

_____ 's Whysheet for
Your name

Why is riding a bicycle faster than running?

Yeah, why? Write (or draw) your answer:



Whybricks

Giving physical science form

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Part 1: Gears

For the first part of this investigation, you are going to explore how gears work.

Build it!

First, build the uniform gearbox out of Whybricks.

 **Grab this resource!** 

The **Uniform gearbox** build guide.

Once you have built the uniform gearbox, test it out. Tinker and experiment to see how everything works.

Try spinning the crank on the same side of the gearbox as the gears. Then try spinning the crank on the opposite side of the gearbox. Choose one crank and turn it slowly, then spin it fast. Turn one crank clockwise, then turn it counter clockwise.

I notice...

What do you notice about this phenomenon? Write your observations on your Notice sheet.

I wonder...

What are you wondering about? Write your questions on your Wonder sheet.

Now, build the mixed gearbox out of Whybricks.

Once you have built the mixed gearbox, test it out. Tinker and experiment to see how everything works.

 **Grab this resource!** 

The **Mixed gearbox** build guide.



Just like you did with the uniform gearbox, experiment with the different cranks. Try spinning the crank on the same side of the gearbox as the gears. Then try spinning the crank on the opposite side of the gearbox. Choose one crank and turn it slowly, then spin it fast. Be sure you do the same thing with the other crank too.

Pay special attention to any differences you notice about the mixed gearbox compared to the uniform gearbox. Does one crank feel harder to turn now? Do the gears move the same way they did with the uniform gearbox?

I notice...

What do you notice about this phenomenon? Write your observations on your Notice sheet.

I wonder...

What are you now wondering about? Write your questions on your Wonder sheet.

I wonder... Why would you use different sized gears?

Gears are a very common part of many types of machines. One place you have probably seen gears is on a bicycle. If you look closely at the front and back gears of a bicycle, you will notice something. The front gear is bigger than the back gear!

Even on bicycles with multiple gears, the ones in the front are bigger than the ones at the back wheel. Why is that?

 **Grab this resource!** 

The **Gears** WOW sheet.



Explain what a **gear ratio** is using the mixed gearbox as an example. Be sure to include the gear ratio for the mixed gearbox in your answer:

Explain why you might use gears of different sizes in a machine. Use the mixed gearbox and the uniform gearbox as examples:



Part 2: Gears in motion

This is an engineering design challenge. Your goal is to engineer a device that uses gears to change the speed, the size, or the direction of your input force to perform a task.

Step 1: Brainstorm

What types of machines use gears? What types of tasks do those machines do? How do they use the gears to help them perform that task? What could you create that uses gears and what task will it do?

Write and draw your ideas.

Idea #1

Idea #2

Idea #3



Idea #4

Idea #5

Idea #6

Idea #7

Idea #8



Step 2: Design your test

How will you know whether or not your design is successful? You need to design a test that you can run with each gear design you try to determine whether or not your idea is successful.

The goal is: to engineer a device that uses gears to change the speed, the size, or the direction of your input force to perform a task.

Things I need to know to run my test:

How I will set up and run my test (including the materials and equipment I will use and my procedure):



How I will measure the outcome:

Step 3: Build, test, learn, repeat

You are now ready to start **iterating**. Iterating is the process of taking one of your ideas and trying it out. You will try to build your idea and then test it out. Somethings will work and somethings won't. You then take what you learnt and apply it to a new iteration. That is to say, you apply the learning to a new version and try again!

For each iteration there are three steps:

1. Build. Describe and draw your build for your records.
2. Run your test and record your results.
3. Record your ideas for how to improve your next iteration.

If at any point things don't work how you thought they would, record what happened and what you did to solve the problem. You will need this for your next iteration!



Iteration #1

Describe and draw your build:



Run your test and record your results:

Record your ideas for how to improve your next iteration:



Iteration #2

Describe and draw your build:



Run your test and record your results:

Record your ideas for how to improve your next iteration:



Iteration #3

Describe and draw your build:



Run your test and record your results:

Record your ideas for how to improve your next iteration:



Iteration #4

Describe and draw your build:



Run your test and record your results:

Record your ideas for how to improve your next iteration:



Iteration #5

Describe and draw your build:



Run your test and record your results:

Record your ideas for how to improve your next iteration:



Wrap-up

Describe your most successful design. Draw and label your design and explain why you believe it was the most successful:

So... why is riding a bicycle faster than running?

