FORCES & MOTION LAB SAIL CAR

PocketLab Edition

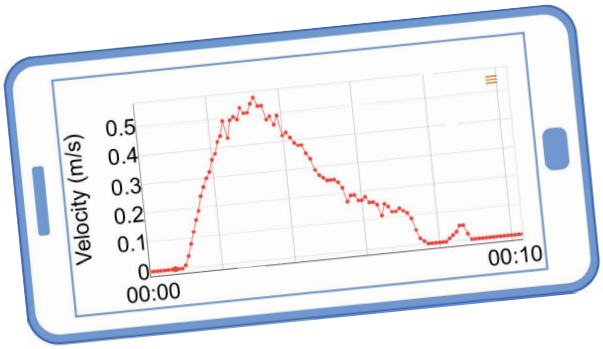
TeacherGeek

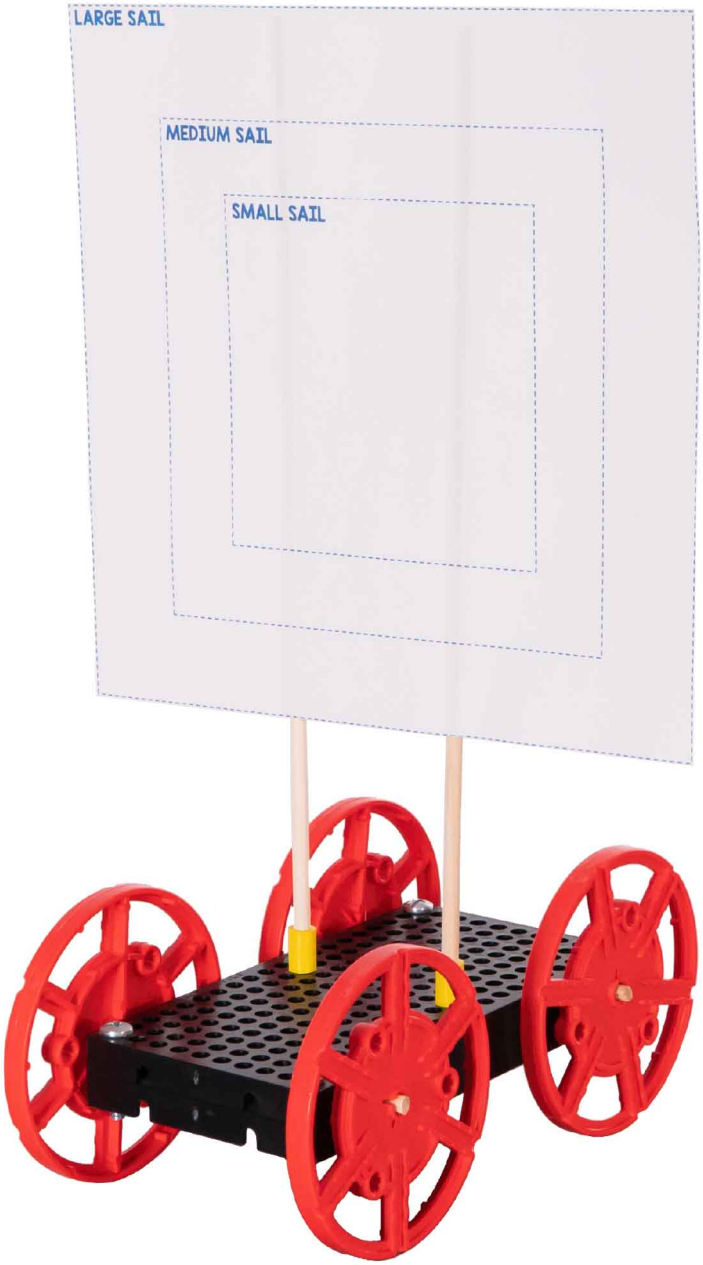
Name:_____

Check out the **Lab Set-Up Video** by scanning the QR Code or going to **teachergeek.com/sailcar**

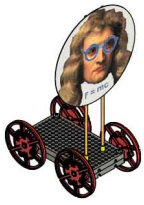
Learn about the drag force.

Then use it to make the best sail car!





LAB SUPPLIES



"Built" Sail Car

Fan

Tape

Scissors

PocketLab Sensor

The PocketLab must be paired with a compatible laptop, Chromebook, tablet, or phone.

