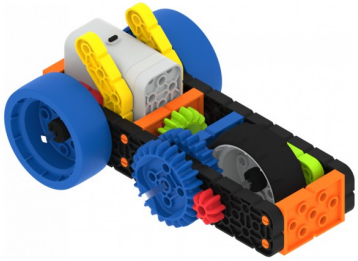


VEX GO Lab 2 Super Car Instructions

VEX GO – Physical Science
Lab 2 – Super Car
Teacher Portal

Contents

Goals and Standards

Implementing VEX GO STEM Labs
STEM Labs are designed to be the online teacher's manual for VEX GO. Like a printed teacher's manual, the teacher-facing content of the STEM Labs provides all of the resources, materials, and information needed to be able to plan, teach, and assess with VEX GO. The Lab Image Slideshows are the student-facing companion to this material. For more detailed information about how to implement a STEM Lab in your classroom, see the Implementing VEX GO STEM Labs article.

Goals

Students will apply
How data can be gathered, read, and used to predict results and make estimations.

Students will make meaning of

Predicting an object's continued motion, change in motion, or stability.
Using the same data in both a predictive and reective way, to understand how things work.

Students will be skilled at

- Recording data accurately.
- Making predictions based o of data.

Students will know

- What the turning the knob of the car does and how it aects the distance traveled by the car.
- How students can use the gathered data of number of turns and distance traveled to make predictions.

Objective(s)
Objective

1. Predict car performance based on data from previous experiments.
2. Identify that increased force caused by the turn of the knob of the rubber band, causes the Super Car to travel further.
3. Apply spatial concepts when conducting the Super Car build, during experiment trials and in class discussions.

Activity

1. Students will experiment with the eects of more or less turns on the distance travelled by their Super Car in 5 trials. They will document their predictions and results on a Data Collection Sheet.
2. Students will analyze data collected in several experiments, to identify that turns increase force, which then aects distance.
3. Communicate build instructions and experiments using spatial language.

Assessment

1. Students will compete in distance contests to see if they can use their data to accurately predict a winner. Groups will share the data collected on their Data Collection Sheet.
2. Students will be able to describe how the turn of the knob on the rubber band increases force, and how their experiments informed this conclusion in class discussions.
3. Students will demonstrate their understanding by using spatial language when communicating build instructions and experiment results.

Connections to Standards

Showcase Standards
Next Generation Science Standards (NGSS)
NGSS 3-PS2-1: Plan and conduct an investigation to provide evidence of the eects of balanced and unbalanced forces on the motion of an object.
How Standard is Achieved: Students will conduct an investigation during Play Part 1 to measure the distances their Super Car travels when the knob is turned dierent amounts. Students will analyze how the force from the rubber band aects the motion of the car.

Showcase Standards

Next Generation Science Standards (NGSS)

NGSS 3-PS2-2: Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

How Standard is Achieved: Students will rst relate their experiences to making predictions by recalling past experiences of them shooting a ball into a basketball hoop in the Engage section. Students will also engage in predictions during the Mid Play Break by observing patterns in the data collected from Play Part 1. In Play Part 2, students will compete in distance contests to see if they can use their data to accurately predict a winner.

Additional Standards

International Society for Technical Education (ISTE)

ISTE – (5) Computational Thinker – 5c: Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.

How Standard is Achieved: Throughout the Lab, students will investigate how specic component parts of the Super Car build will impact the distance that the car will travel. Students will break down the complex system of the Super Car's build in the Engage section to note how the force is being transferred from the rubber band to the car's wheel. In the Play section, the students will engage in problem-solving by analyzing their data from Play Part 1 to predict a winner for the Distance Contest in Play Part 2.

Summary

Materials Needed

The following is a list of all the materials that are needed to complete the VEX GO Lab. These materials include student facing materials as well as teacher facilitation materials. It is recommended that you assign two students to each VEX GO Kit.

In some Labs, links to teaching resources in a slideshow format have been included. These slides can help provide context and inspiration for your students. Teachers will be guided in how to implement the slides with suggestions throughout the lab. All slides are editable, and can be projected for students or used as a teacher resource. To edit the Google Slides, make a copy into your personal Drive and edit as needed.