Now that you've completed this investigation, what do you think about your original answer?

Can you add any new information to your original explanation?

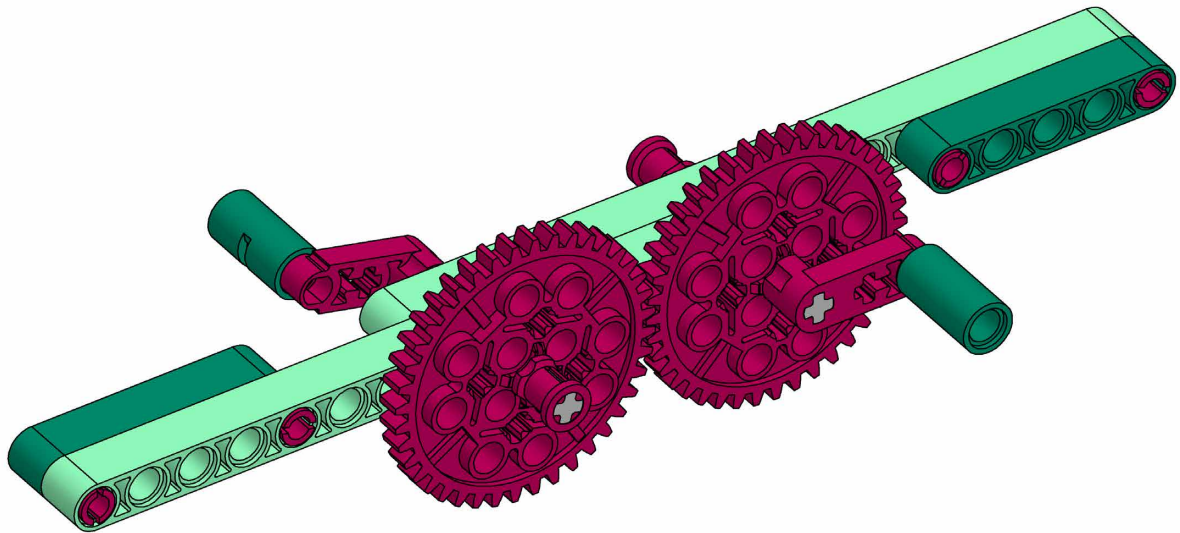
And... what are you wondering about now?

  **Now I wonder...**

Now that you have completed the investigation, what new questions do you have?

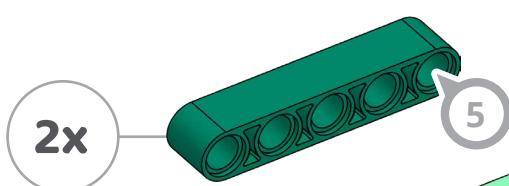
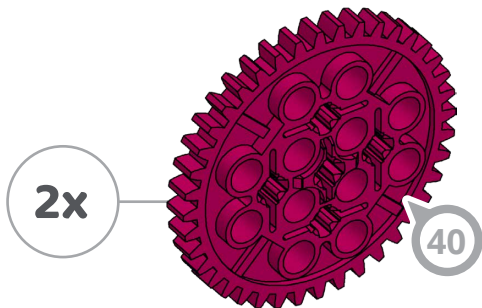
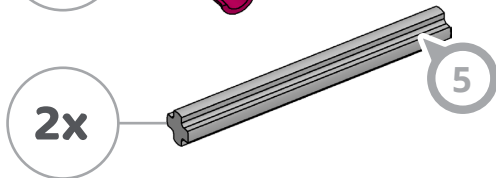
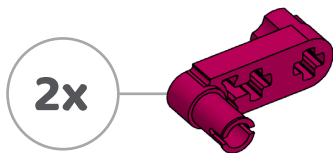
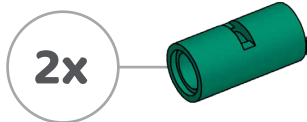
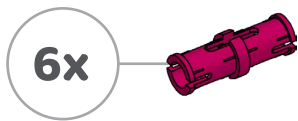


