A Speedy Slide

You have probably been familiar with playgrounds and slides since you were a small child. The force of gravity pulls you down a slide. The force of friction prevents you from going super fast. In the first part of this experiment, you will use a Motion Detector to determine your velocity going down a playground slide. In the second part, you will experiment with different ways to increase your velocity going down the slide.

OBJECTIVES

- Use a Motion Detector to determine your velocity going down a slide.
- Experiment with ways to increase your velocity going down the slide.
- Explain your results.

MATERIALS

computer
Vernier computer interface
Vernier data-collection software
Motion Detector
playground slide

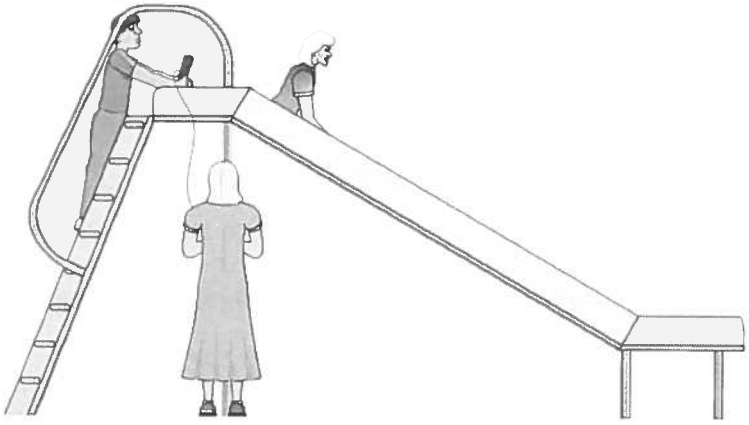

Figure 1

PROCEDURE

Part I Sliding Velocity

1. If your Motion Detector has a sensitivity switch, set it to Ball/Walk. Connect the Motion Detector. Start the Vernier data-collection program and open the file "38 A Speedy Slide" from the *Middle School Science with Vernier* folder.

2. Take your preliminary data-collection positions.
   a. One member of the group should first go up the slide steps and sit at the top of the slide.
   b. A second person, while holding the Motion Detector, should go high enough on the slide steps to hold the Motion Detector behind the person who will slide.
   c. The third person should stand on the ground next to the slide, while holding the interface.

3. Take your final data-collection positions.
   a. The slider, while holding on, should move forward enough to allow a 15 cm distance between his or her back and the Motion Detector.
   b. The person holding the Motion Detector should hold the Motion Detector steady and aim it at the slider's back.
   c. The person holding the interface should move to a comfortable position that does not cause a pull on the Motion Detector cable.

4. Collect data.
   a. Click ▶ Collect.
   b. The slider should begin to slide when you hear clicking from the Motion Detector.
   c. When data collection is done for this trial, the person with the Motion Detector should come down to the ground. **Caution**: No student should attempt to pass another person while he or she is on the steps.

5. Determine the slider's speed.
   a. When data collection has ended, click Statistics, . Record the maximum velocity in your data table.
   b. Close the Statistics box.

6. Repeat Steps 2–5 two more times.

Part II A Speedier Slide

7. Design a plan to increase the slider's speed.
   a. Try out some ideas for increasing the slider's speed. You may not coat the slide with anything that must be washed off.
   b. Decide on a plan to best increase the slider's speed.
   c. Describe your plan in the Speedier Slide Plan section below.

8. Test your plan using Steps 3–6.

SPEEDIER SLIDE PLAN

DATA

	Maximum Velocity (m/s)			
	Trial 1	Trial 2	Trial 3	Average
Part I				
Part II				

PROCESSING THE DATA

1. Calculate the average maximum velocity for your three trials in Part I. Record the average in the space provided in the data table. Calculate and record the average maximum velocity for Part II.
2. Subtract your Part I average maximum velocity from your Part II average speed to determine how much your team improved its velocity.
3. What methods did other groups use to improve their velocities?
4. Which of the methods worked best? Explain why it worked best.
5. If you could increase the height of the slide, how would the slider's maximum velocity be affected?
6. What is the purpose of the level portion at the bottom of many slides?

EXTENSIONS

1. Design and carry out a plan to measure your velocity on a different piece of playground equipment.
2. Have a contest to see who in your class or group can obtain the greatest velocity going down a slide.