Other editable documents have been included to assist in implementing the Labs in a small group format. Print the worksheets as is or copy and edit those documents to suit the needs of your classroom. Example Data Collection sheet setups have been included for certain experiments as well as the original blank copy. While they oer suggestions for setup, these documents are all editable to best suit your classroom and the needs of your students.

Materials	Purpose	Recommendation
VEX GO Kit	For building the Super Car.	1 per group
Pre-built Super Car (optional)	For demonstration.	1 for teacher demonstration
Lab 2 Image Slideshow	For teacher and student reference.	1 for teacher facilitation
Super Car Build Instructions (PDF) or Super Car Build Instructions (3D)	For students to build the Super Car.	1 per group
Unpowered to Powered Super Car Build Instructions (PDF)	For students building the Powered Super Car from the Unpowered model built in the previous Lab	1 per group
Robotics Roles & Routines	Editable Google Doc for organizing group work and best practices for using the VEX GO Kit.	1 per group
Data Collection Sheet or Lab 2 Data Collection Example	For students to record data during the Play section.	1 per group
Masking Tape	For students to mark the distance traveled by their Super Car.	1 roll per group
Markers	For students to mark the distance traveled by their Super Car.	1 per group
Ruler/ Measuring Tape	For students to measure the distance traveled by their Super Car.	1 per group
Pencils	For students to record data, document design ideas and fill out the Robotics Roles & Routines worksheets.	1 per student
Pin Tool	To help remove pins or pry beams apart.	1 per group
Get Ready…Get VEX…GO! PDF Book (optional)	To read with students to introduce them to VEX GO through a story and introductory build.	1 for demonstration purposes
Get Ready…Get VEX…GO! Teacher's Guide (optional)	For additional prompts when introducing students to VEX GO with the PDF Book.	1 for teacher use

Engage

Begin the lab by engaging with the students.

Hook
Ask students if they have ever tried to shoot a basketball into a hoop. How did they know how hard to throw the ball? Relate their experiences to making predictions based on past data. For example, “The ball didn’t go far enough on the rst try, so I threw it harder the next time.”

Leading Question
Demonstrate a trial with the Super Car and have students make a prediction on how far it will tr avel.
Then ask the students, “if we were to repeat the experiment, would you make the same guess? ”

Build
Student groups will build a Super Car of their own, using the build instructions and in the roles of Builder and Journalist.

Play
Allow students to explore the concepts introduced.
Part 1
Students will conduct 5 trials of their car, and measure the distances that it travels each time. On the Lab 2 Data Collection sheet students will track:

1. how many times the knob was turned
2. how far it travelled

Mid-Play Break
Discuss Part 1’s ndings of how far the Super Car travels after dierent numbers of turns in preparation for application in Part 2.
Part 2
Together as a class, students will compete in distance contests to see if they can use their data to accurately predict a winner.
Share
Allow students to discuss and display their learning.
Discussion Prompts

1. Did your predictions get more accurate over time? Why do you think that is?
2. What worked well in your build? What was most challenging?
3. What, if anything, did you do to change how far the car drove? Why did this have an eect?

Engage

Launch the Engage Section
ACTS is what the teacher will do and ASKS is how the teacher will facilitate.

ACTS	ASKS
1.Engage students in the lesson by making a connection to a personal experience. 2. Relate their basketball experiences to making predictions based on past data. 3.Present a pre-built Super Car to the class. Make sur e that everyone knows how it works. 4. Using masking tape or markers, have each student mark where they think the Super Car will travel. Make sure to demonstrate on a flat surface like a tabletop or floor. 5.Ask students to explain their reasons for choosing thi s distance. 6. Wind up the car and see who “wins.”	1Ask students if they have ever tried to shoot a basket ball into a hoop. How did they know how hard to throw the ball? 2.For example, “The ball didn’t go far enough on the fir st try, so I threw it harder the next time.” 3.Demonstrate how to turn the Orange Knob to power the car. 4. How far do you think this Super Car will go? 5.As they are marking spots, ask WHY they think that. Track responses on the board. 6.Now that we’ve seen it go once, would you change y our prediction if we were to do it again?

Getting the Students Ready to Build
We are going to try winding and launching the Super Car again, but this time, with your own cars.

