

Biomechanics of the Meter Stick Drop: Challenge Worksheet

Materials: One meter stick or ruler per group, one worksheet per student

Introduction: In the video, the students discussed performing a meter stick drop to determine their reaction times to the visual stimulus of a falling ruler. You will now perform the same activity for the purpose of determining the time it takes for you to react and catch a falling ruler.

Roles:

Before data collection begins, designate one person to be the Catcher—the person who catches the ruler and the person who the collected data will refer to. Another person should be the Dropper—the person who will hold the meter stick in place and then drop it for the Catcher to attempt to grab. If there are only two people in your group, either the Dropper or Catcher should record the data down after each drop. If there is a third person in the group, they will be the Recorder. Throughout the course of the experiment, each group member should take a turn being Dropper, Catcher, and Recorder.

Procedure:

1. The Dropper will hold a meter stick vertically between the thumb and index finger of the Catcher's open hand. The meter stick should be held so that the zero mark is level with the tops of the Catcher's fingers. The Catcher should not be touching the meter stick before it falls.
2. Without warning, the Dropper should release the meter stick so that it falls between the Catcher's thumb and finger.
3. The Catcher should catch the meter stick as quickly as possible.
4. The Recorder writes down the distance, in centimeters, the meter stick fell through the Catcher's fingers.
5. Repeat steps 1-4 until there is data for ten trials.
6. Switch roles and record data for the reaction times of the other group members.

Data:

Record the distance the meter stick fell in the "Distance" column. Use the formula below to calculate the Catcher's reaction time based on the distance the meter stick fell. Remember that the amount of time the meter stick was in the air is the same as the amount of time it took the Catcher to react to seeing it fall.

$$d = \frac{1}{2}gt^2$$

d = the distance the meter stick fell, in cm

g = the acceleration of gravity, 9.81 m/s²

t = the time the meter stick was falling, in s

Be sure to convert the distance fell from cm to m before plugging it into the formula!

Name: _____

| Trial # | Person 1 | | Person 2 | | Person 3 | |
|---------|---------------|-------------------|---------------|-------------------|---------------|-------------------|
| | Distance (cm) | Reaction Time (s) | Distance (cm) | Reaction Time (s) | Distance (cm) | Reaction Time (s) |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| | Average: | | Average: | | Average: | |

Analysis:

1. In the data table, calculate your reaction time for each trial.
2. Calculate your average reaction time.
3. Record your partners' data as well so that you can compare your data in the next section.

Questions: (Each person in the group should answer the questions for their own reaction time data unless the question specifically asks for comparison with group members' data.)

1. Were any of your trials very different from the other ones? If so, explain why they were so different. If not, explain how you were able to be so precise and consistent in your data.
2. Most, if not all, of your distances and reaction times will be different from each other. How can you explain this?
3. Name any possible errors you might have introduced or made during the experiment.
4. Whose reaction time was faster, yours or your partners? List at least three factors that could explain why different people have different reaction times.