Gear Racer

Science
- Experiment and measure position versus time
- Motion
- Scientific investigation
- Mechanisms – Gear

Technology
- Assembling components
- Evaluating
- Gear ratio

Engineering
- Describe and explain parts of a gear box
- Engineering design
- Test and evaluate before making improvements

Mathematics
- Determine percent of error
- Select and apply techniques and tools to accurately measure length to appropriate levels of precision
- Understand the metric system of measurement

Vocabulary
- Acceleration
- Average speed
- Friction
- Gearing
- Gear ratio
- Surface
- Wheels

Other materials required
- Measuring tape
- Stop and start line
- Stop-watch

Connect

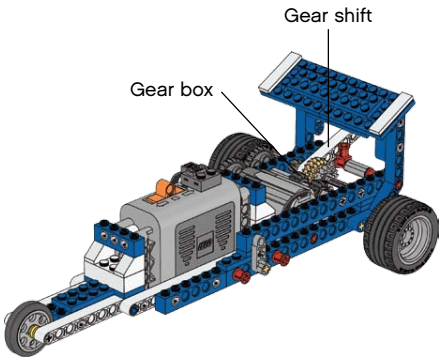
Racing cars are exciting because they travel so fast. The fastest racing cars, Formula 1 racing cars travel at speeds of over 225 mph. The driver has to drive around bends that change direction. To do this the driver has to slow the car down without losing power. The driver uses a gearbox to do this. All cars have gearboxes and the development of gearboxes in racing cars has led to better gearboxes being available in family cars. In the same way the different materials and structures developed to make racing cars faster, stronger and lighter are now used to improve the performance of everyday cars.

You will build a model Gear Racer and investigate how its speed can be influenced by shifting gears.

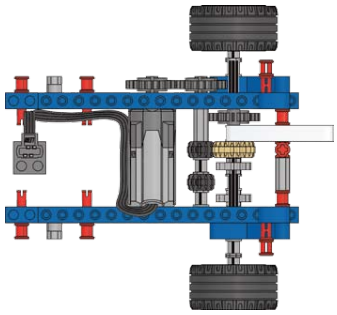
Construct

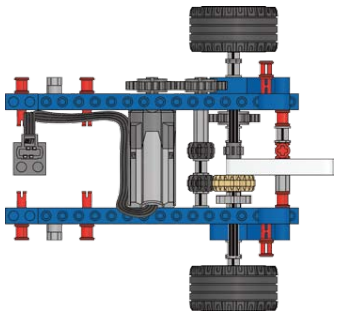
Build the Gear Racer
(Building Instruction 18A and 18B to page 17, step 20)

- Keep the power lead clear of all moving parts



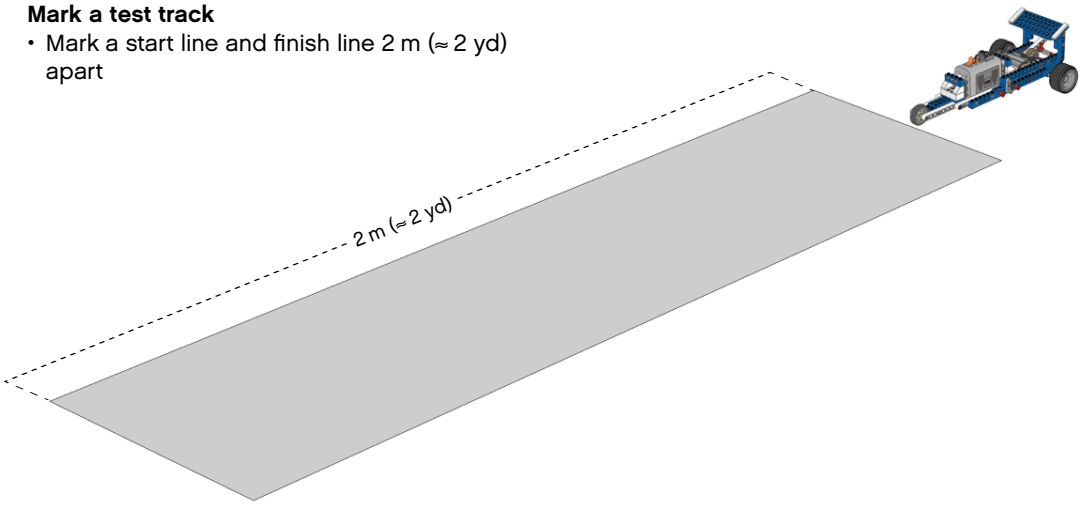
- Try the two gear positions and make sure the gears mesh





Mark a test track

- Mark a start line and finish line 2 m (≈ 2 yd) apart



Contemplate

Why does a Gear Racer use a gear box?
Due to the gears in a Gear Racer it can deliver the best in both power and speed transmission.
Calculate the average speed of the Gear Racer by using this formula:

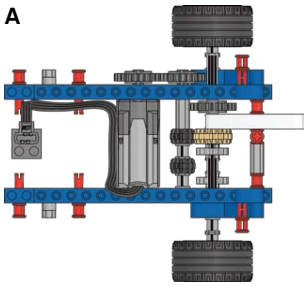
$$\text{Average speed} = \frac{\text{Distance}}{\text{Time}}$$

First, calculate the gear ratio of the Gear Racer with the gear set in position A and predict how much time the Gear Racer will need to do the 2 m (≈ 2 yd) stretch.
Record the gear ratio and your prediction on the worksheet.

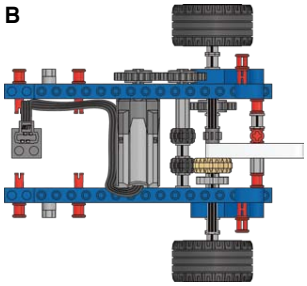
Then test your prediction and calculate the average speed.
Record your findings on the worksheet.

Next, follow the same procedure for the Gear Racer with the gear set in position B.

A

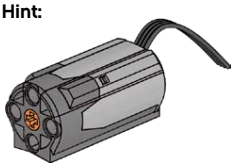


B



Hint:
You can find all of the formulas you need to calculate gear ratio in the Principle Models section for Gear.

Hint:



The LEGO® motor turns at about 400 rpm unloaded.

The circumference of the large LEGO wheel is 135.7 mm (≈ 5.3 in).

Continue

Redesign needed?
Race cars come in many different types to fit the race type and race track.
Now redesign the Gear Racer to make it the best in its class. We have highlighted some questions you could explore. Choose one area that you would like to investigate.

Then design a test that will help you explore how it functions and possible additional improvements you could make to your new Gear Racer. Remember to record all your test results.