

EPro8 Challenge

Engineer Problem Solve Innovate

Gearbox



Bikes, cars and toys all have gearboxes. What is it? How does it work? How can you build one?



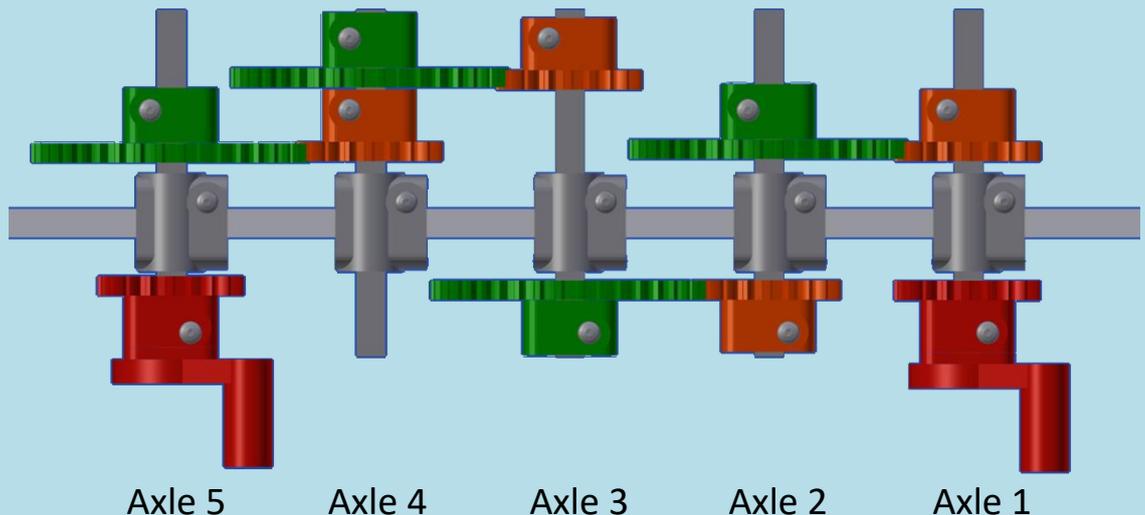
This challenge contains optional activities using the EPro8 Electronics Starter Kit.

This activity is designed as a tutorial rather than a challenge. You should follow the tutorial video while working through the activities. Go to www.EPro8Challenge.co.nz/Tutorial and enter the Code **GRBX**.

Gearbox Construction

Criteria

Construct a gearbox as shown:



Axle 5

Axle 4

Axle 3

Axle 2

Axle 1

The components in this image have been colour coded:

Crank Handle

Red

Small Gear

Bronze

Large Gear

Green

Hint

The key thing in this build is that you have a big gear and a small gear ON THE SAME AXLE.

Gearbox Observations

Criteria	<p>Turn the crank handle on Axle 1.</p> <p>How many times do you need to turn the crank handle to make the gears on Axle 2 go around once?</p> <p>How many times do you need to turn the crank handle to make the gears on Axle 3, Axle 4 and Axle 5 go around once?</p>
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Motorised Speed Reduction Gearbox

Criteria	<p>Replace Axle 1 with a motor. Wire the motor up so that a push button makes the motor go.</p> <p>Use a stopwatch to time how long Axle 2, Axle 3, and Axle 4 take to rotate.</p>
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How it Works

Criteria	<p>Watch the tutorial video to learn the maths behind a gearbox.</p> <p>Pause the video at each step to think about how this applies to your gearbox.</p>
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Brainstorm: Speed

Criteria	<p>Working as a team, brainstorm some ideas where you would want to change the speed of a contraption.</p>
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Strength Test

Criteria	<p>Add a reel to the slow end of the gearbox. Connect a 2kg weight to the reel.</p> <p>How easy is it to lift the weight using the crank handle that is on the same axle as the reel?</p> <p>How easy is it to lift the weight using the crank handle that is on the other end of the gearbox?</p> <p>Have a strength test with the strongest student in your class where that student winds the slow gear and you wind the fast gear.</p>
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Brainstorm: Strength

Criteria	Working as a team, brainstorm some ideas about where you would want a contraption to be stronger.
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Crazy Maths

Criteria	<p>Your earlier observation showed each gear / axle combination took twice as many turns to rotate as the previous.</p> <p>If you turned the fast gear once a second, how many gear axle combinations would you need to make the slow gear turn ROUGHLY once per minute?</p> <p>If you turned the fast gear once a second, how many gear / axle combinations would you need to make the slow gear turn ROUGHLY once per hour?</p> <p>If you turned the fast gear once a second, how many gear / axle combinations would you need to make the slow gear turn ROUGHLY once per day?</p>
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Hint	The number doubles every gear. So that would be 2, 4, 8, 16, 32, 64...
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Motorised Speed Increase Gearbox

Criteria	Reconfigure your motorised gearbox so that each axle rotates faster than the previous one.
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Hint	What would happen if you connected the motor to the other end of the gearbox?
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