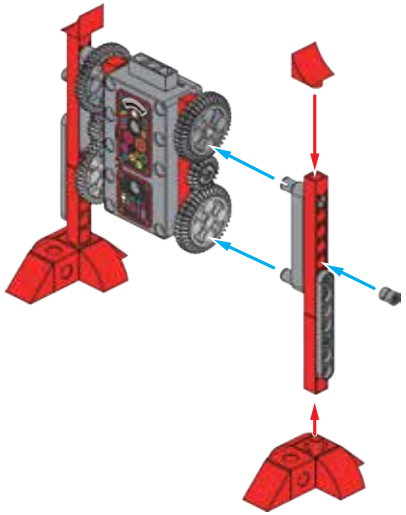

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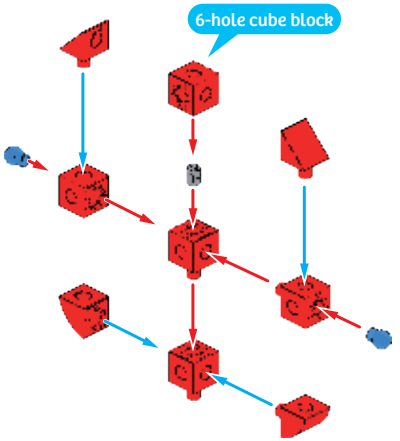

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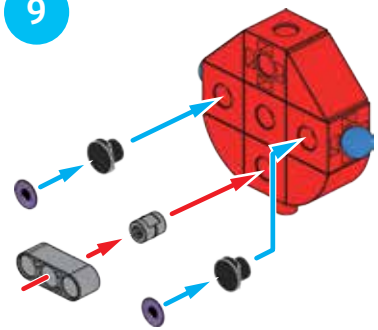

Choose the eye stickers from the sticker sheet.

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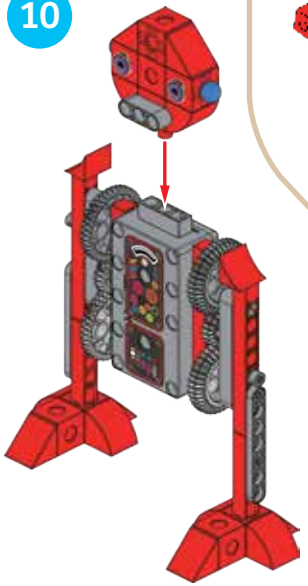

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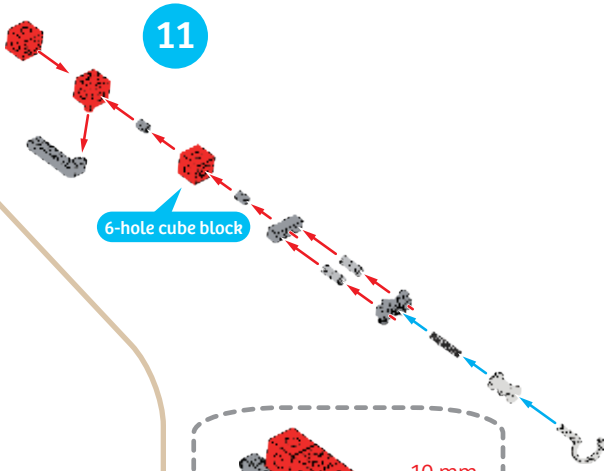

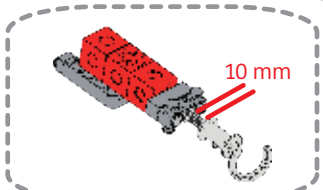

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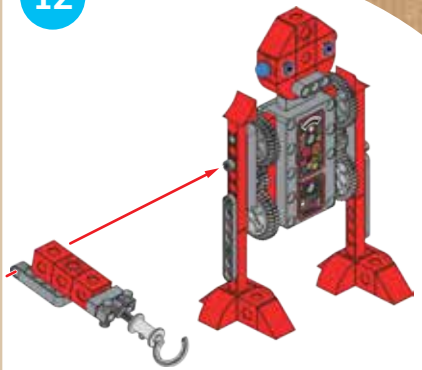
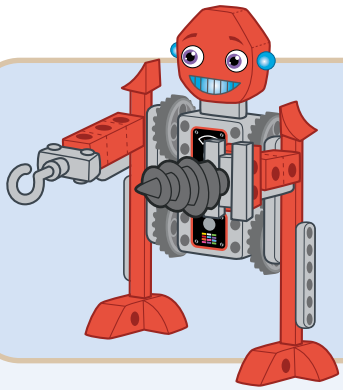
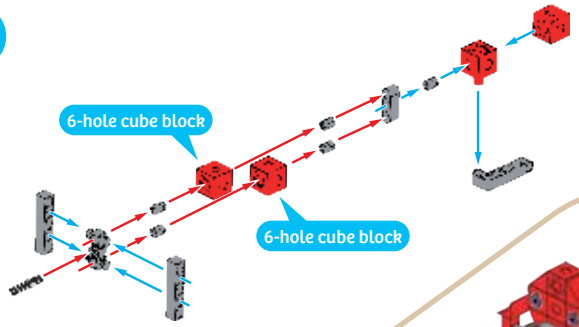
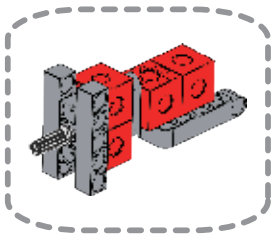




The model of the Drill-Bot has long rods attached to two medium gears on each side of the motor box. As the gears turn, the rods move up and down in a reciprocating motion, a little like the wheels of an old-fashioned locomotive. Compare this motion to that of the Walker-Bot.

13





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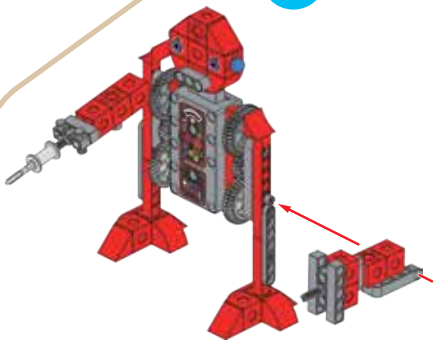

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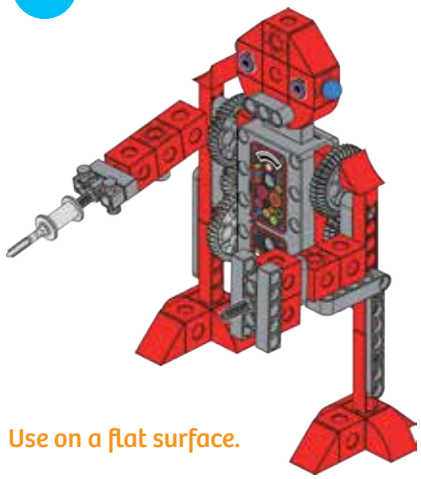


Use on a flat surface.

Done!

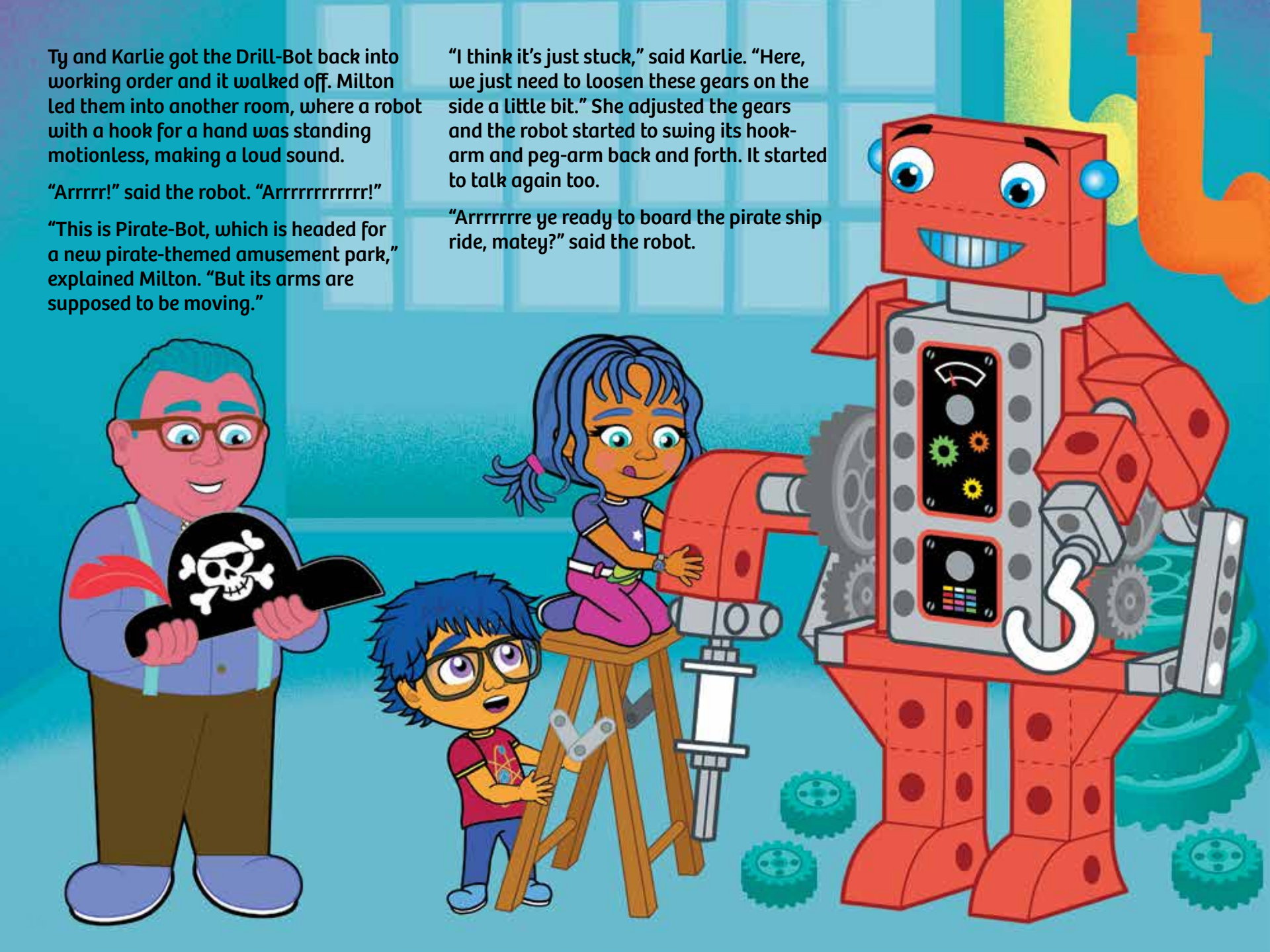
Ty and Karlie got the Drill-Bot back into working order and it walked off. Milton led them into another room, where a robot with a hook for a hand was standing motionless, making a loud sound.

"Arrrrr!" said the robot. "Arrrrrrrrrrrr!"

"This is Pirate-Bot, which is headed for a new pirate-themed amusement park," explained Milton. "But its arms are supposed to be moving."

