Skills Practice Lab

Testing Reaction Time

Introduction

Objects in free fall near Earth's surface accelerate under the influence of gravity. This acceleration is constant, but it may be reduced somewhat by air resistance. Near Earth's surface, the acceleration due to gravity is 9.8 m/s^2. You can use this acceleration and a measurement of falling distance to calculate the time that an object is in free fall.

Predicting human reaction time is more complicated than predicting a simple physical event such as the time an object takes to fall. Human reaction time depends on many factors, such as the time a signal takes to go from your eyes to your brain, the time your brain takes to process the signal, and the time your brain takes to signal a reaction. Although the steps in reaction time are complicated, you can determine overall reaction time by using simple measurements.

In this lab, you will test your reaction time by measuring how far a meterstick falls before you can catch it. You will measure the distance that the meterstick falls and will then use an equation based on free-fall acceleration to determine the amount of time the meterstick took to fall. You will also measure the amount of time the meterstick falls by using a stopwatch and will compare the measured reaction time with the calculated reaction time.

OBJECTIVES

Calculate reaction time by using falling-distance data.

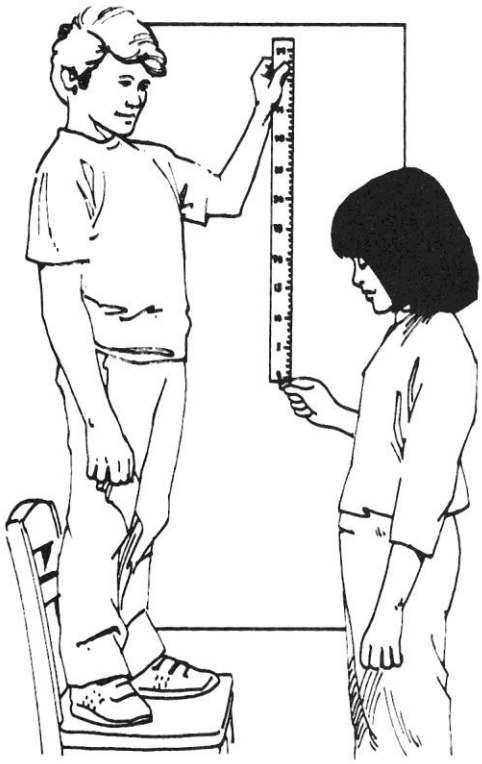
Compare reaction times measured by using a stopwatch with reaction times calculated from falling-distance data.

Evaluate the methods used to determine reaction time in the experiment.

MATERIALS

- calculator
- meterstick
- paper
- stopwatch

PROCEDURE



1. Work in pairs. Record your partner's name in the data table. Hold the meterstick vertically with the zero end down. Have your partner stand in front of you with his or her thumb and forefinger open about an inch and a half apart and lined up with the bottom (zero end) of the meterstick.
2. Drop the meterstick. Your partner should try to catch the meterstick between his or her thumb and forefinger as quickly as possible. Once your partner catches the meterstick, you can measure how far the meterstick fell by reading the point on the meterstick that your partner grabbed. Convert this distance to meters, and record it in the data table.
3. Repeat steps 1–2 nine more times, for a total of 10 trials. Record all falling distances in the data table.
4. Repeat steps 1–2 again, but this time use a stopwatch. Try to start the stopwatch at the same time that you release the meterstick, and stop the stopwatch as soon as your partner catches the meterstick. Repeat this process until you have completed 5 trials. Record all times in the lower part of the data table. You do not need to measure or record distance for these time trials.
5. Change places with your partner, and repeat steps 1–4. Record all falling distances in your partner's data table. If you are working in a group of more than two people, continue repeating steps 1–4 until everyone has had a chance to test reaction time.

Data Table

Name: _____			
Distance data		**Time data**	
Trial	**Distance (m)**	**Trial**	**Time (s)**
1		11	
2		12	
3		13	
4		14	
5		15	
6		Average time (s)	
7			
8			
9			
10			
Average distance (m)			
Reaction time (s)			

ANALYSIS

1. **Organizing data** For each person in the group, calculate the average falling distance by adding the distance for the first 10 trials and then dividing by 10. Record the average in the data table.
2. **Organizing data** For each person in the group, calculate reaction time from the average distance by using the following formula:

$$reaction\ time = \sqrt{\frac{2 \times average\ distance}{9.8\ \text{m/s}^2}}$$

3. **Organizing data** For each person in the group, calculate the average falling time by adding the time for the last 5 trials and then dividing by 5. Record the average in the data table.

CONCLUSIONS

1. **Evaluating methods** How does the average falling time you calculated by using data from the stopwatch compare with the reaction time you calculated by using the average falling distance? Should these values be the same? Why might these values be different?

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2. **Evaluating results** How does your reaction time compare with those of other members of your group? Who has the fastest reaction time?

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3. **Evaluating data** How did your reaction time change over the first 10 trials? Do you see any evidence of improvement with practice?

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4. **Evaluating methods** Why did each of you do 10 trials to find an average distance instead of doing just 1 trial? Do you think your results would be more accurate if you did even more trials? Explain your answer.

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EXTENSIONS

1. **Designing experiments** Repeat this experiment, but blindfold the person who is catching the meterstick. As soon as you drop the meterstick, signal your blindfolded partner by using your voice. Repeat this process for several trials. Then, repeat the process for several more trials, but signal your blindfolded partner by tapping your partner on the arm or shoulder. You do not need to use the stopwatch; use only falling-distance data. Which of these signaling methods produces the fastest reaction time? How do these reaction times compare with the reaction time when the catcher is not blindfolded?