Uniform gearbox

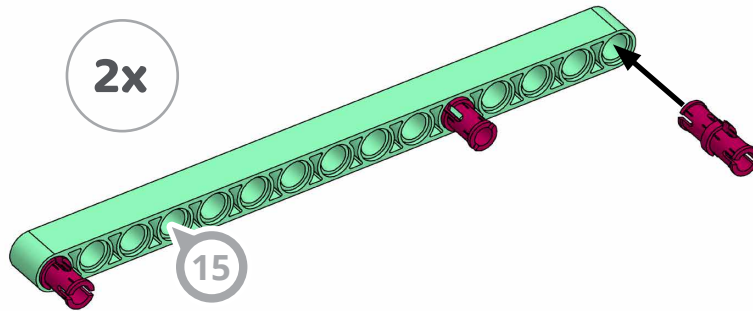


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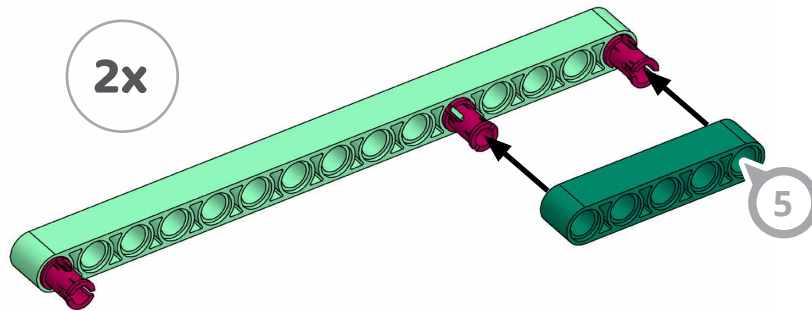
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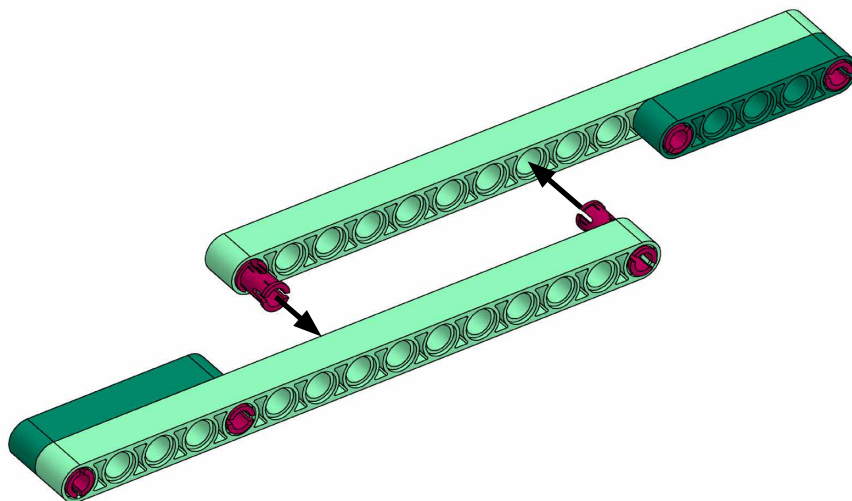
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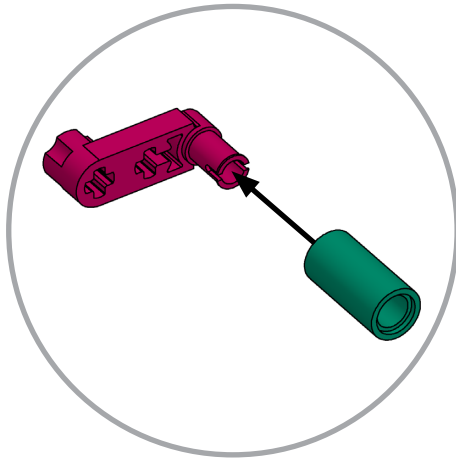