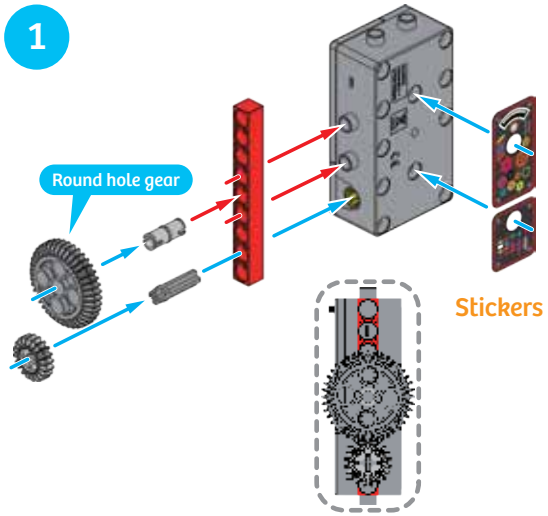
"I think it's just stuck," said Karlie. "Here, we just need to loosen these gears on the side a little bit." She adjusted the gears and the robot started to swing its hook-arm and peg-arm back and forth. It started to talk again too.

"Arrrrrrre ye ready to board the pirate ship ride, matey?" said the robot.



PIRATE-BOT

1



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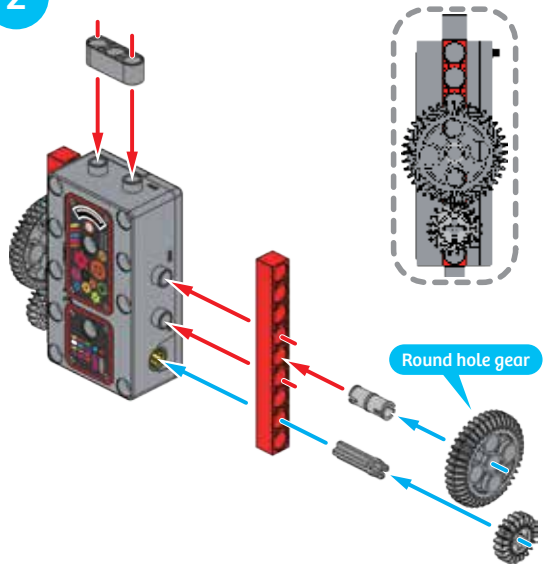

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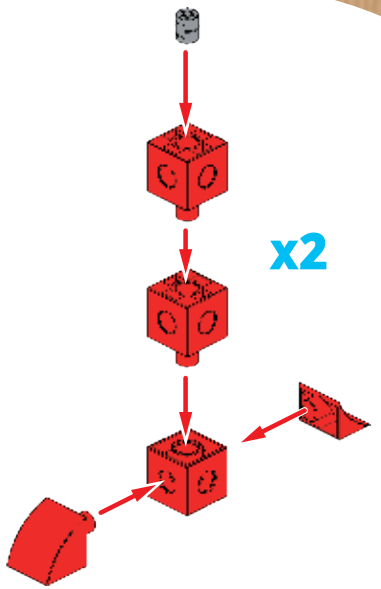

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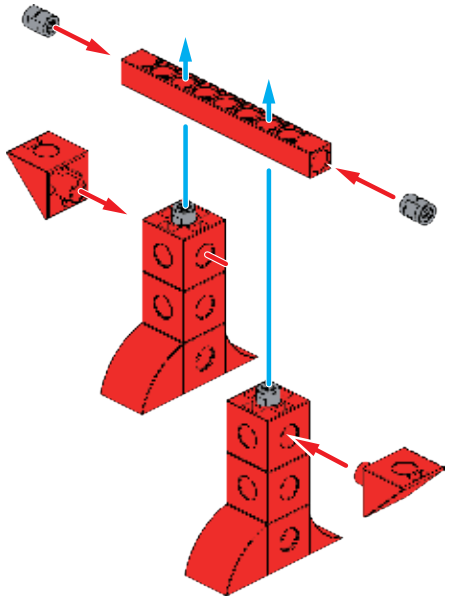

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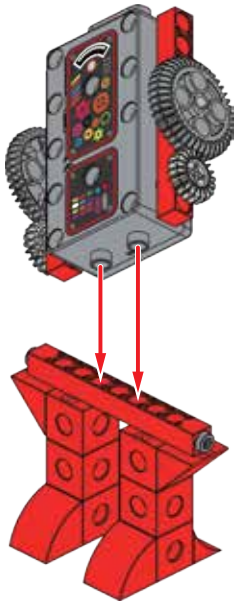

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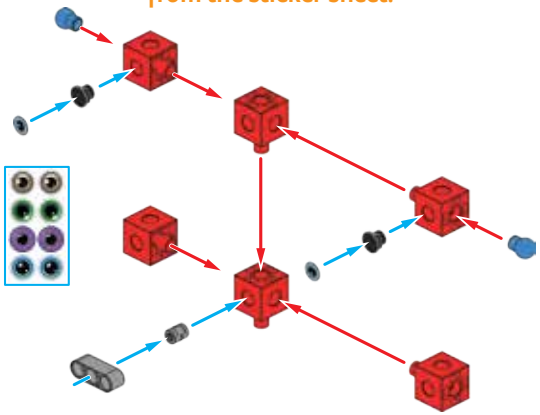

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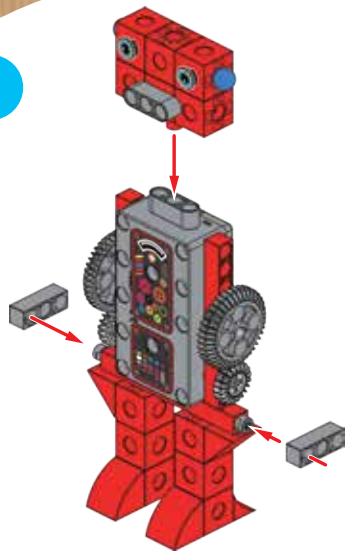

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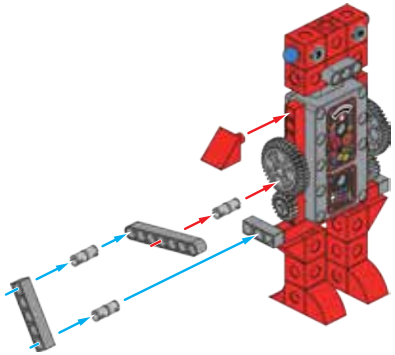

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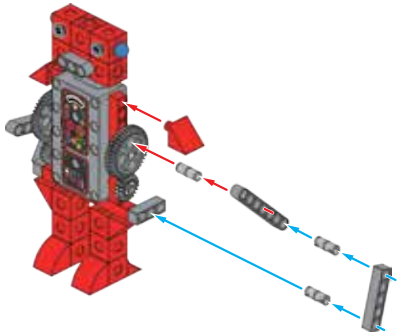

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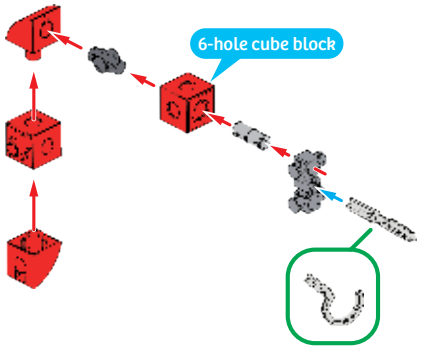

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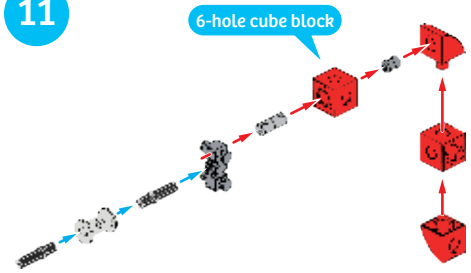

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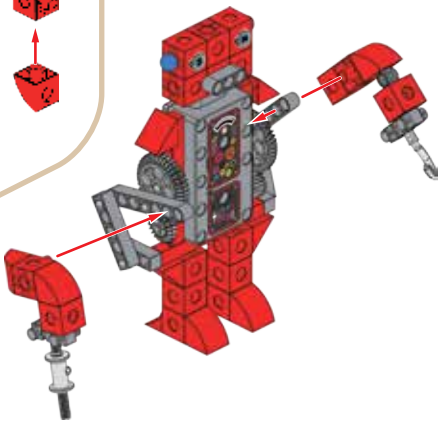
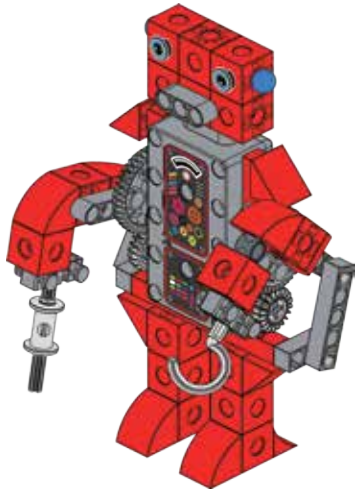
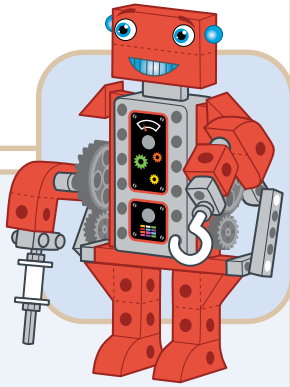


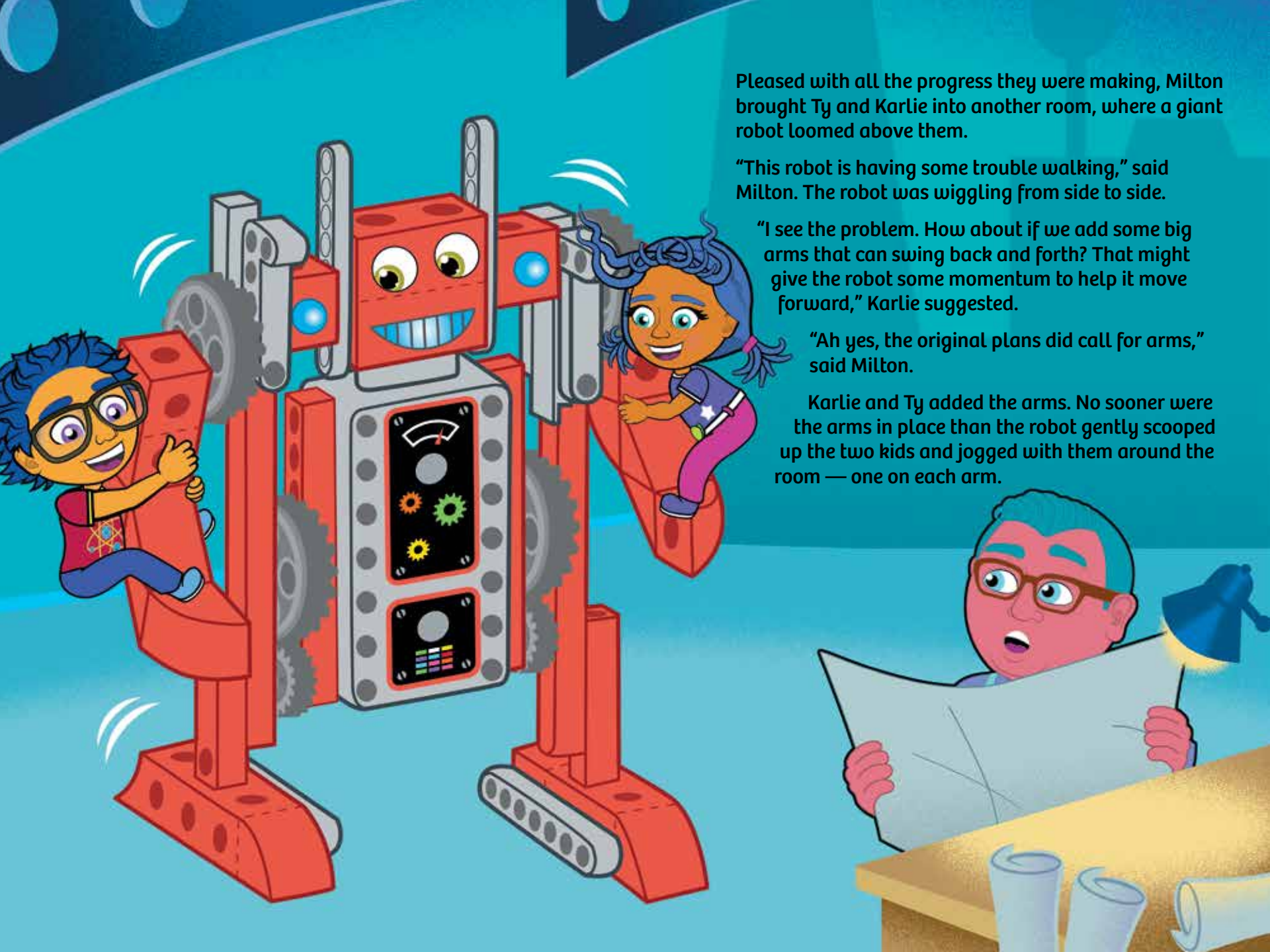


Use on a flat surface.

