Gear Racer

Name(s): _____ **Date and Subject:** _____

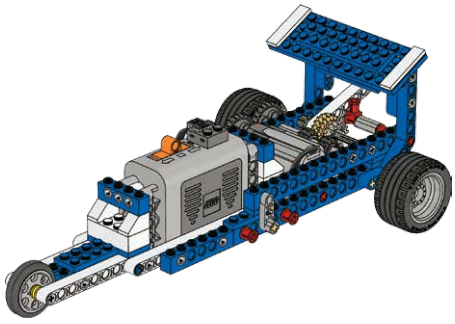
Build the Gear Racer

(building instructions 18A and 18B to page 17, step 20)

- Keep the power lead clear of all moving parts
- Try the two gear position and make sure the gears mesh

Mark a Test Track

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



Why does a gear racer use a gear box?

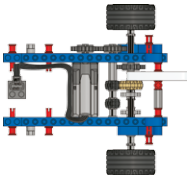
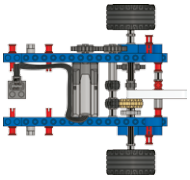
Due to the gears in a gear racer it can deliver the best in both power and speed transmission.
Calculate the average speed of the gear racer by using this formula:

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

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.

Then test your prediction and calculate the average speed.

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

Gear Racer Gear Box Setting	Gear Ratio	Predicted Time	Actual Time	Percentage of Accuracy	Average Speed
A  (page 17, step 20)					
B  (page 18, step 21)					

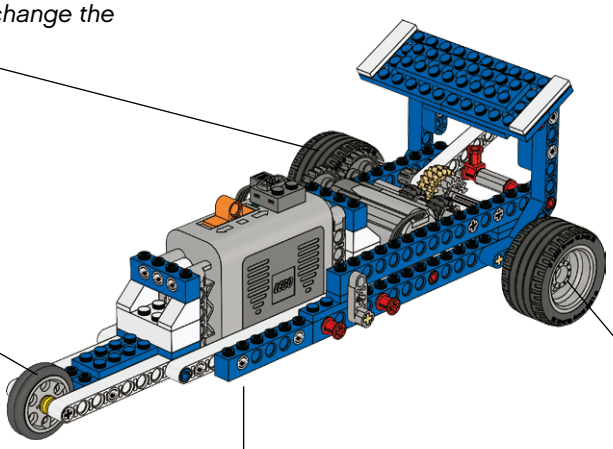
Redesign needed?

Race cars come in many different types to fit the race type and race track.

Now redesign the gear racer to make it 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 of your test results.

What if you wanted the gear racer to climb steep slopes – how might you change the gearing?



What if you wanted the gear racer to turn corners – how would you change the front wheel?

What if you wanted the gear racer to go faster – how might you change the rear wheels?

What if you wanted the gear racer to be able to drive fast along a sloping bank – what would you change?

Gear Racer

Name(s): _____ **Date:** _____

NGSS GOALS	 BRONZE	 SILVER	 GOLD	 PLATINUM
1. Student work related to this Crosscutting Concept: In this project, we tested at least two different gear ratios to explore how a change in gears affects the speed of the car.				
Stability and Change: Students observe that changes in one part of a system might cause large changes in another.	• We tested our gear racer using gear setting A. • We observed three different gear pairs between the motor and the wheel axle. ☐	• We met Bronze. • We tested our gear racer using gear setting B. • We completed our measurements and calculations on our student worksheet. ☐	• We met Silver. • We identified which change in our gear system caused a change in our gear racer's speed. ☐	• We met Gold. • We used our observations from this experiment to propose new gear redesign ideas. • We predicted the changes our proposed redesign would create. ☐
2. Student work related to this Practice: In this project, we considered multiple redesign ideas before deciding on our final solution.				
Engaging in Argument from Evidence: Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.	• We discussed as a group all of the redesign questions provided to us on our student worksheet. • We came up with one possible solution. ☐	• We met Bronze. • We discussed and agreed upon our redesign goal. • We discussed at least two solutions to meet our design goal. • We tested two solutions. ☐	• We met Silver. • We created a measurable goal (a turn angle, a speed, a slope angle, etc.) • We tested our solutions. • We used evidence from our tests in a discussion about which solution was the best. ☐	• We met Gold. • We concluded our discussion and picked the best design solution to meet our measurable goals. ☐
3. Student work related to this Practice: In this project, we redesigned our gear racer. We communicated our redesign focus and the test results that evaluated the new design's performance.				
Obtaining, Evaluating, and Communicating Information: Communicate scientific and/or technical information about a proposed object in writing and/or through oral presentation.	• We documented our redesign process with an outline that included our redesign focus, our ideas, and our test results. ☐	• We met Bronze. • We added sketches to our outline(or digital photos / videos). • We added a data table to organize our test results. ☐	• We met Silver. • We added a clear conclusion. • We added more descriptive notes to our document or presentation. • We rehearsed our presentation. ☐	• We met Gold. • We included a rough draft of our outline. • We improved our work based on input from others. • We sharedour final document or presentation. ☐
Notes:				