

Race Car

The light changes from red to green, and off you go! Did your pit team choose the right wheels? Will your team win?

🕒 30–45 min. 📦 Beginner 🎓 Grades 3–5



Teacher Support

Key objectives

Students will:

- Customize a race car to explore different variables, like mass and rolling resistance, to see whose car can go the farthest
- Record data and use it to make predictions and recognize patterns

Things you will need

- LEGO® Education BricQ_Motion Essential Set (one for every two students)
- Yardsticks (one per group)

Additional resources

[Building instructions book "B," pages 4 - 18](#)

[Student Worksheet](#)

[Assessment Rubric](#)

Educational standards

- NGSS 3-PS2-2
- NGSS-3-5-ETS1-2
- ISTE: 4c
- CCSS.ELA-LITERACY.SL.3.1

Lesson extension

- CCSS.MATH.CONTENT.3.MD.A.2

Prepare

- Review the online student material. Use a projector to share this material with your students during the lesson.
- Make sure that you've covered ways of recognizing patterns in motion in an earlier lesson.
- Consider the abilities and backgrounds of all of your students. Differentiate the lesson to make it accessible to everyone. See the *Differentiation* section below for suggestions.

Engage

(Whole Class, 5 Minutes)

- Watch the student video [here](#), or access it via the online student material.
 - Facilitate a quick discussion about which forces the students have seen in action as they watched the car race in the video.
 - Ask questions, like:
 - Which force makes a race car move? *(The reaction force or thrust acts on the car's wheels to make them move. This comes from the motor or something else that's pushing the car forward.)*
 - Which force makes the race car stop? *(The force of friction takes energy away from the car to slow it down as it rolls on its wheels. This is called "rolling resistance.")*
 - What can make the car go faster or slower? *(Reducing mass and surface friction will help make the car go faster. Increasing mass and surface friction will slow it down.)*
 - Tell students that they'll be building a race car model and launcher, and then experiment to recognize a pattern in the car's motion.
 - Distribute a set to each group.
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Explore

(Small Groups, 25 Minutes)

- Have students work in pairs to build the Race Car model. Tell them to take turns, one partner searching for the bricks while the other builds, switching roles after each step has been done.
- You can find support for building in the *Tips* section below.

Experiment 1:

- Have the students test their cars with the medium-sized yellow wheels to see how far they'll travel. Tell them to pull back the launcher to position 5 and then let go.
 - Ask them to record the result on their Student Worksheets (Teacher Support – Additional Resources).

Experiment 2:

- Now ask the students to test their cars with small gray wheels and the large white wheels.
 - Remind them to record the results of each test.
 - As they test and record their observations, encourage them to predict how far they think each car will go by placing a brick beside the track.
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Explain

(Whole Class, 10 Minutes)

- Gather your students together to share what they've learned.
 - Ask questions, like:
 - What did you observe when you tried the different wheels? *(The smaller wheels traveled less distance than the larger wheels. This is because the smaller wheels rotate on the axle faster than the bigger wheels, which creates more friction).*
 - How can you make your car go as far as possible? *(Answers should include pulling spring back all the way back, reducing weight, using the larger wheels, and launching the car on a smooth surface.)*
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Elaborate

(Whole Class, 5 Minutes)

- Gather your students together to review and discuss their experiments.
 - Ask questions, like:
 - What patterns did you recognize in your car's motion when you changed the size of the wheels?
 - Were you able to predict what would happen next?
 - Once they've tested each of the wheel sizes, have them customize their cars using the remaining bricks from the set.
 - Allow time for the students to disassemble their models, sort the bricks back into the trays, and clean up their workstations.
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Evaluate

(Ongoing Throughout the Lesson)

- Ask guiding questions to encourage your students to "think aloud" and explain their thought processes and reasoning in the problem-solving decisions they've made when building their models.

Observation Checklist

- Measure your students' proficiency in describing the pattern in the motion of an object and how this pattern can be used to predict future motion.
- Create a scale that matches your needs. For example:
 1. Needs additional support
 2. Can work independently
 3. Can teach others

Self-Assessment

- Have each student choose the brick that they feel best represents their performance:
 - Green: I think I can recognize a pattern in the car's motion.
 - Blue: I know I can recognize a pattern in the car's motion.
- Purple: I can recognize a pattern in the car's motion, use this pattern to predict future motion, and I can help a friend understand, too.

Peer-Feedback

- In their teams, have the students discuss their experiences working together.
 - Encourage them to use statements like:
 - I liked it when you....
 - I'd like to hear more about how you....
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Tips

Model Tips

- Show your students how to count the studs on the plates to help them place the bricks correctly. Point out that they should pay attention to the position of the numbered tile and marker on the launcher.
- To launch the car, the students must pull the launcher back to position 5, place the car against the flat pushing plate, and then let go.
- Tell the students to take care not to squeeze the wheels on too tightly because the extra friction will slow the car down.

Differentiation

Simplify this lesson by:

- Having your students try only the medium-sized yellow wheels and large white wheels

Increase the difficulty by:

- Having the students add a weighted brick to see if it changes how their cars behave
 - Having the students try pulling only halfway back on the launcher (*position 3*) when launching their cars
 - Can they predict where the car will stop based on their observations in experiments 1 and 2?
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Extensions

(Note: This will require additional time.)

To incorporate math skills development, have your students use standard units to estimate and then measure the masses of objects from the set (*e.g., weighted brick 53 g, big wheels 16 g, medium wheels 6 g*).

CCSS.MATH.CONTENT.3.MD.A.2