

Sail Car

Ahoy! Build a sail car and explore an invisible push force. Which sail design will catch the most wind and make your sail car go the farthest?

🕒 30–45 min.

📦 Intermed.

🎓 K-2



Teacher Support

Key objectives

Students will:

- Explore the effects of different strengths of wind pushing on an object to move a sail car

Things you will need

- LEGO® Education BricQ_Motion Essential Sets (one for every two students)
- 2-3 medium-sized electric fans (ideally, 1 for every 8 students)
- Pencils
- Scissors
- 3 pieces of paper for each group
- Yardsticks

Additional resources

[Building instructions book "A," pages 62 - 70](#)

[Student Worksheet](#)

[Assessment Rubric](#)

Educational standards

- NGSS K-PS2-1
- ISTE: 7c
- CCSS.ELA-LITERACY.SL.1.2

Lesson extension

- CCSS.MATH.PRACTICE.MD1

Prepare

- Review the online student material. Use a projector to share this material with your students during the lesson.
- Set up a sail car testing area:
 - You'll need a smooth surface of about 3 yards long and 1 yard wide.
 - Use masking tape to mark the starting line.
 - If you don't have electric fans, have your students wave their storage box lids or blow on their sails to create "wind" instead.
- Make sure that you've covered the concept of push 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.
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Engage

(Whole Class, 5 Minutes)

- Watch the student video [here](#), or access it via the online student material.
 - Facilitate a discussion about how wind is a force that pushes and pulls, and how sails are shaped to capture that force most effectively.
 - Ask questions, like:
 - How does a sail car move? (*The wind pushes it.*)
 - Can you see the wind? (*No, but you can see the effects of the wind.*)
 - If the students need a little guidance, help them by asking:
 - How many different sail shapes did you see in the video?
 - Which shape and size sail do you think will work best?
 - Tell students they'll be building a sail car and designing their own sails.
 - Distribute a set to each group.
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Explore

(Small Groups, 30 Minutes)

- Have the students work in pairs to build the Sail 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.
- When the students have finished building, have them design and make at least 2 different paper sails to test.
- Part 1: Ask the students to predict how far their sail car will go with each type of sail. Tell them to put a brick or a Minifigure next to the testing area to mark where they think their sail car will stop during each trial. Have them use a yardstick to measure. Make sure they record their actual results after each trial (Teacher Support – Additional Resources).
- Part 2: After the students have tested all of their sails, have them:
 - Design one more sail each (*i.e., 2 per group*)
 - Test their sail cars again

- Decide which sail shape is best and why
 - If time allows, have the whole class race their favorite sail designs in a "sail car regatta."
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Explain

(Whole Class, 5 Minutes)

- Gather the students together to share what they've built.
 - Ask questions, like:
 - Which sail shape pushed your sail car the farthest? Why?
 - Explain that the shape and size of the sail help capture the wind to push the sail car forward and that the direction of the wind may affect its motion. Bigger sails have more area for the wind to push on, so big sails will move the car faster, making it go farther than smaller sails.
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Elaborate

(Whole Class, 10 Minutes)

- Ask the students questions to help them compare the strengths and weaknesses of their sail and car designs. Here are some suggestions:
 - Which sail pushed your sail car the farthest?
 - Why do you think it was your best design? Was it the shape? The size? Something else about the design?
 - What would you change to make it even better?
 - 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 the 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 how different sail designs catch wind and how this affects how the sails push their cars.
- 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 describe what "push" and "pull" mean.
 - Blue: I know I can describe what "push" and "pull" mean.
 - Purple: I can describe and explain what "push" and "pull" mean, and can help a friend understand, too.

Peer-Feedback

- In their small groups, have the students discuss their experiences working as a group.
 - Encourage them to use statements like:
 - I liked it when you....
 - I'd like to hear more about when you....
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Tips

Model Tips

- The students can use scissors to cut out their sail designs or simply tear the paper. Encourage them to also experiment with folding the paper to make it more rigid along the direction of the fold.
- The LEGO® paper clip elements hold the sails in place by gripping the top and bottom of the sail. If the paper is too thin, it might blow out of the clips. If this happens, fold the paper to double or triple the thickness, and it'll stay in.
- The sails should be at least 6 inches tall to fit the default sail car build. The students can also make their masts taller or shorter, which will require them to adjust the height of their sails.
- The students can use an electric fan to push the sails, use the storage box lid as a hand fan, or blow on the sails.
- They can place a Minifigure with a checkered flag to mark the distance their car traveled after each trial. If the previous distance is beaten, they should move the Minifigure to the new stopping point; otherwise, leave it where it is.

Differentiation

Simplify this lesson by:

- Having the students test 2 sail designs (*limit shape choices to a rectangle and a triangle*)

Increase the difficulty by:

- Encouraging your students to use different materials for their sails (e.g., only LEGO® bricks, cardboard), then assess how this affected their performance
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Extensions

(Note: This will require additional time.)

To incorporate math skills development, have your students use LEGO bricks in combinations of 2s, 5s, or 10s to estimate, measure, and compare the length of the distance their sail car travels.

CCSS.MATH.PRACTICE.MD1