Done!



The model of the Pirate-Bot has gears connected to its arms which move the arms back and forth. Watch the speed of the small and medium gears closely. Which one moves faster? The small gear moves faster because it has half the number of teeth. For every two rotations of the small gear, the medium gear only goes around once.



Pleased with all the progress they were making, Milton brought Ty and Karlie into another room, where a giant robot loomed above them.

"This robot is having some trouble walking," said Milton. The robot was wiggling from side to side.

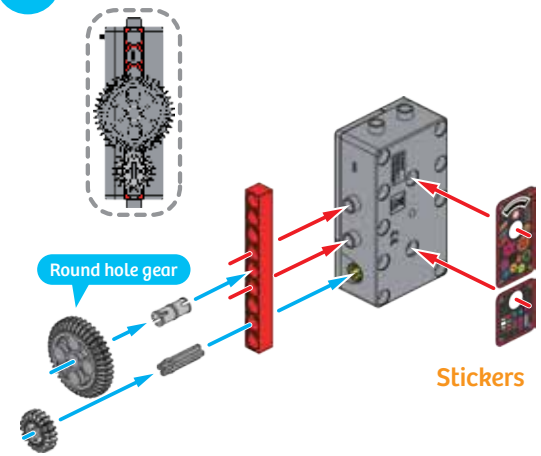
"I see the problem. How about if we add some big arms that can swing back and forth? That might give the robot some momentum to help it move forward," Karlie suggested.

"Ah yes, the original plans did call for arms," said Milton.

Karlie and Ty added the arms. No sooner were the arms in place than the robot gently scooped up the two kids and jogged with them around the room — one on each arm.

JOGGER-BOT

1



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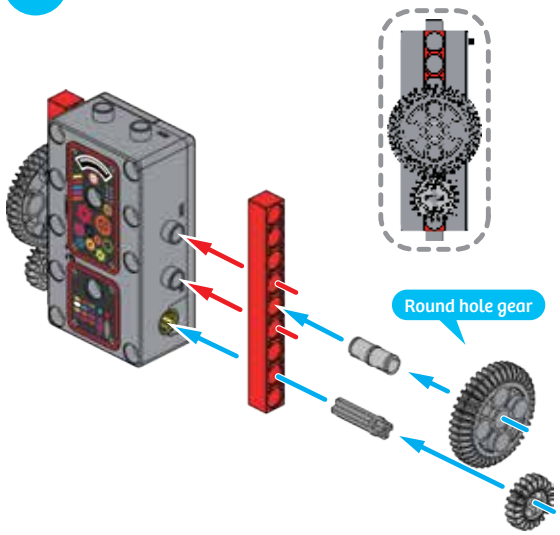

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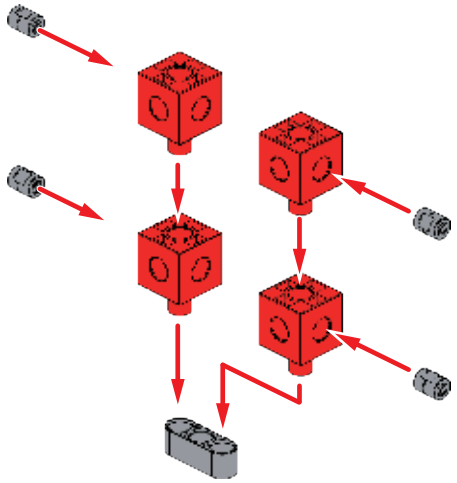

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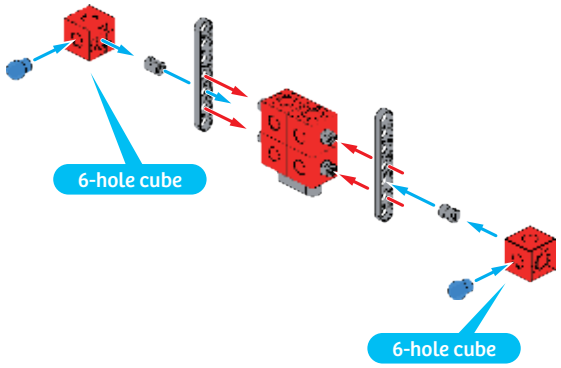

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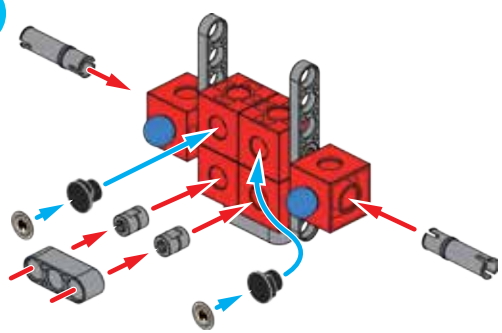

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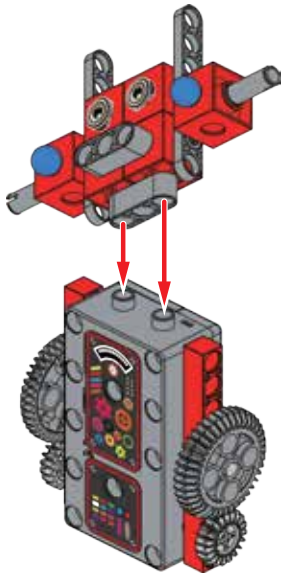

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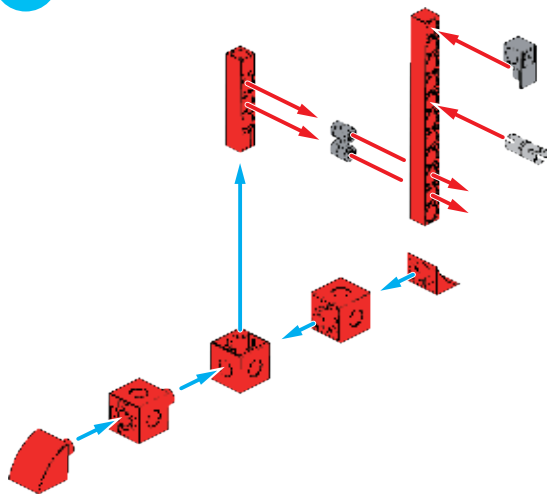

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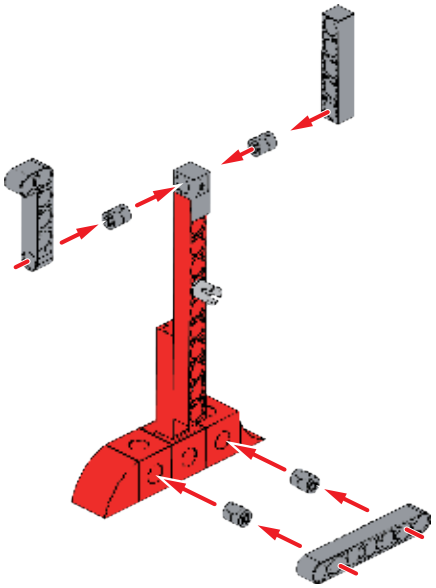

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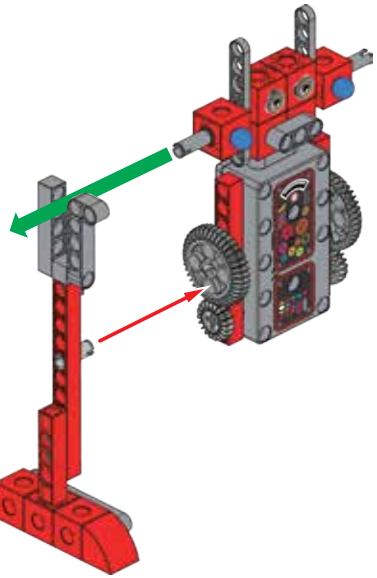

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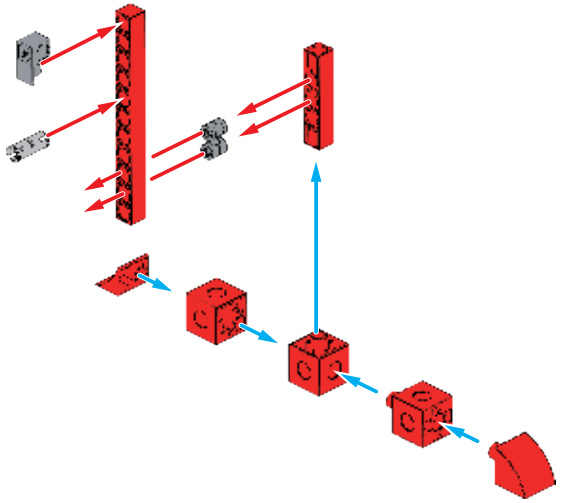

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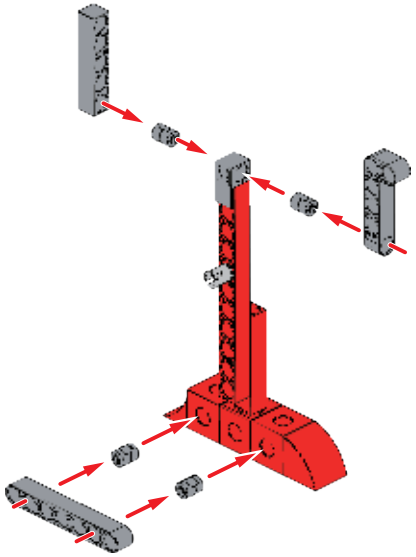

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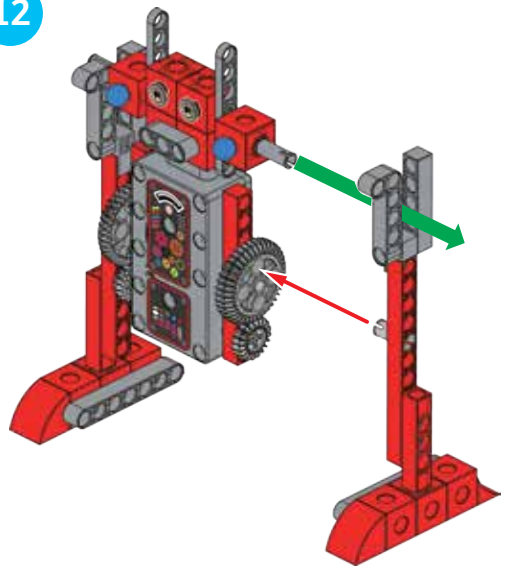