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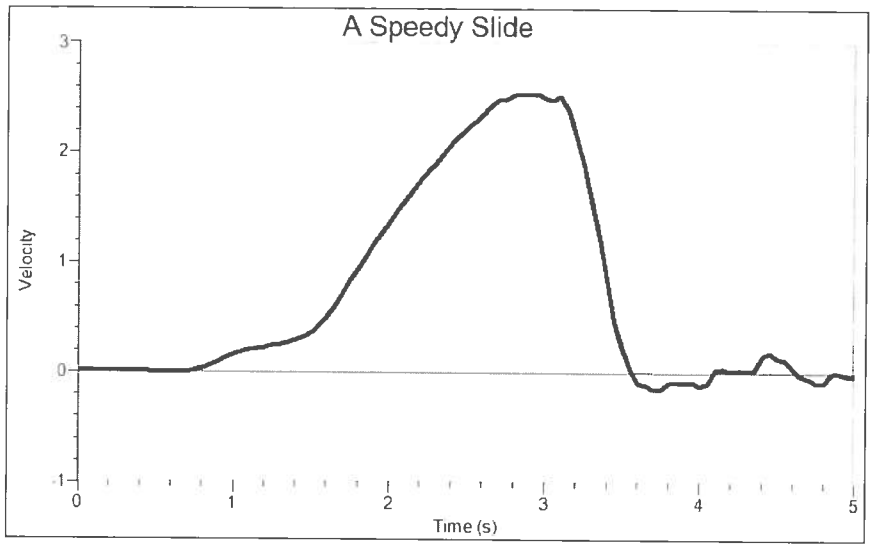
1. In the Electronic Resources you will find multiple versions of each student experiment—one for each supported data-collection software or app (e.g., Logger *Pro* and Graphical Analysis). Deliver to your students the version that supports the software and hardware they will use. Sign in to your account at **vernier.com/account** to access the Electronic Resources. See Appendix A for more information. **Note**: The printed version of the book and the PDF of the entire book (found in the Electronic Resources) include only the Logger *Pro* versions of the experiments.
2. In this activity, students take the data-collection equipment outside in order to collect data. The preferred data-collection method is to use an interface, such as a LabQuest, that can function as a standalone device. If your interface must be connected to a computer (e.g., LabQuest Mini or LabQuest Stream), each group will need a laptop or Chromebook.
3. The use of a playground area with several slides is preferable for this experiment.
4. The slides should be straight. Slides with other shapes could be used in an extension.
5. You may wish to carry the data-collection equipment to the playground area in a box or boxes, and distribute the equipment to your students there.
6. For safety reasons, remind your students not to attempt to pass each other while on the slide steps.
7. Depending on the type of slides that are available, you may wish to change the way your students position themselves for data collection. Some slides have large platforms where the student with the Motion Detector and the student with the calculator and interface can be located.
8. Students can use wax paper, slippery cloth, sand, and other materials to increase their speed. To enable your students to be prepared, be sure to alert them to Part II in advance.
9. If time permits, you may wish to allow class members to have their sliding rates determined.
10. For additional information about the Vernier probeware used in this experiment, including tips and product specifications, visit **www.vernier.com/manuals** and download the appropriate user manual.
11. If you are using Go Direct sensors, see **www.vernier.com/start/go-direct** for information about how to connect your sensor.

ESTIMATED TIME

We estimate that this experiment can be completed in one 45–60 minute class period.

SAMPLE RESULTS

	Maximum Velocity (m/s)			
	Trial 1	Trial 2	Trial 3	Average
Part I	1.97	2.02	2.00	2.00
Part II	2.80	3.07	2.82	2.90



ANSWERS TO QUESTIONS

1. See the Sample Results.
2. In the Sample Results, the Part II speed was 0.90 m/s greater than the Part I speed. Wax paper was used to decrease friction and increase speed.
3. Answers will vary. Speeds will differ because of differences such as contact area, weight, streamlining, and the use of low-friction materials.
4. Answers will vary.
5. Increasing the height of the slide should increase speed.
6. The stone dropped from the top of the slide should hit the ground first because friction and the incline of the slide slow the rolling stone more.
7. The level part at the bottom of a slide slows sliders and prevents injuries.