Facilitate the Build

1. Instruct

   Instruct students to join their groups, and have them complete the Robot Roles & Routines Sheet. Use the Suggested Role Responsibilities slide in the Lab Image Slideshow as a guide for students to complete this sheet.
2. Distribute

   Distribute build instructions to each groups. Journalists should gather the materials on the checklist.
3. Facilitate

   Facilitate building process:

   1. Builders can begin building. If there are multiple builders, they should alternate steps to complete the build.

   2. Journalists should assist with build instructions as needed and should set up the Data Collection Sheet for the Play portion.

VEX GO Super Car

4. Offer

   Offer suggestions and note positive team building and problem solving strategies as teams build together.

Teacher Troubleshooting

- If students are having trouble with the pins, oer the Pin Tool as support.
- Give rubber bands out AS EACH GROUP GETS TO THAT STEP, to prevent distractions earlier in the build.

Facilitation Strategies

- Student “Help Desk” – if groups are having trouble with the build, they can ask other groups for support. If one group nds a trick or a helpful hint, encourage them to share it with the class.
- Offer in-the-moment observations as teams work well, and invite them to share teamwork strategies with the class.
- **Use the Get Ready…Get VEX…GO! PDF Book and Teacher’s Guide – If students are new to VEX GO, read the PDF book and use the prompts in the Teacher’s Guide to facilitate an introduction to building and using VEX GO before** beginning the Lab activities. Students can join their groups and gather their VEX GO Kits, and follow along with the building activity within the book as you read.

  Use the Teacher’s Guide to facilitate student engagement. To focus on VEX GO connections in a more concrete or tangible way, use the Share, Show, or Find prompts on each page to give students an opportunity to get to know their kits in more depth.

  To focus on the habits of mind that support building and learning with VEX GO, like persistence, patience, and teamwork, use the Think prompts on each page to engage students in conversations about mindset and strategies to support successful group work and creative thinking.

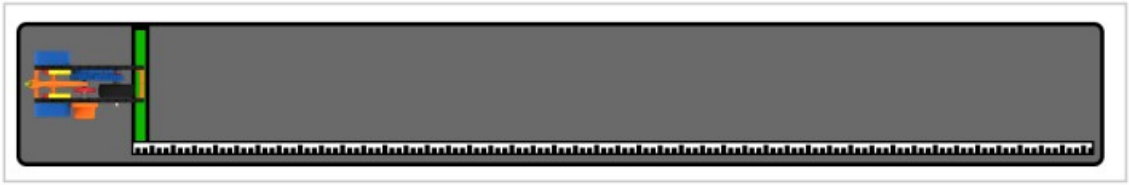
  To learn more about using the PDF book and accompanying Teacher’s Guide as a teaching tool any time you are using VEX GO in your classroom, see this VEX Library article.

Play

Part 1 – Step by Step

1. Instruct

   Instruct each group to set up a “test drive” space in the room. Include a starting line, and attach the measuring tape to the table in a straight, at line for measuring distance.