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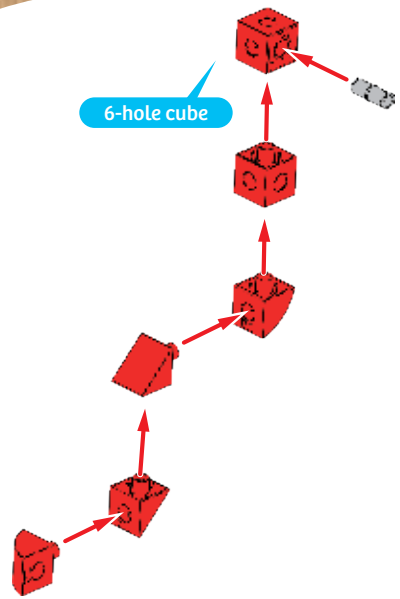

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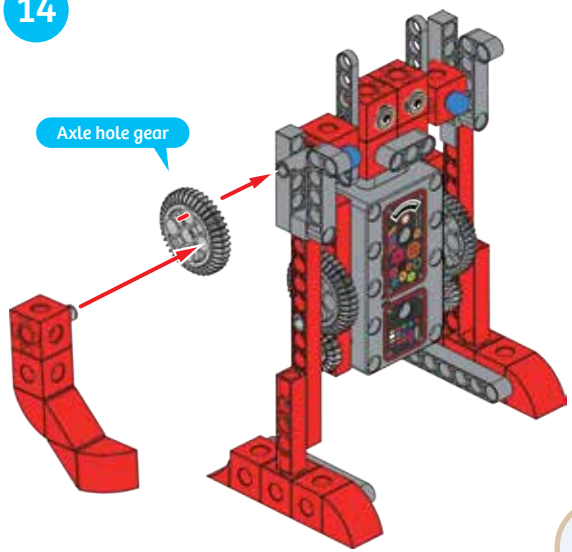

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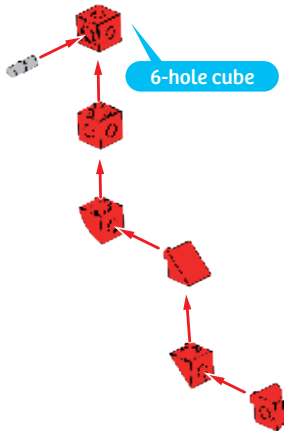
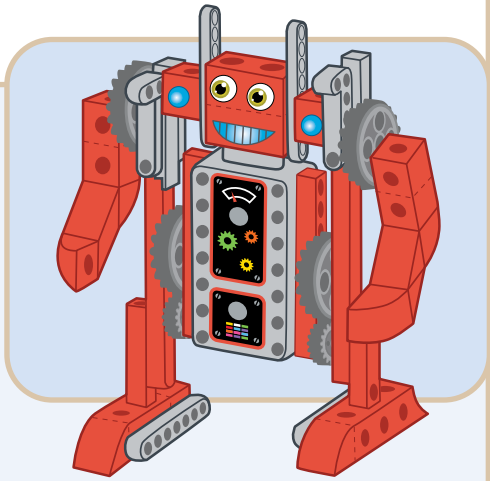
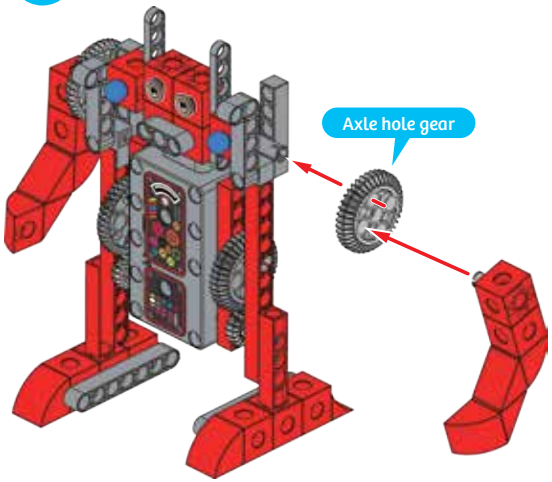




The arms on the model of the Jogger-Bot are not connected to the motor. Instead, each arm just swings freely back and forth like a pendulum, propelled by the motion of the legs. Test the model with and without the arms. How does the swinging of the arms affect the motion of the robot model?

16



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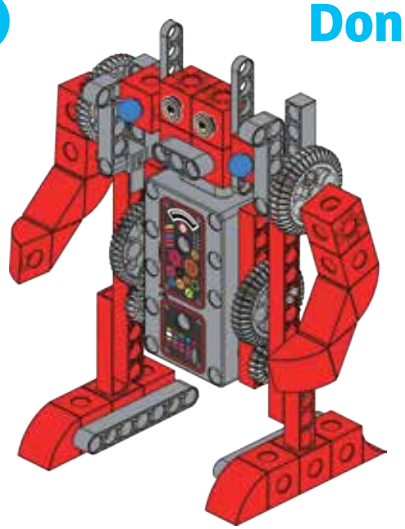


Done!

Use on a flat surface.

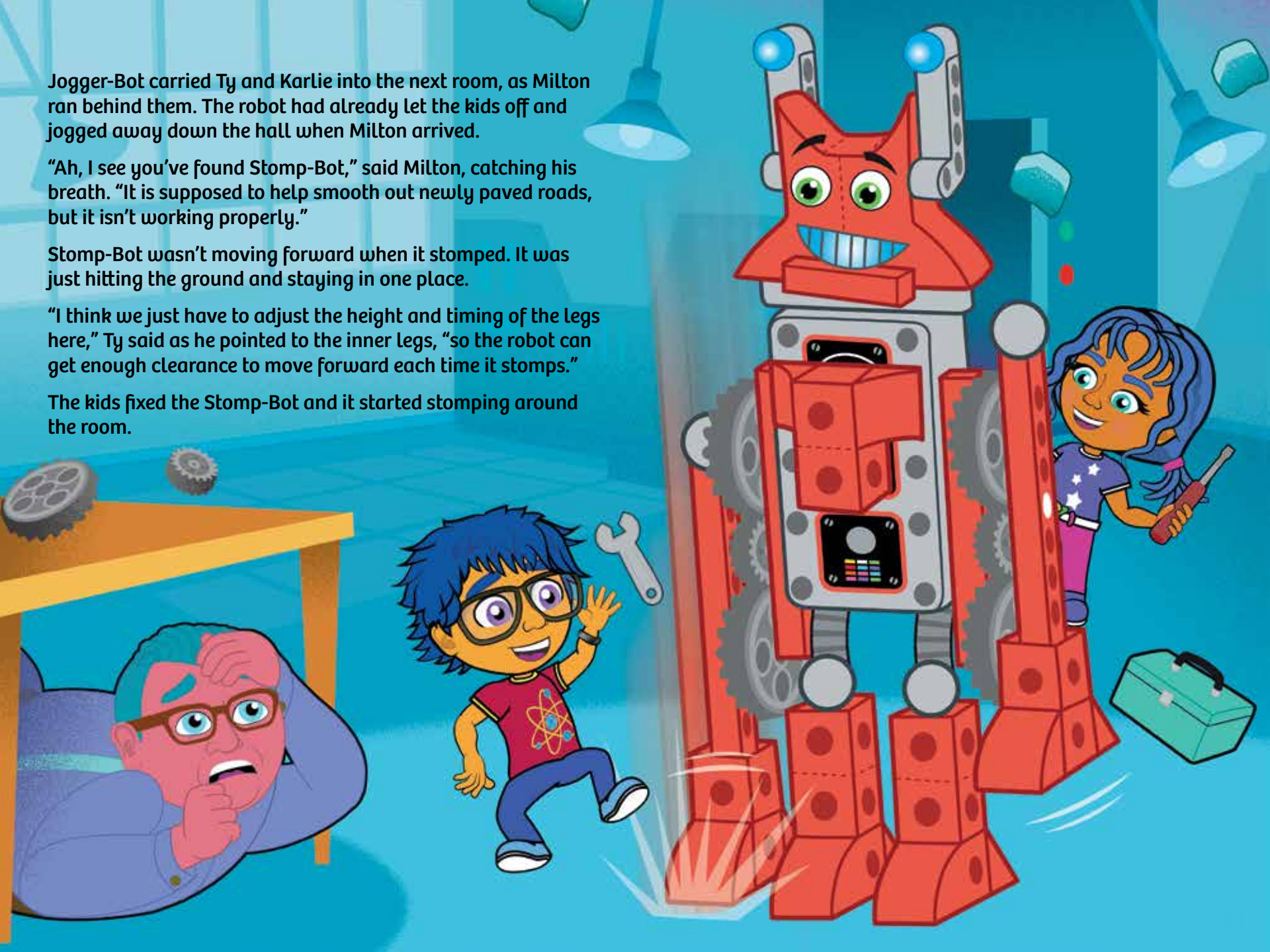
Jogger-Bot carried Ty and Karlie into the next room, as Milton ran behind them. The robot had already let the kids off and jogged away down the hall when Milton arrived.

"Ah, I see you've found Stomp-Bot," said Milton, catching his breath. "It is supposed to help smooth out newly paved roads, but it isn't working properly."

Stomp-Bot wasn't moving forward when it stomped. It was just hitting the ground and staying in one place.

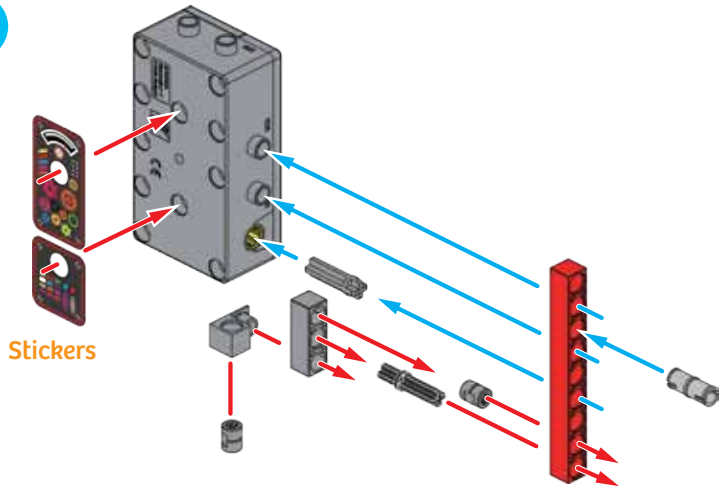
"I think we just have to adjust the height and timing of the legs here," Ty said as he pointed to the inner legs, "so the robot can get enough clearance to move forward each time it stomps."

The kids fixed the Stomp-Bot and it started stomping around the room.