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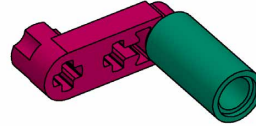
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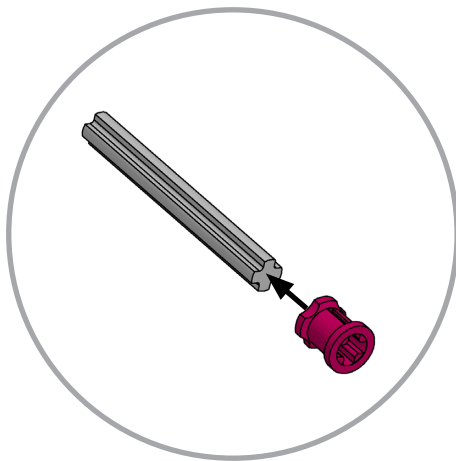
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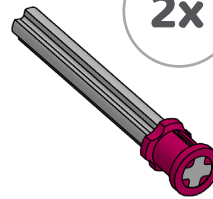
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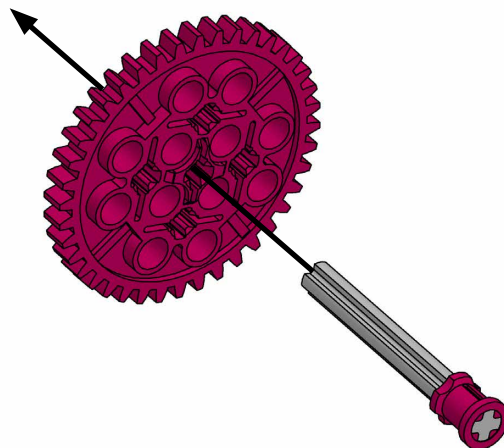