Build the Sail Car using the **Go Guide**, available at **teachergeek.com/sailcar**

Get a PocketLab at **thepocketlab.com**

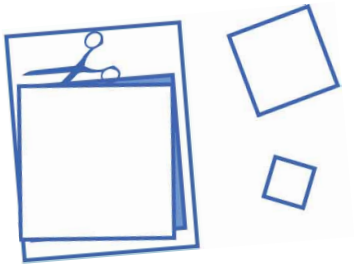
FORCES & MOTION LAB SAIL CAR

THE DRAG FORCE

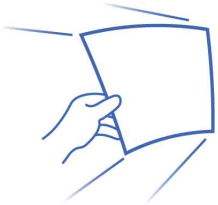
Drag is the force of the wind pushing your sail car. Forces like drag change your car's velocity.

How does drag affect the motion of your car?

1. Cut out the 3 sails on the last page of this guide, or make your own. If making your own sails, the same shape but different sizes.

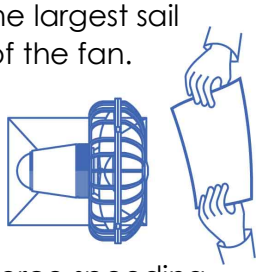


2. Wave the largest sail through the air.



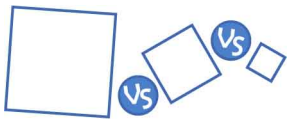
Is the drag force speeding up or slowing down your hand?

3. Now hold the largest sail still in front of the fan.



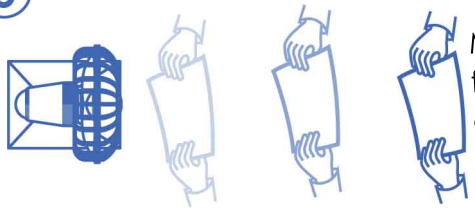
Is the drag force speeding up or slowing down your sail?

4. Use the fan to compare the differently sized sails.



Which sail has the most drag?

5. Move the sail farther from the fan.

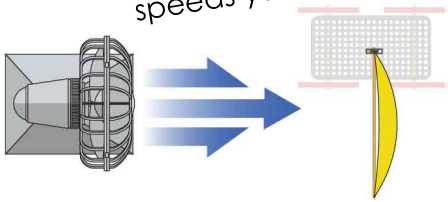


Move from very close to very far.

What happens to the drag force as distance increases?

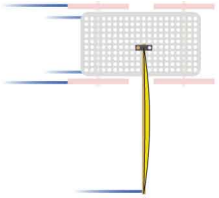
GOOD AND BAD DRAG

GOOD DRAG
speeds you up!



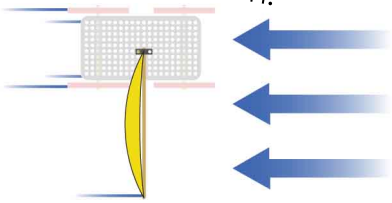
Close to the fan, the wind moves faster than your car, so drag speeds up your car.

NO DRAG
no effect...



Your car will eventually go the same speed as the wind, so there is no drag.

BAD DRAG
slows you down!



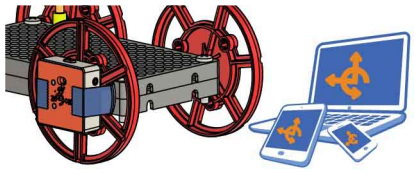
Far from the fan, the wind slows down more than your car, so drag will slow your car.

Overall, will more drag make your car faster or slower?

MEASURING MOTION

You are going to use a PocketLab to test drag. But first, let's see how PocketLab works.

6 Set up your PocketLab.



7 Play with your car! Then match the descriptions to the graphs.

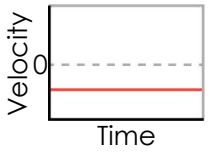
A _____Not moving

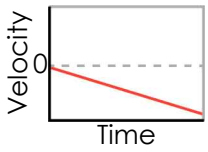
B _____Moving forward with constant speed

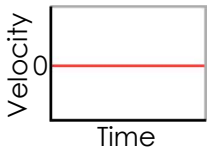
C _____Moving backward with constant speed

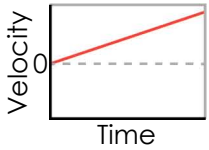
D _____Moving forward and speeding up

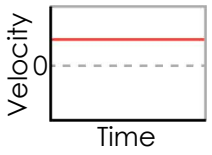
E _____Moving backward and speeding up

1. 