STOMP-BOT

1



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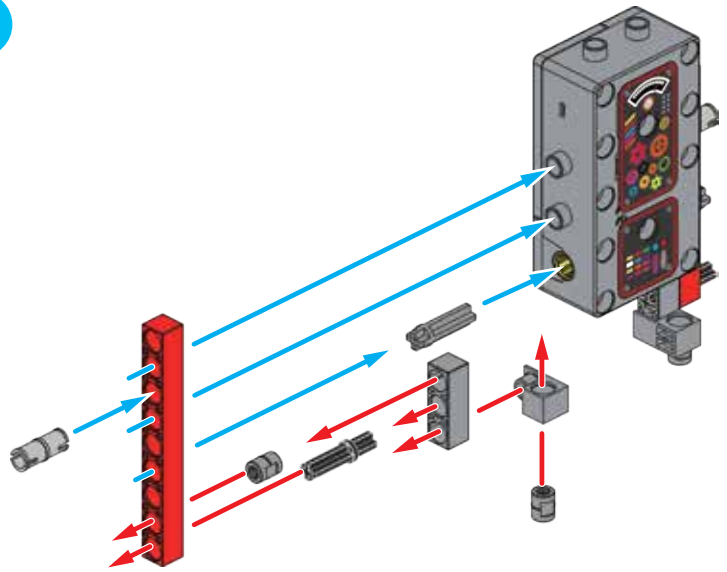

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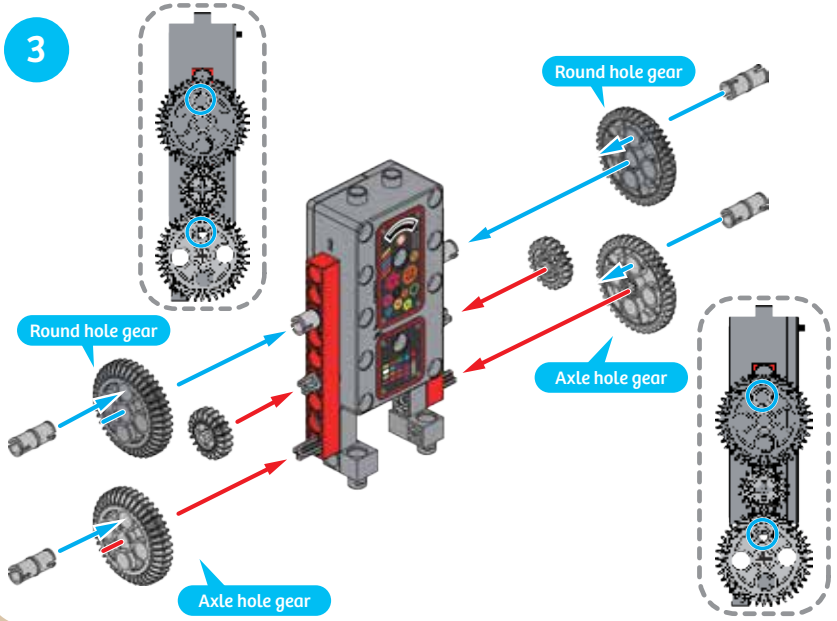

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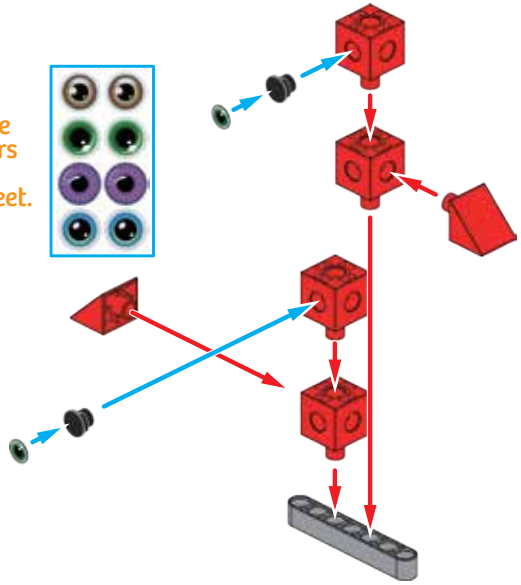

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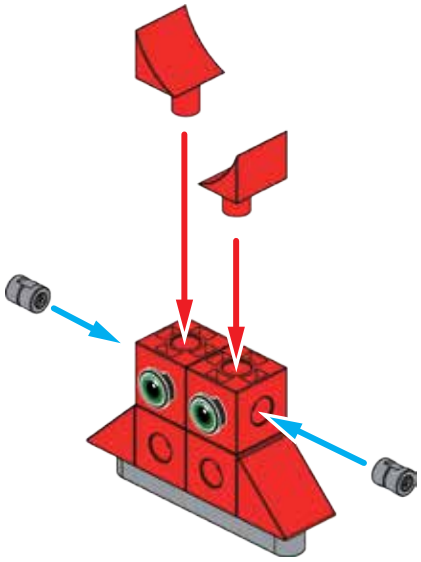

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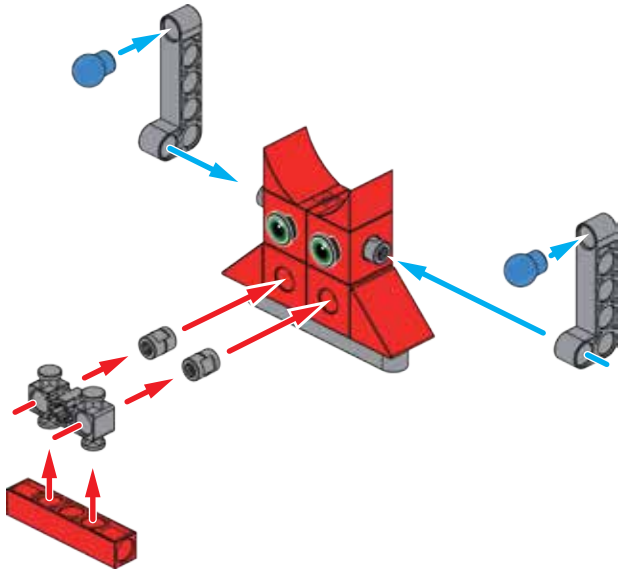

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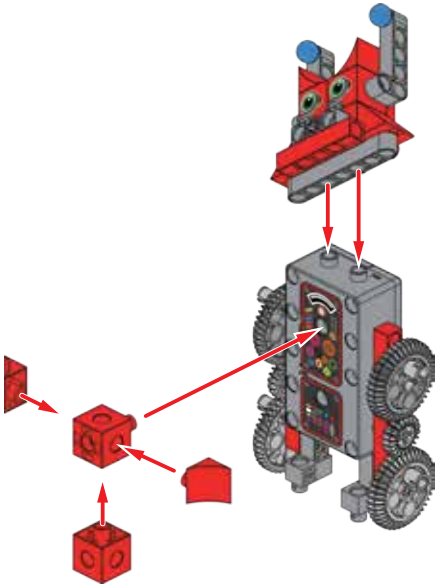

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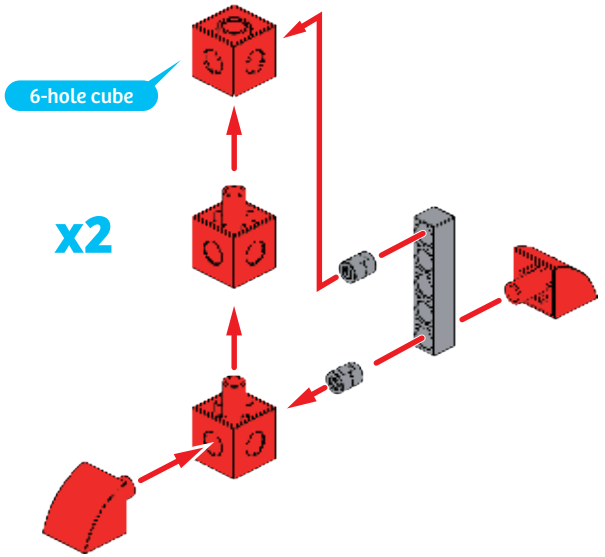

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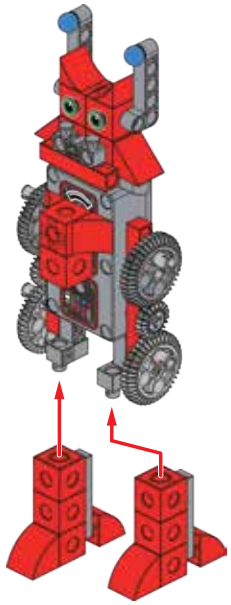

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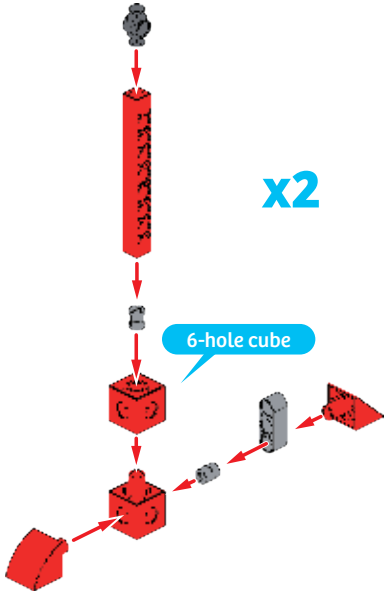

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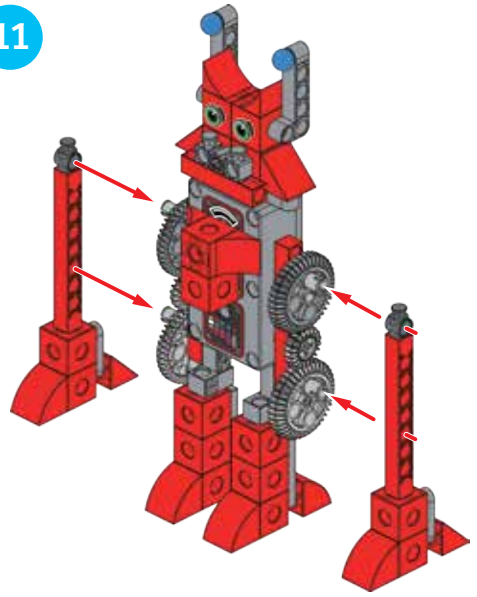
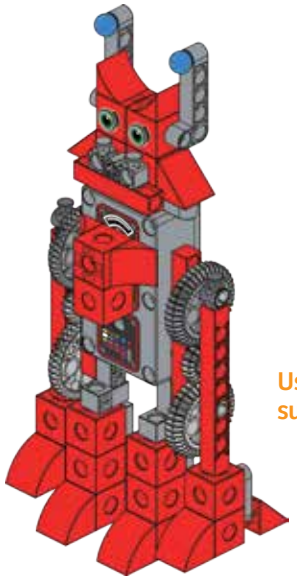
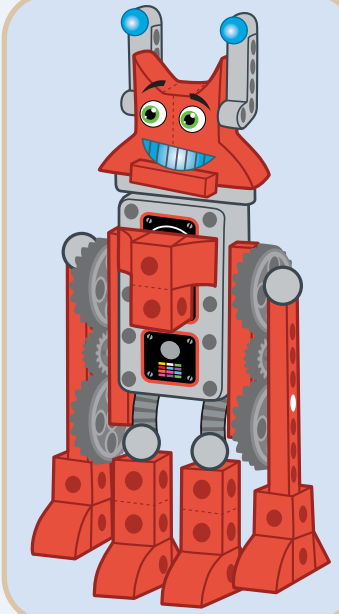


