LABORATORY

Although many factors contribute to car accidents, speeding is the most common kind of risky driving. Unsafe speed is involved in about 20% of fatal car accidents in the United States.

Speed is the distance an object travels in a certain amount of time. For example, a car that travels a distance of 80 kilometers in one hour has a speed of 80 kilometers per hour. Any object's speed can be calculated by dividing the distance traveled by the time taken, as shown in the equation:

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

People use many different units to describe speed. These include miles per hour (MPH), kilometers per hour (kph or km/h), and meters per second (m/s).

CHALLENGE

How can you measure the speed of a moving cart?

This car speedometer shows speed in miles per hour and in kilometers per hour. Kilometers per hour is the speed unit commonly used in other countries.
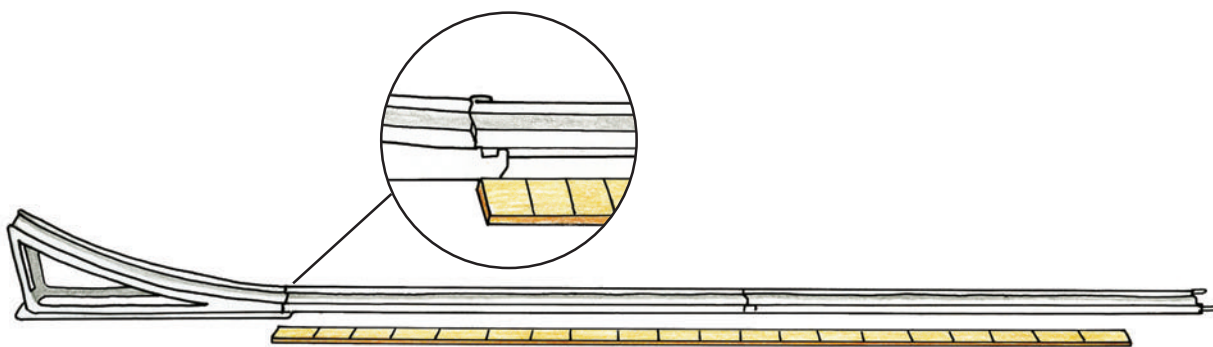
MATERIALS

For each group of four students

2 track pieces
1 cart
1 ramp
1 timer
1 meterstick
1 marker
   masking tape

PROCEDURE

Part A: Measuring Time and Distance

1. Set up the ramp and track as shown below.

2. Use the meterstick, masking tape, and marker to measure and mark the beginning and end of the first 100 cm of the level part of the track. Make sure to place the tape next to the track instead of directly on the track.

The fastest track cyclists can travel a 4000 meter (2.5 mile) track in just under 4 minutes.

Cart Speed

Trial	Distance (cm)	Time (s)	Speed (cm/s)
1	100		
2	100		
3	100		
		Average	

3. In your science notebook, make a table like the one above.

4. Hold the cart so that its rear axle is at Notch A on the ramp.

5. Release the cart, and start the stopwatch when the rear wheels of the cart travels over the beginning of the level track. Time how long it takes until the rear wheels travel to the 100 cm mark. Record the time in your table in the Trial 1 row.

6. Repeat Steps 4–5 two more times. Use the Trial 2 and 3 rows to record your data.

7. Use the equation below to calculate the speed of the cart for each trial:
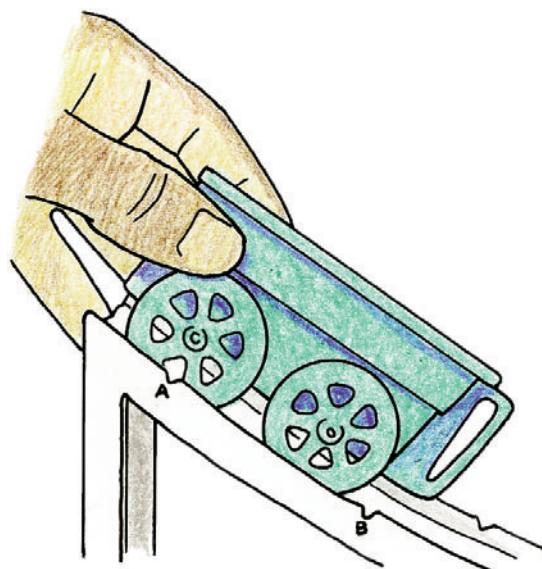
$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

8. Calculate the average of the three trials. Record the average of the speeds in your table.

Part B: The Effect of Release Height

9. Imagine what would happen to the cart speed if you changed the release height of the cart. In your science notebook, write how releasing it at a lesser height would affect its speed. Explain.

10. To test your prediction, write a procedure that uses the equipment you have already experimented with.

    Hint: Your plan should take into account that the cart might not always travel 100 cm before coming to a stop.

11. Prepare a data table for recording your measurements.

12. Show your plans to your teacher.

13. Carry out your experiment and record your data.

ANALYSIS

1. According to your data from Part A, what is the speed of the cart?

2. According to your data from Part B, what is the effect of release height on speed?

3. List some common units for speed. Why are there so many different units?

4. What part(s) of your experimental design in Part B:

    a. increased your confidence in the results?

    b. decreased your confidence in the results?

5. What is a car's speed in m/s if it travels:

    a. 5 meters in 0.1 seconds?

    b. 5 meters in 0.2 seconds?

    c. 10 meters in 0.2 seconds?

6. **Reflection:** Why do you think speeding is a factor in about 20% of fatal car accidents?

EXTENSION 1

Post your results on the *Issues and Physical Science* page of the SEPUP website, and compare your data set to that of students in other classes.

EXTENSION 2

If the speed limit is 60 MPH, could the police give a speeding ticket to any of the drivers of the cars in Analysis Question 5?

Hint: 1,000 m = 1 km = 0.62 miles

A radar gun uses sound waves to measure how far a car moves in a short amount of time. It quickly calculates the speed and displays it for the user.