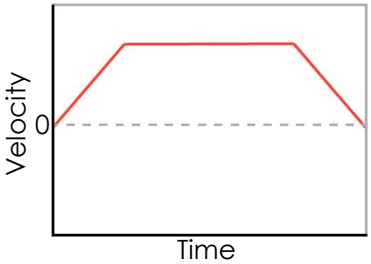
2. 

3. 

4. 

5. 

8 Describe the motion this graph represents.



It starts by _____ _____

Then it _____ _____

Lastly, it _____ _____

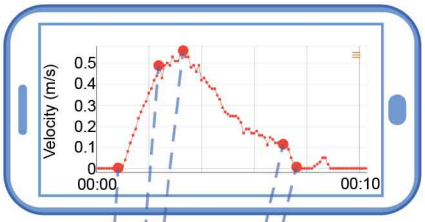
GET SOME DATA!

How does changing drag affect your car's velocity? Set up an experiment to find out!

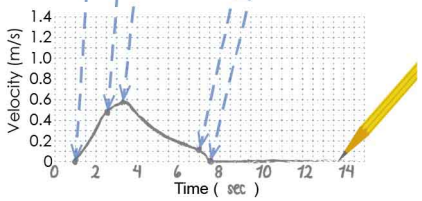
9 What variables do you need to keep track of?

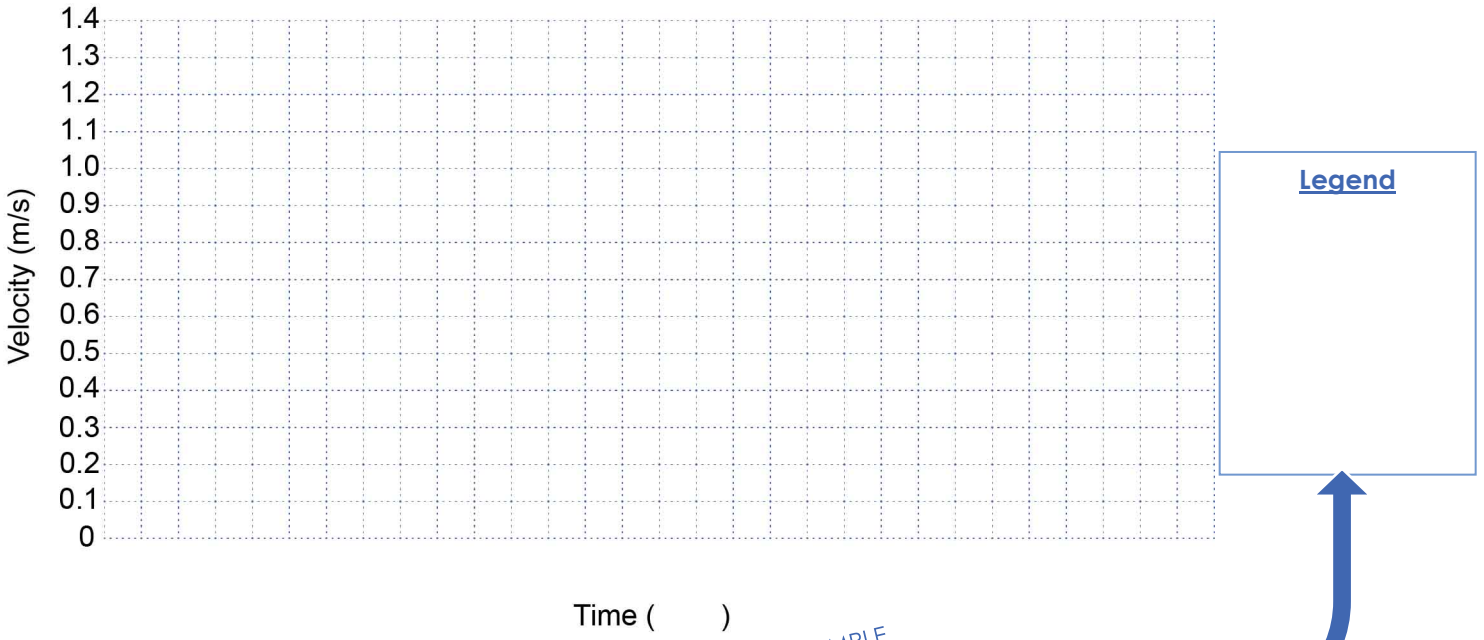
Independent Variable(s)	Dependent Variable(s)	Control Variable(s)