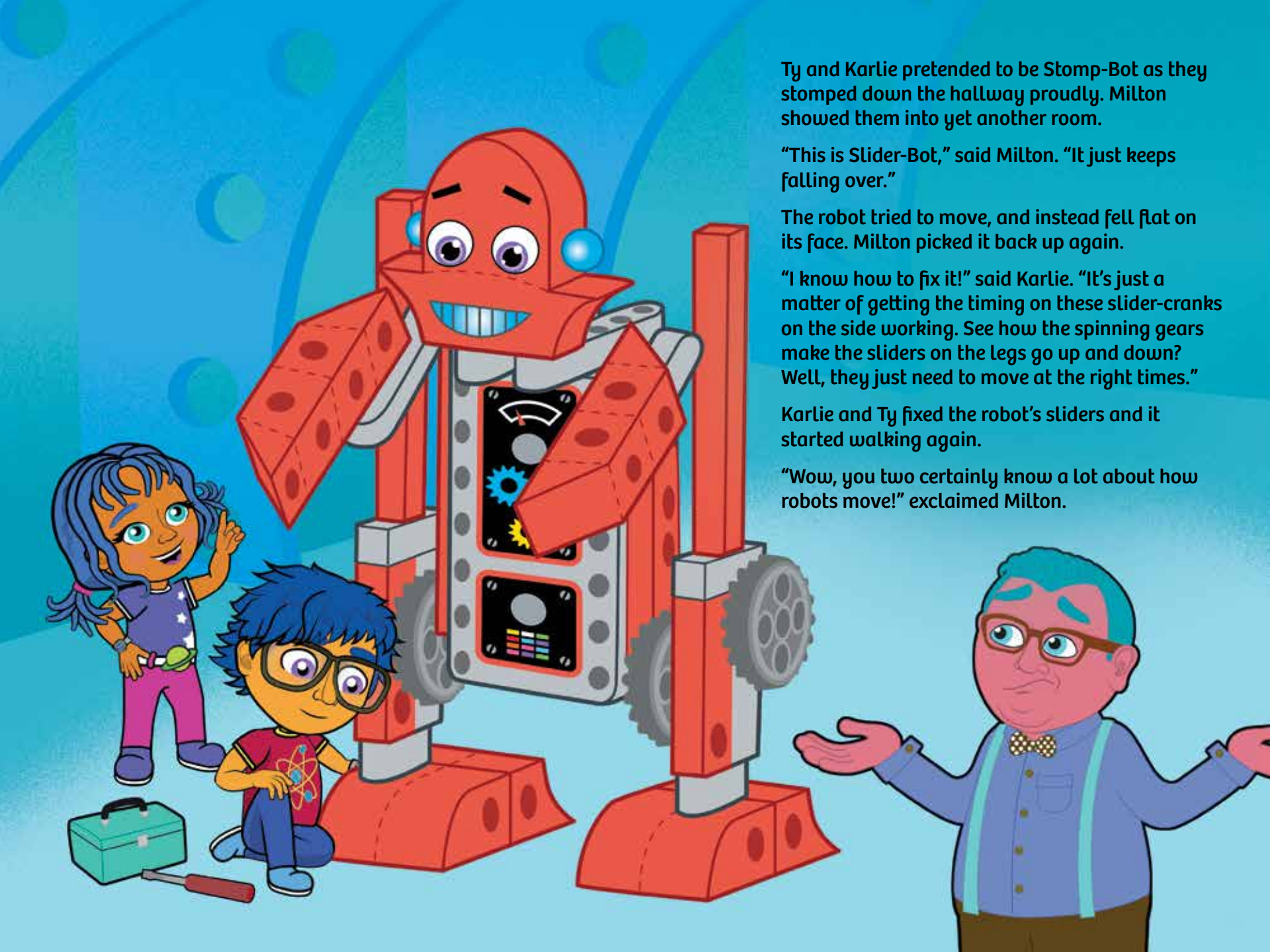


Done!

Use on a flat surface.

The model of the Stomp-Bot shows how having four legs instead of two can lead to a much more stable walking machine. In this model, two of the four legs are always on the ground at any one time. The inner legs support the model as the outer legs rotate upward, to the front of the model, and then downward. When the outer legs make contact with the ground, they start pushing the whole model upward because they are able to extend down further than the inner legs do. Two legs at a time, the model marches forward.





Ty and Karlie pretended to be Stomp-Bot as they stomped down the hallway proudly. Milton showed them into yet another room.

"This is Slider-Bot," said Milton. "It just keeps falling over."

The robot tried to move, and instead fell flat on its face. Milton picked it back up again.

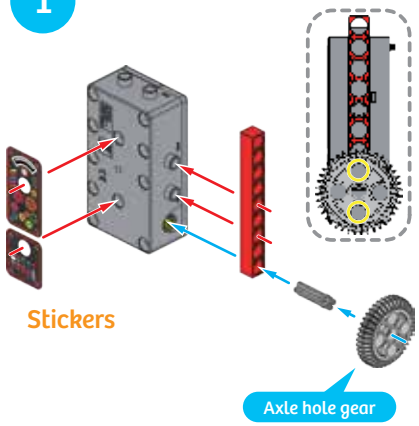
"I know how to fix it!" said Karlie. "It's just a matter of getting the timing on these slider-cranks on the side working. See how the spinning gears make the sliders on the legs go up and down? Well, they just need to move at the right times."

Karlie and Ty fixed the robot's sliders and it started walking again.

"Wow, you two certainly know a lot about how robots move!" exclaimed Milton.

SLIDER-BOT

1



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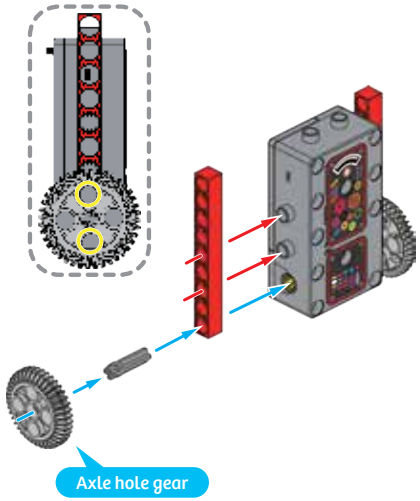

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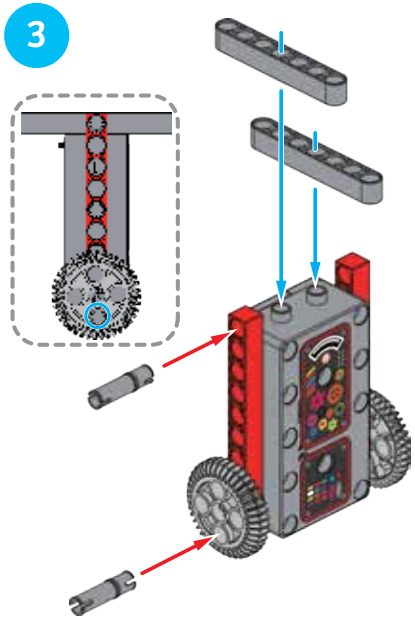

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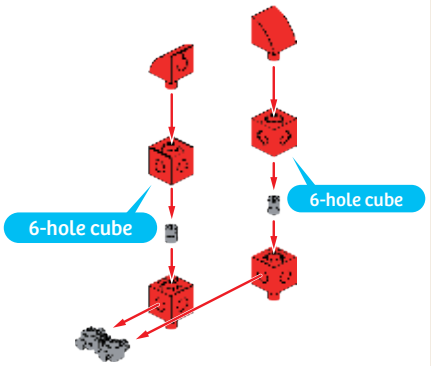

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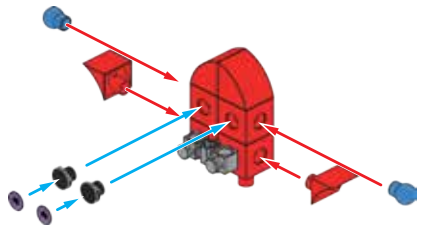

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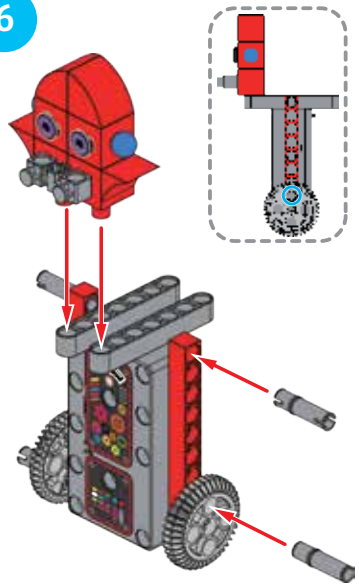

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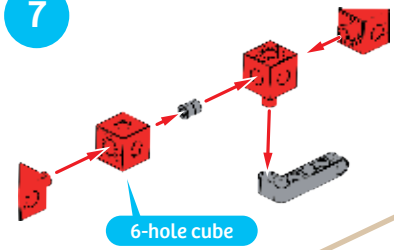

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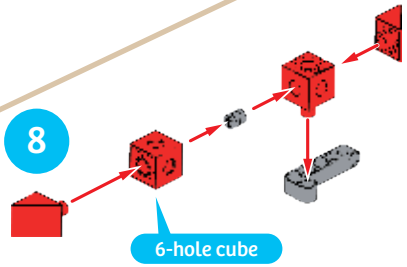

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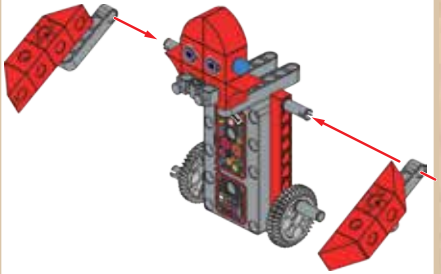

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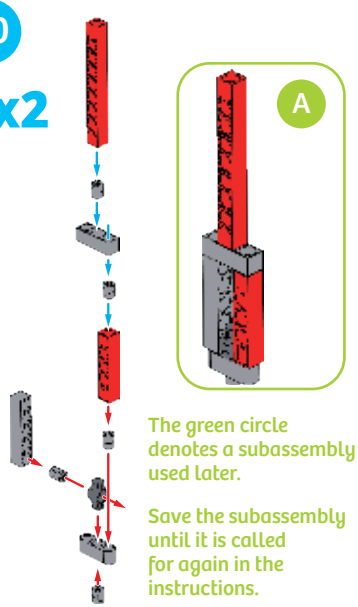
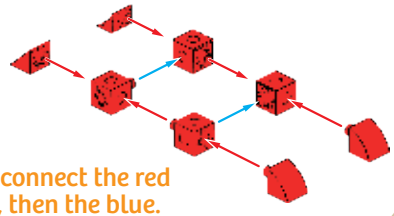


The green circle denotes a subassembly used later.

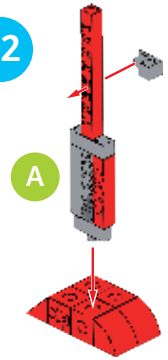
Save the subassembly until it is called for again in the instructions.

11



First connect the red lines, then the blue.

12



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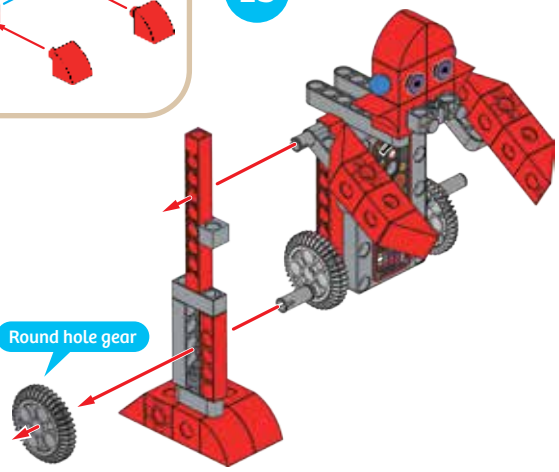

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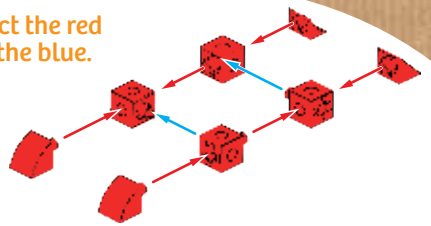
First connect the red lines, then the blue.