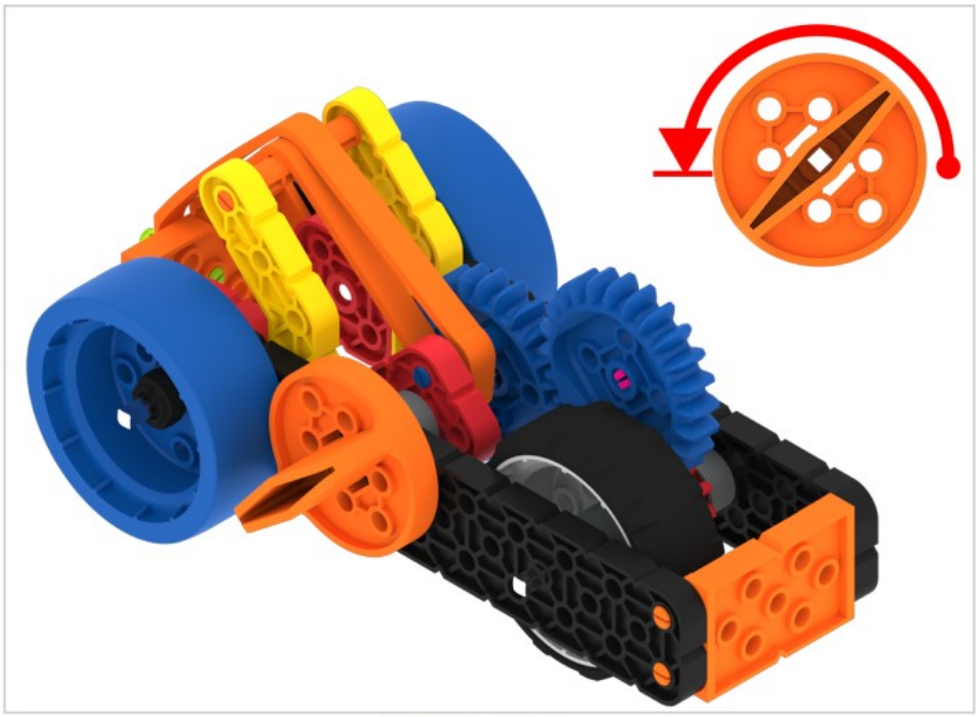


2. Model

   Model how to complete a test trial and record the results by using a group’s setup.

   Run a ‘practice trial’ for the class, and complete a sample row of the Data Collection Sheet.

   Turn the Super Car’s Orange Knob at the starting line, counting aloud as you do.



VEX GO Super Car Turn

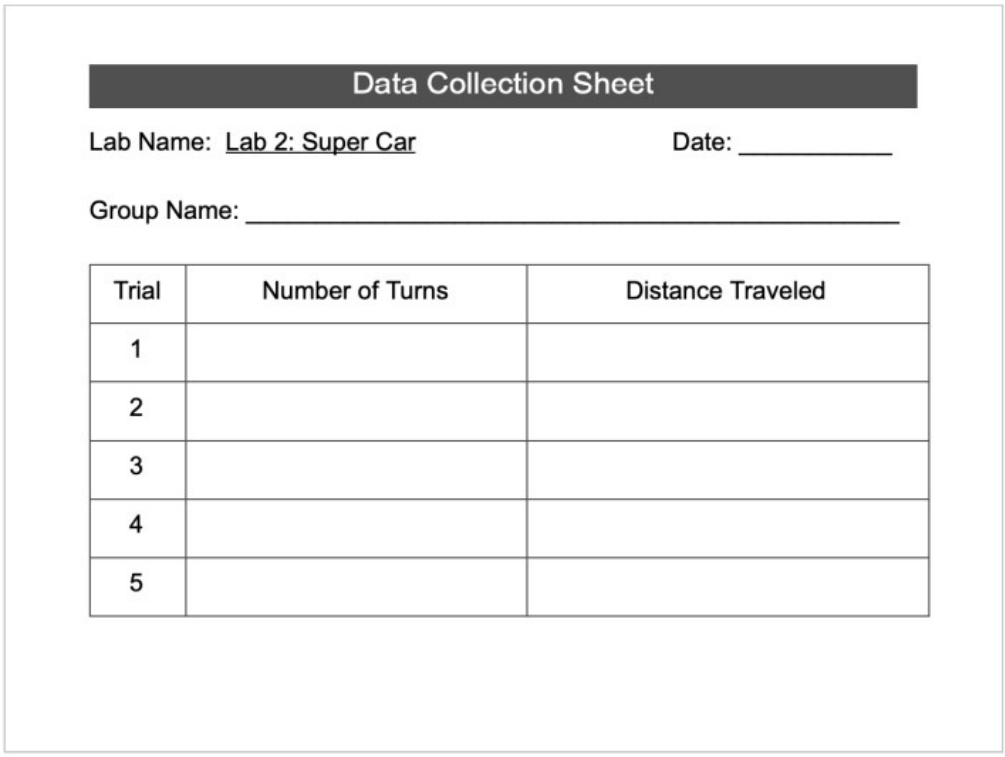
   Then, let it go and mark the distance traveled when it comes to rest.

   Complete a sample data row by asking students for each entry (which trial number, number of turns, and distance traveled).

   Ask if there are any questions before moving forward.

3. Facilitate

   Facilitate as each group completes at least 5 trials of the Super Car, with the journalists recording data on the Data Collection Sheet. Students should take turns setting up the car and winding it.