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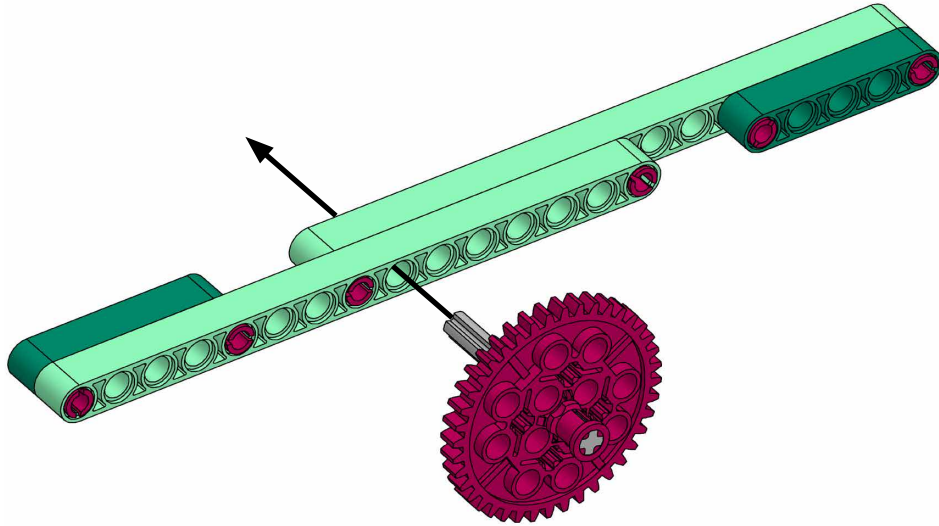
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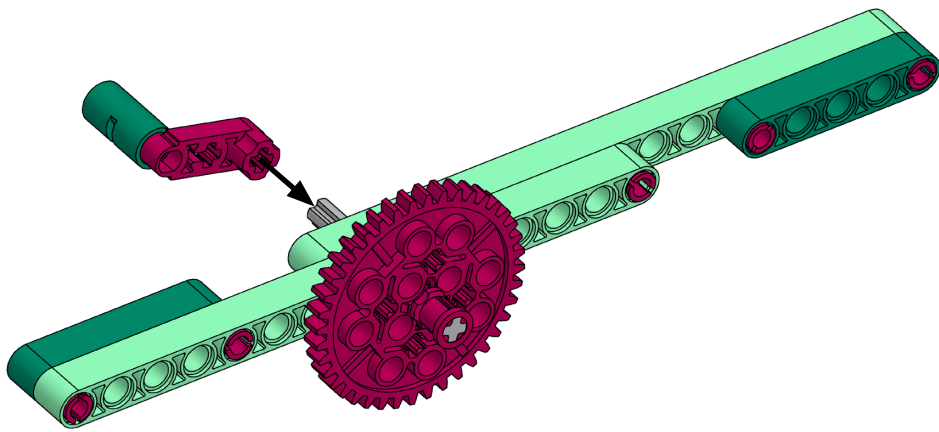
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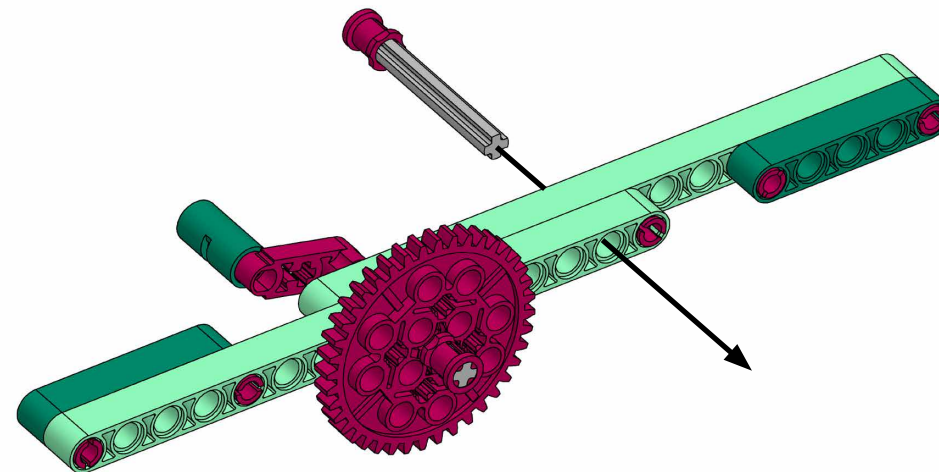