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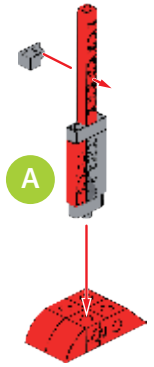

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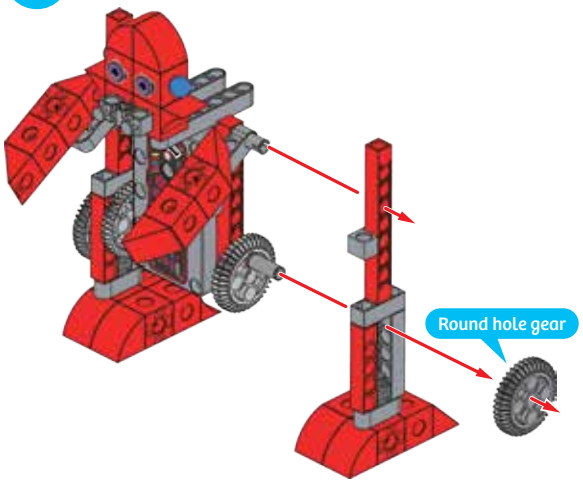
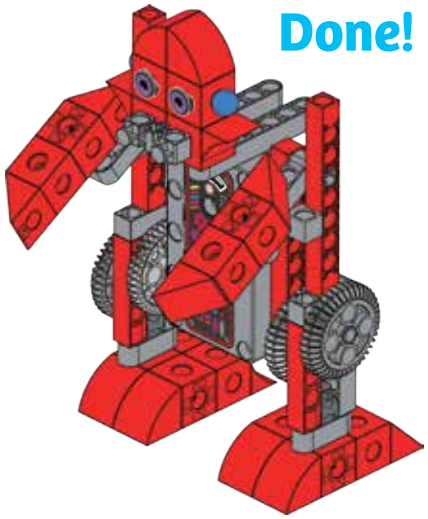
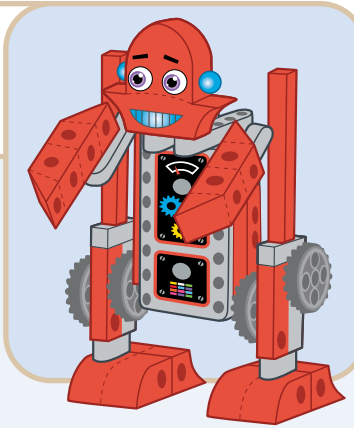


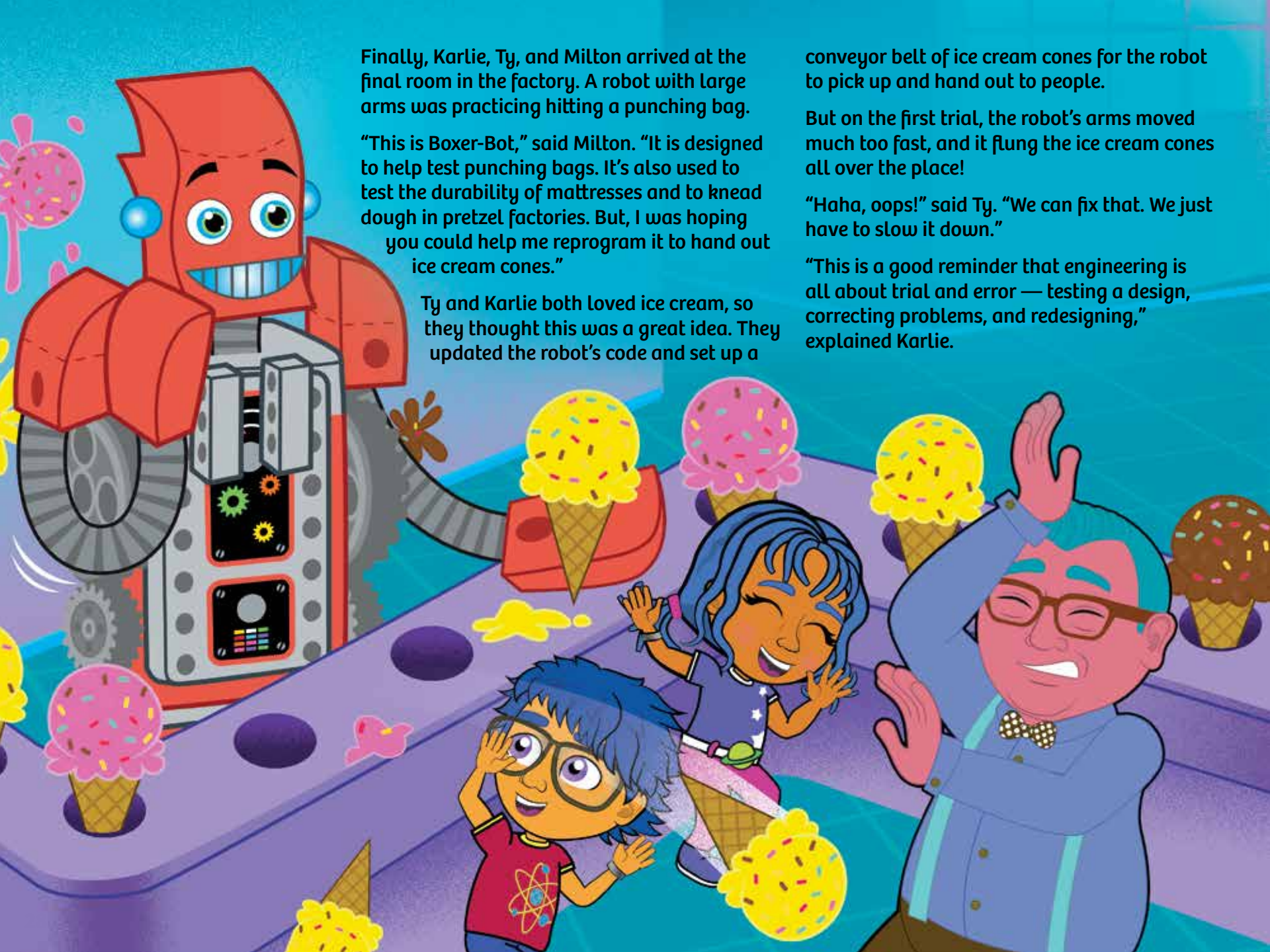
Done!



Use on a flat surface.



The model of the Slider-Bot uses a type of crank called a slider crank to convert the rotating motion of the gears into the vertical up-and-down motion of the legs. The legs are not fixed directly to the gears; instead each leg has a slot in it in which a pin that is spinning around on the gear slides up and down.



Finally, Karlie, Ty, and Milton arrived at the final room in the factory. A robot with large arms was practicing hitting a punching bag.

"This is Boxer-Bot," said Milton. "It is designed to help test punching bags. It's also used to test the durability of mattresses and to knead dough in pretzel factories. But, I was hoping you could help me reprogram it to hand out ice cream cones."

Ty and Karlie both loved ice cream, so they thought this was a great idea. They updated the robot's code and set up a conveyor belt of ice cream cones for the robot to pick up and hand out to people.

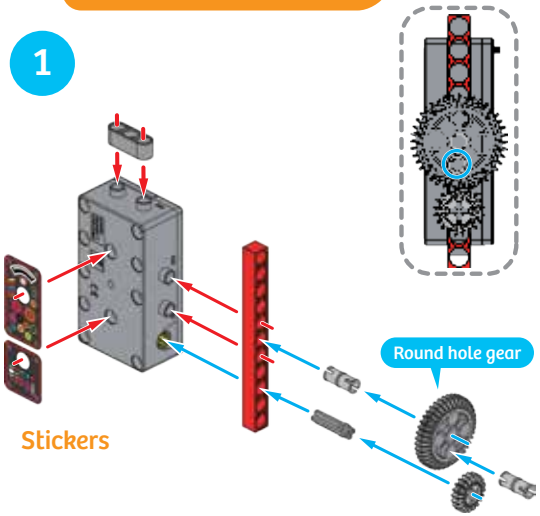
But on the first trial, the robot's arms moved much too fast, and it flung the ice cream cones all over the place!

"Haha, oops!" said Ty. "We can fix that. We just have to slow it down."

"This is a good reminder that engineering is all about trial and error — testing a design, correcting problems, and redesigning," explained Karlie.

BOXER-BOT

1



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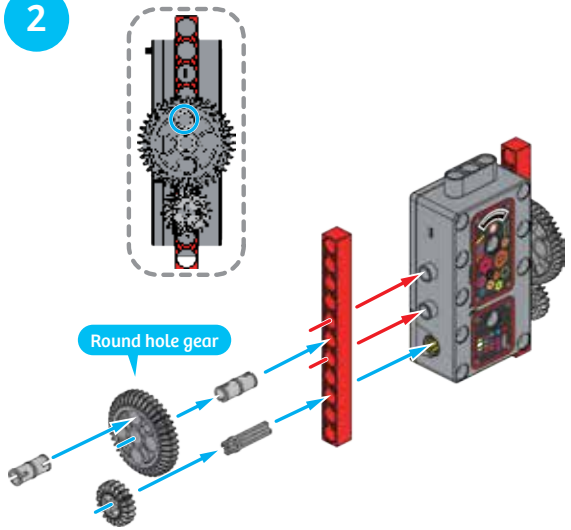

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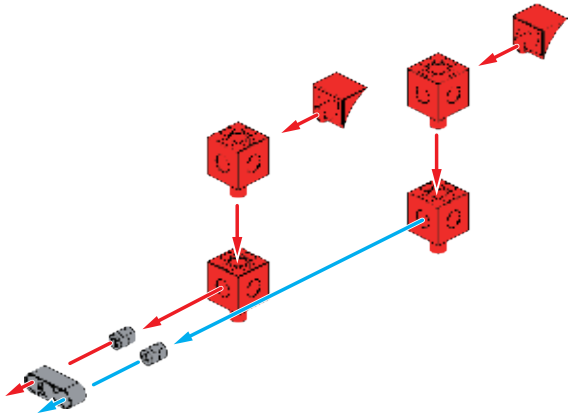

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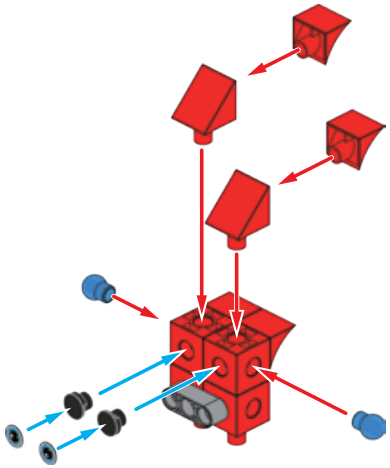

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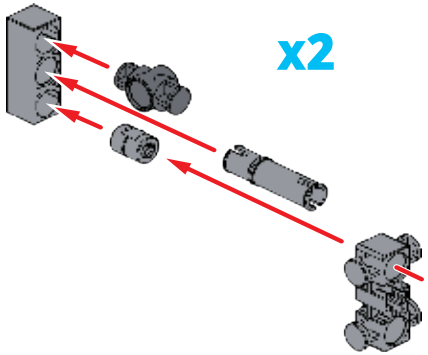