Data Collection Sheet

Lab Name: Lab 2: Super Car Date: _____

Group Name: _____

Trial	Number of Turns	Distance Traveled
1		
2		
3		
4		
5		

Data Collection Sheet

4. Remind
   Remind teams to experiment with the number of turns they use to wind the car. Students should be conducting at least 5 trials total.
5. Ask
   Ask students to make predictions about how far their car will travel on the next trial as you move around the room, noting progress and successful teamwork strategies.

Optional: If students are unable to answer a question in the moment, encourage them to write down their questions to keep track of them, and ask at the Mid-Play Break.

Mid-Play Break & Group Discussion

As soon as every group has completed at least 5 trials, come together for a brief conversation.

- What questions did your group have as you were test driving your Super Car?
- Ask the groups to share their results from their 5 trials.
  Groups should share their longest and shortest runs, and what they attribute those results to.
- Did your car go farther than others? Why or why not? How many turns did you decide are best to use?

Part 2 – Step by Step

1. Instruct
   Instruct each group to bring their car to a central space for the whole class “Test Drive Event”. Use a group’s test drive area if space allows, or create a central space in the room.
2. Model
   Model for students how to use a prediction chart, and how the “Test Drive Event” will work. Create a prediction chart on the board. Have each group declare how many turns they will use and how far they predict the car will

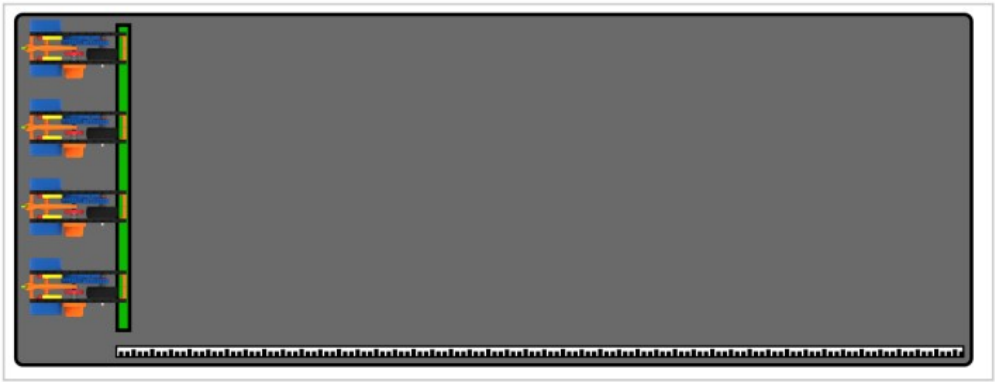
go before the group race. An example of a prediction chart could be a table, showing what the student thinks will happen and what actually happened.

Name	# of Turns	Predicted Distance	Actual Distance

Sample Prediction Chart

Model for students how to prepare for the “Test Drive Event”.

1. Groups will compete in “heats” or rounds.
2. Anywhere from 2-4 groups can enter their Super Cars in each “heat” (depending on space).
3. Winners of each heat move to the next heat until a nal winner is declared.
4. Optional: The class can use their Data Collection Sheet to track the winners, predictions and results, alongside a central chart on the board.



3. Facilitate

   Facilitate the Test Drive Event.

   1. Ask students to assess the relationship between the team’s predictions and the performance of the Super Cars.
   2. Which teams were able to predict most accurately?

4. Remind

   Remind groups to use the data they collected previously to predict how far their Super Cars will go.

5. Ask

   Ask students about how their predictions are changing as they watch more heats. Do they feel that they are getting more or less accurate? Why?

Show Your Learning

Discussion Prompts
Observing

- How far did your car drive, and why?
- What did you do to change how far the car moved?
- Why did some cars go farther than others?

Predicting

- What did tracking your own car's movements do for your estimates moving forward?
- Which Super Car would you predict to win a Test Drive Event: a car that has the knob turned more times or fewer times? Why?

Collaborating

- What worked well in your team?
- What challenges did you face?
- What would you change for next time?

Documents / Resources

	VEX GO Lab 2 Super Car [pdf] Instructions Lab 2, Lab 2 Super Car, Super Car, Car

References

- Instructions Online by Cadasio.com
- User Manual