

**Inquiry Lab A**

**40 minutes**

## Calculate Average Speed from a Graph

You probably do not walk the same speed when you walk uphill versus downhill or when you are starting out versus when you are tired. If you are walking and you measure and record the distance you walk every minute, the distances will vary. How might you use these measurements to calculate the average speed you walked? One way is to organize the data on a distance-time graph. In this activity, you will use such a graph to compare average speeds of a ball on a track using different heights of a ramp.

### Ask a Question

How does the height of a ramp affect the speed of a ball along a track?

### Materials

metersticks (6)      stopwatches (6)      masking tape      tennis ball

### Safety

### Make Observations

- 1. Read and complete a lab safety form.
- 2. Make a 3-m track. Place three metersticks end-to-end.
  - Place three other metersticks end-to-end about 6 cm from the first set of metersticks. Use tape to hold the metersticks in place. Mark each half-meter with tape.
  - Use books to make a ramp leading to the track.
- 3. A student should be at each half-meter mark with a stopwatch. Another student should be by the ramp to roll a ball along the track.
- 4. When the ball passes start, all group members should start their stopwatches. Each student should stop his or her stopwatch when the ball crosses the mark where the student is stationed.
- 5. Practice several times to get consistent rolls and times.

### Form a Hypothesis

- 6. Create a hypothesis about how the number of books used as a ramp affects the speed of the ball rolling along the track.

---



---



---

**Lab A continued**

**Test Your Hypothesis**

- 7. Write a plan for varying the number of books and making distance and time measurements.

---



---

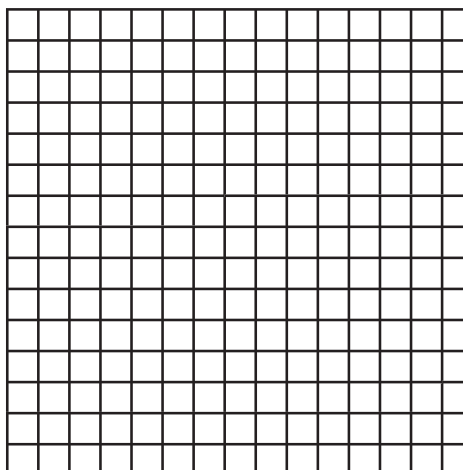


---

- 8. Use the data table below to record your results. Add rows or columns if needed to match your plan.

Distance (m)	Time (s)		
	2 books	3 books	4 books
0.50			
1.00			
1.50			
2.00			
2.50			
3.00			

- 9. Use your plan to make the measurements. Record them in the data table.
- 10. Plot the data for each height of the ramp on a graph that shows the distance the ball traveled on the *x*-axis and time on the *y*-axis.
  - For each ramp height, draw a straight line that goes through the most points.



**Lab A continued**

- 11. Choose two points on each line. Calculate the average speed between these points by dividing the difference in the distances for the two points by the difference in the times.

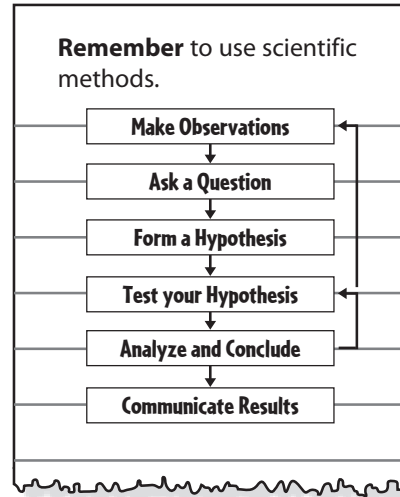
---



---

**Lab Tips**

- If the ball doesn't roll far enough, reduce the track length to 2 m.
- Practice using the stopwatches several times to gain experience in making accurate readings.



**Analyze and Conclude**

- 12. **Compare** the average speeds for each ramp height. Use this comparison to decide whether your hypothesis was correct.

---



---



---

- 13. **The Big Idea** How was the distance-time graph useful for describing the motion of the ball?

---



---



---

**Communicate Your Results**

Prepare a poster that shows your graph and describes how it can be used to calculate average speed.