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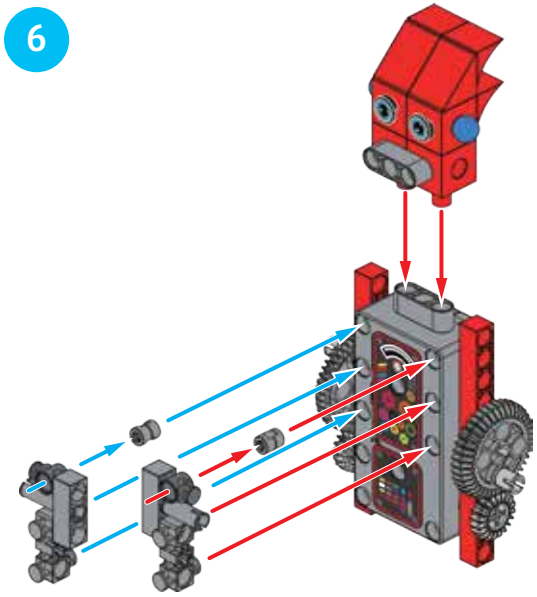

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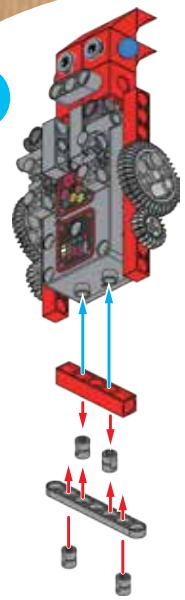

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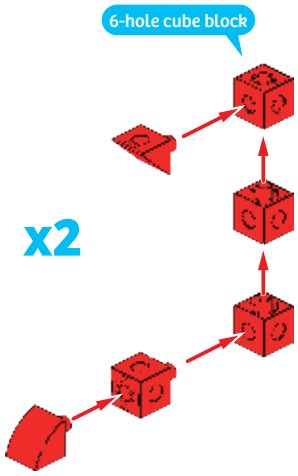

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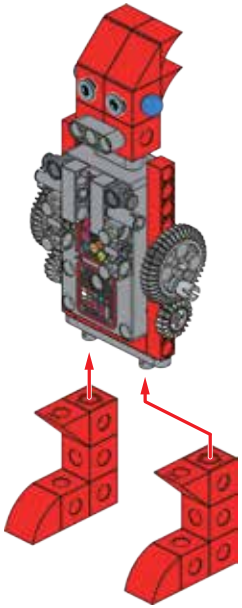

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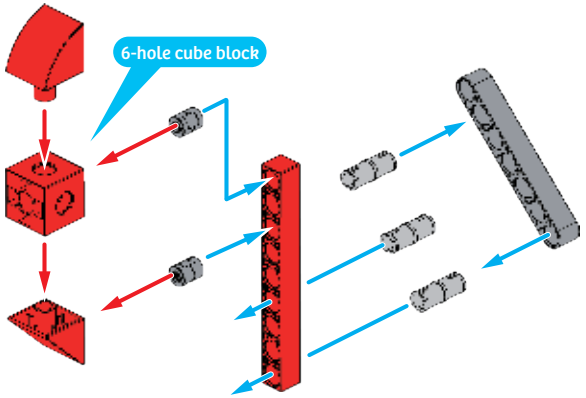

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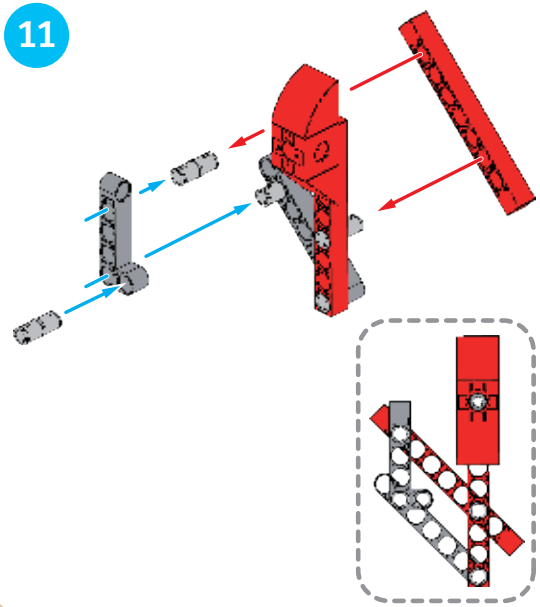

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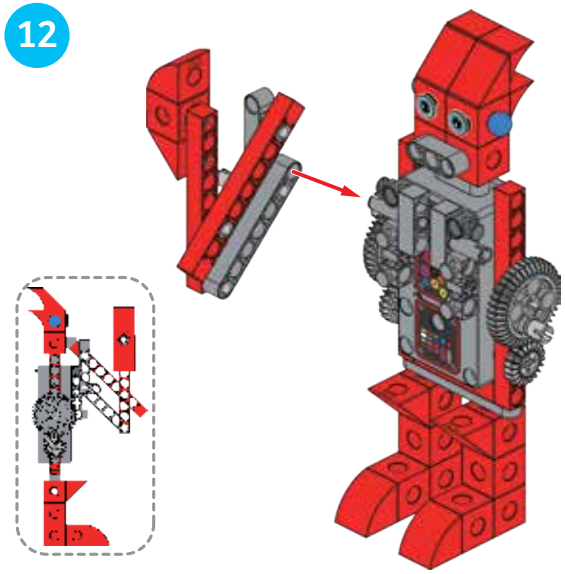

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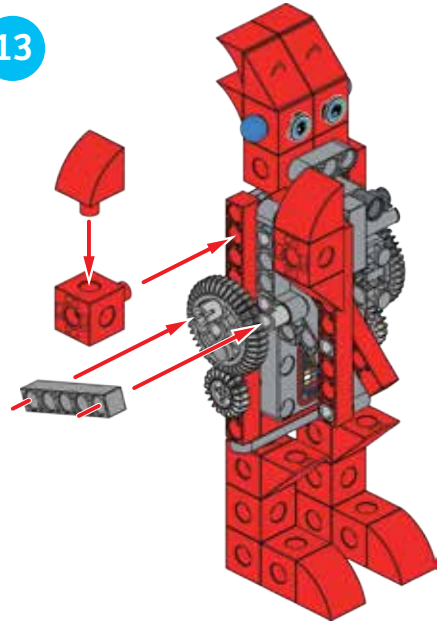

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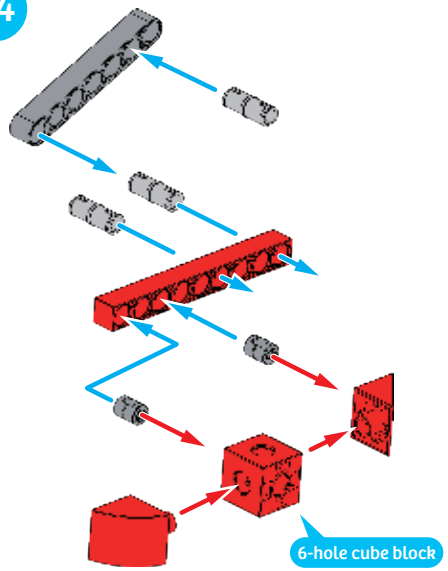

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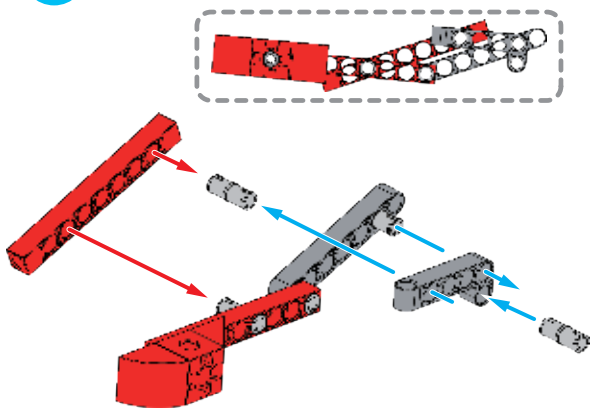

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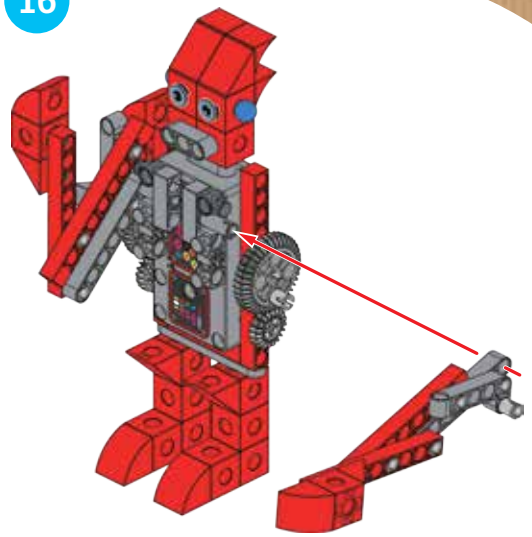

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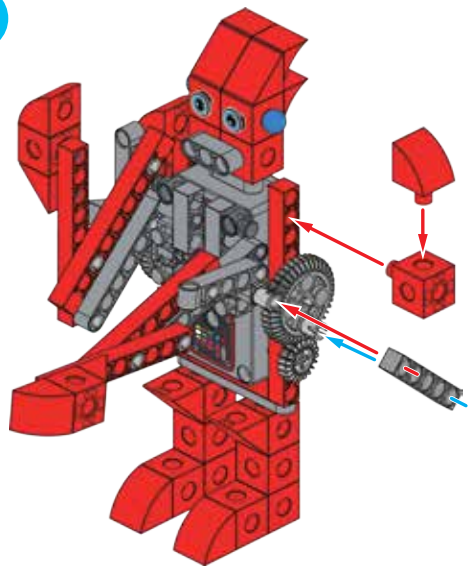
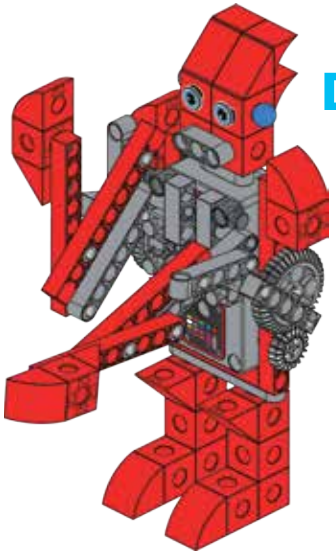
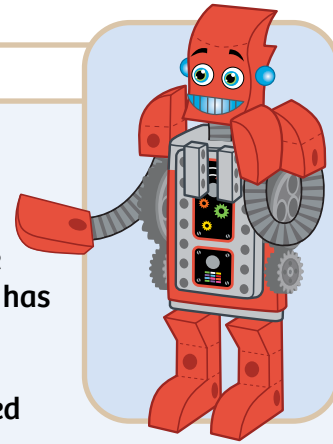




Done!

Use on a flat surface.



The model of the Boxer-Bot moves its arms back and forth in a repetitive motion. The model has gear wheels which turn crankshafts, which are connected to other rods with rotating joints. This type of setup is called a linkage, where two or more movable rods are linked together. Linkages are used almost everywhere in engineering.

The kids made adjustments to the Boxer-Bot so that it served ice cream at a normal speed.

"Whew! I am so relieved to have all of these robots back in working order," said Milton, as he sat down on the floor and licked his ice cream cone. "Thank you so much for all your help, Karlie and Ty."

"You're welcome!" replied Karlie.

"Anytime!" said Ty. "Especially if there's ice cream involved."

Ty and Karlie were both holding an ice cream cone in each hand. They had reprogrammed the Boxer-Bot to slow down and only hand out one cone per person, but not before they had each had a chance to select a few cones of their favorite flavors of ice cream.

"Robotics can be so yummy," said Ty with ice cream all over his face.

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