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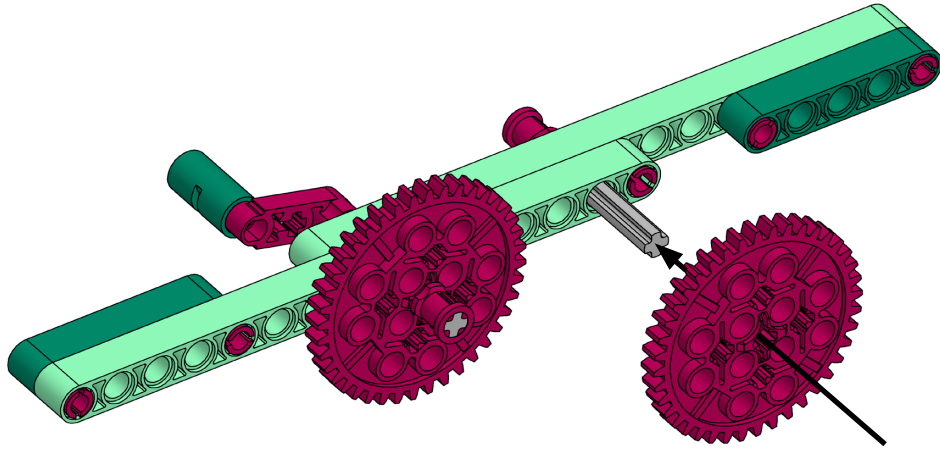
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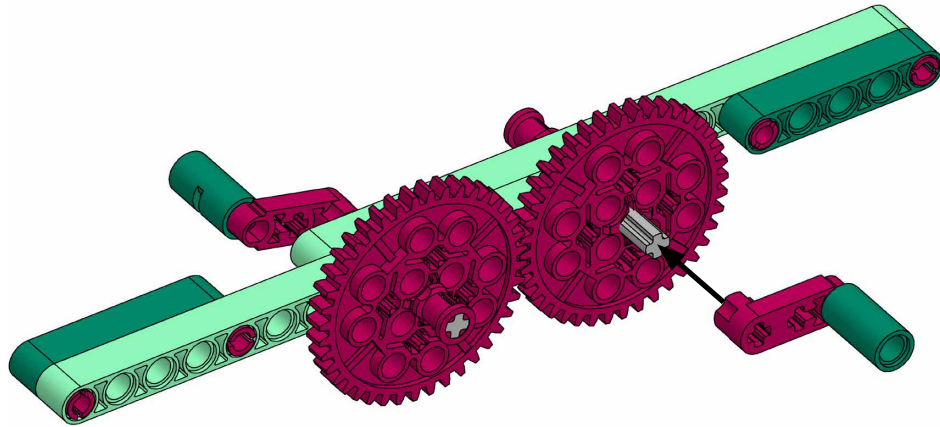
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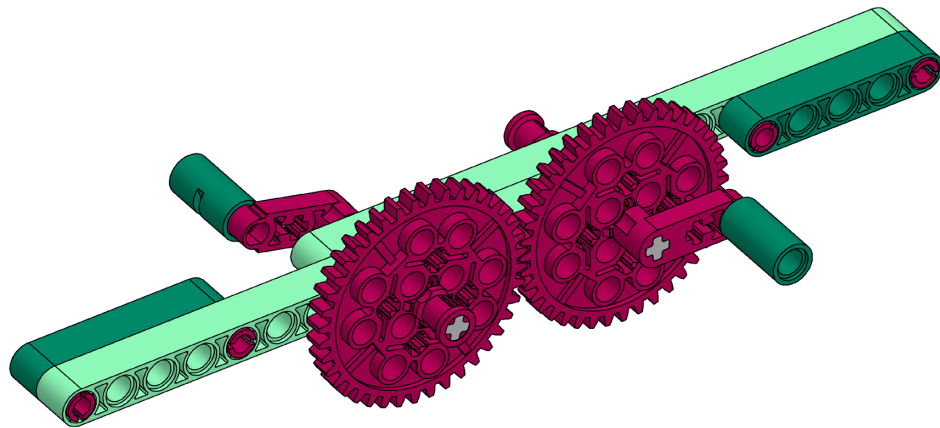
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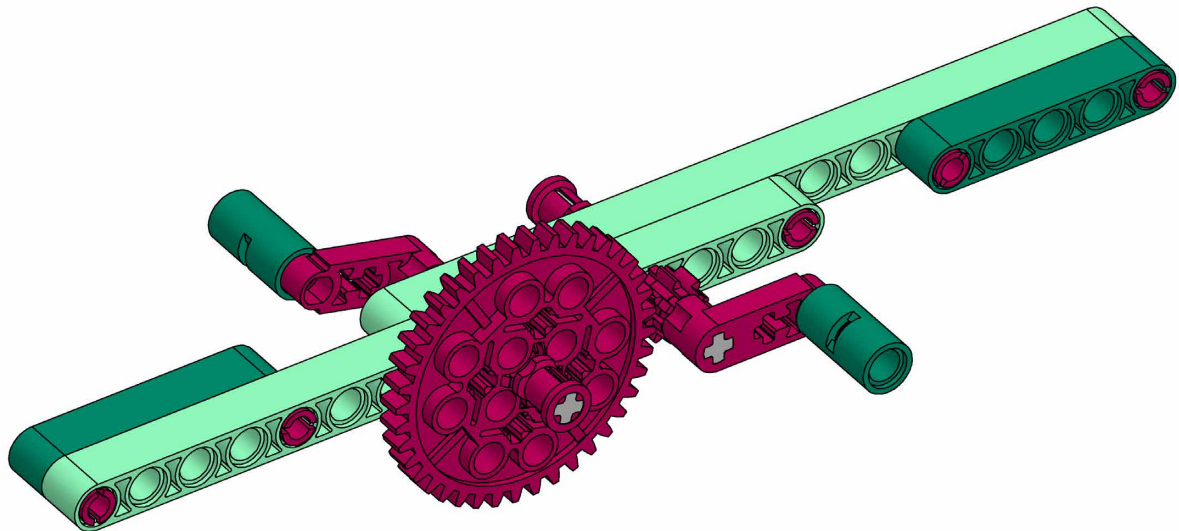