10 Using your smallest sail, sail your car down the track. Record the data on the PocketLab.



11 Transfer your PocketLab's velocity graph to the axes below. The graph doesn't need to be perfect, but you should transfer over important points and match the general shape.





12 Get data for the other sails and graph them on the same axes. Fill in the legend so you can tell one experimental condition from the other.

EXAMPLE

Legend

Big Sail

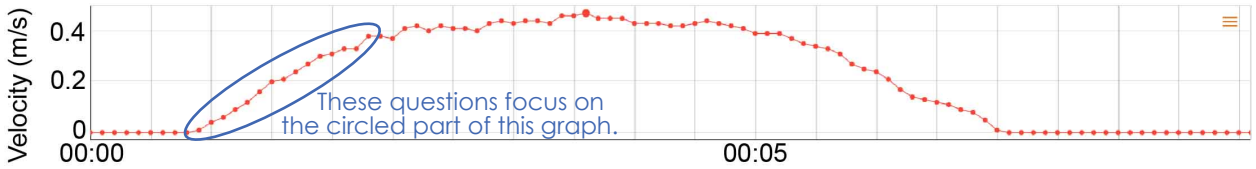
Medium Sail

Small Sail

INTERPRET RESULTS

What does your data tell you about drag? About forces and motion?

13 Answer the questions below referencing the circled part of the graph.



A Circle the choice that best describes the sail car's motion.

1. Constant velocity
2. Speeding up
3. Not moving
4. Slowing down

B Circle all the forces acting on the sail car.

1. Drag pushing forward
2. Drag pushing backward
3. Hand holding the car
4. Gravity pulling car down
5. Ground pushing car up

C Name any unbalanced forces acting on the car and explain how you know the forces are balanced/unbalanced.

_____

_____

_____

_____

D If you increased the size of the car's sail, how would this part of the graph change? Use your car's data from p. 4 to justify your answer.

_____

_____

_____

_____

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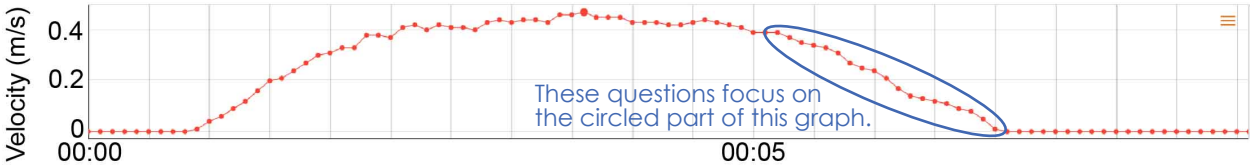

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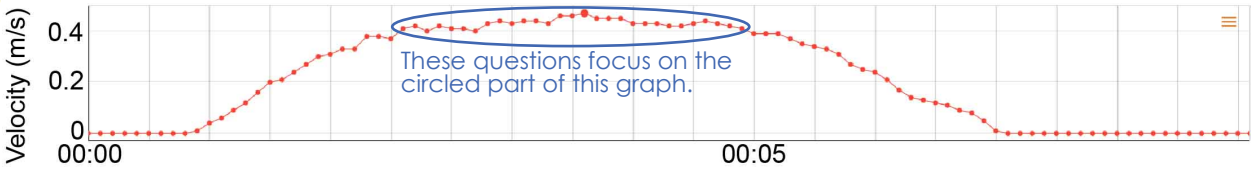

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_____

_____

_____

_____

CONCLUSION

What patterns did you see, and how will they help you build a better sail car?

17 What is drag, and how is it related to sail size?

18 How does drag affect the motion of your sail car?

19 What size sail are you going to put on your sail car? Why?

SMALL SAIL

MEDIUM SAIL

LARGE SAIL