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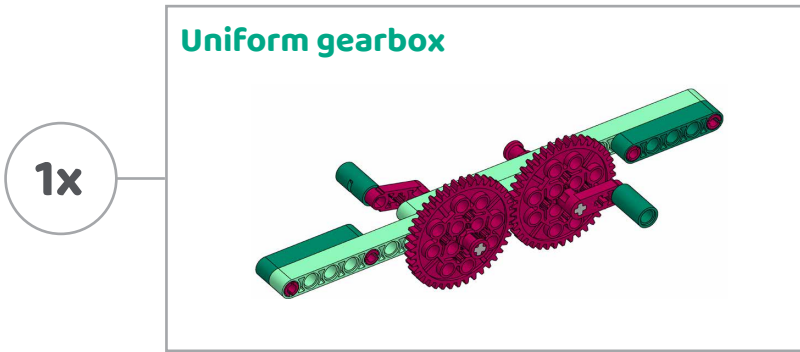
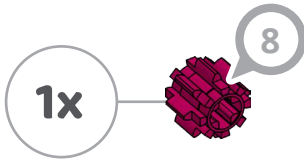
Mixed gearbox

This build requires the following completed builds:
Uniform gearbox

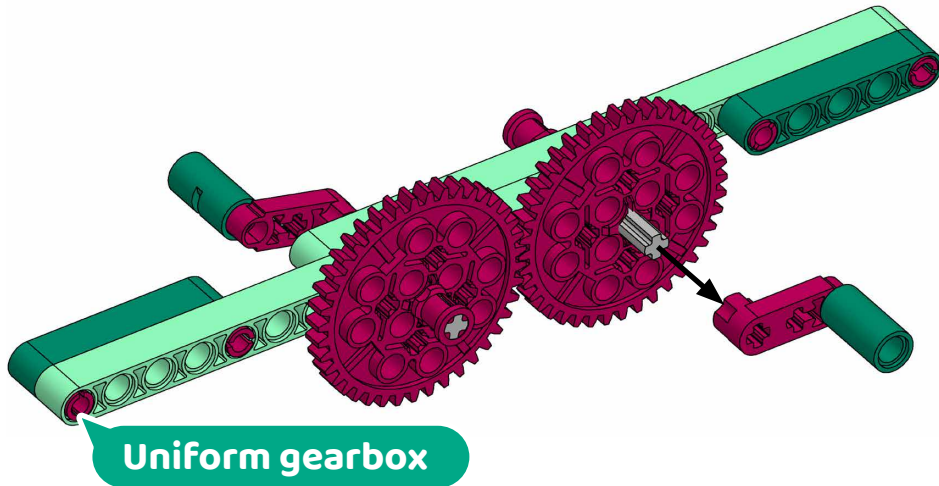


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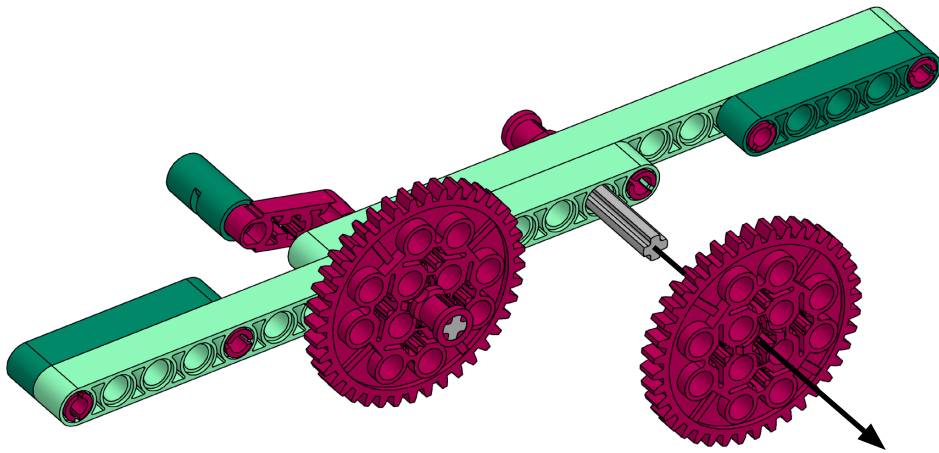
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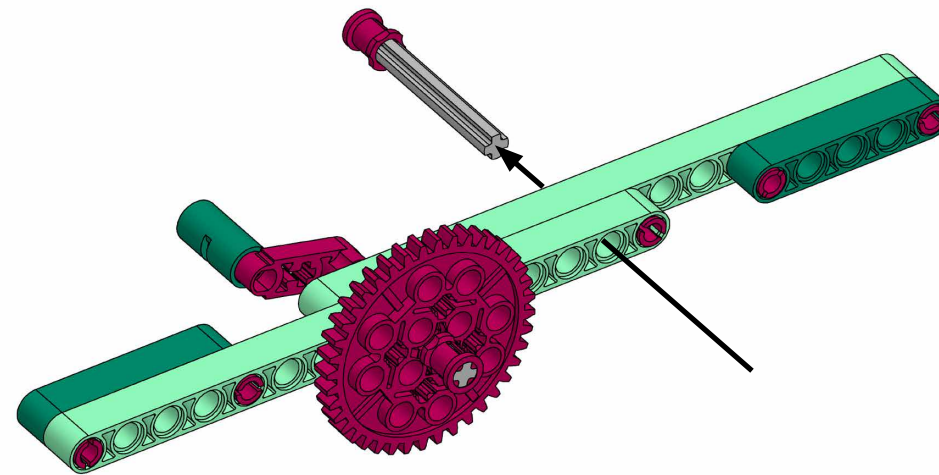
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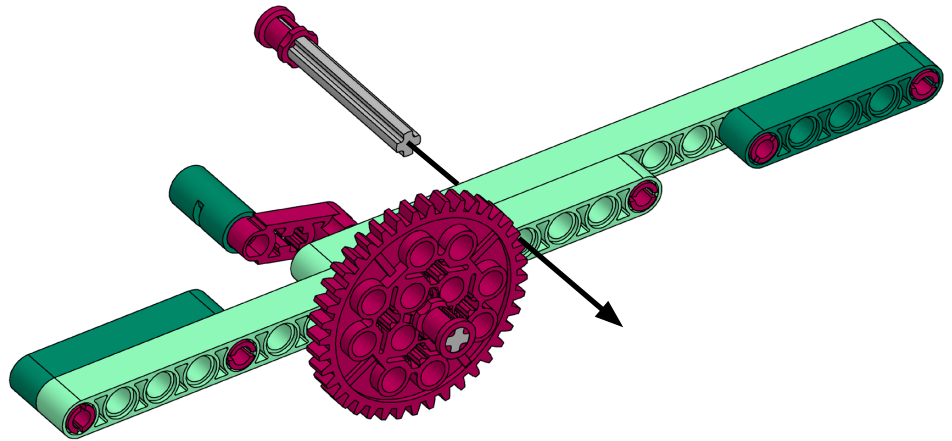
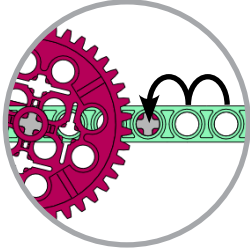
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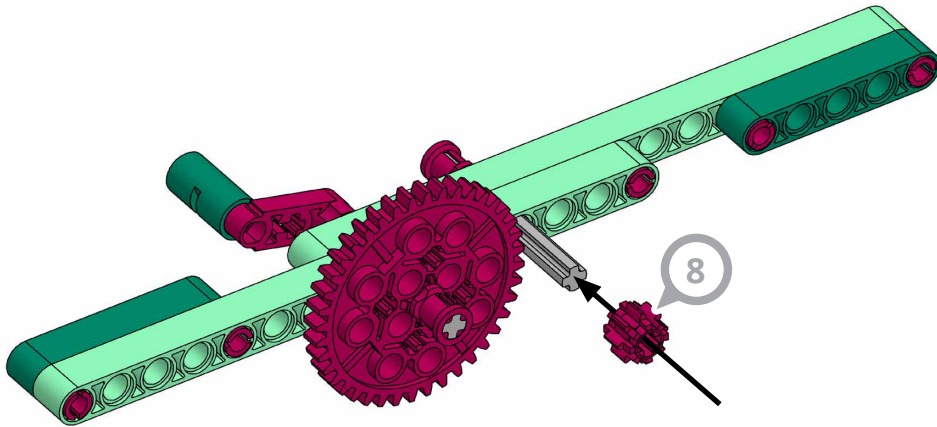
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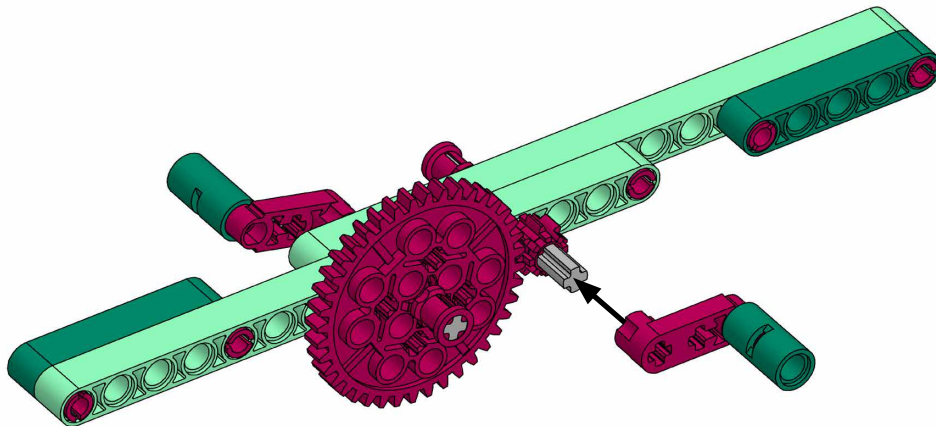
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