

2008  
Winning Lesson Plan  
from Portsmouth,  
Rhode Island

*Motion*

by Mathew Bottone  
The Penfield School

Subject: Physics

Grade Level: 6–8

Duration: 1 hour – This activity is designed to be performed with an entire class.

## Overview and Purpose

To provide students with a first hand understanding of how average speed is determined and to demonstrate the concept of acceleration.

## Educational Standards

Students can make measurements of elapsed time and combine with measurements of distance to calculate units of speed and acceleration. Application of physics formulae:

- $\text{speed} = \text{distance}/\text{time}$
- $\text{acceleration} = \text{speed}/\text{time}$

Students will make proficient use of stop watches and measuring tape and mathematic calculations. Students will also make graphic representations of their results to compare and contrast with the class. Bar graphs or line graphs are both appropriate for this activity.

## Objectives

Students will be required to calculate their own average rate of speed over a 40 meter sprint, as well as their rates of acceleration over four “split” times measured at 10 meter intervals.

## Materials

- A space at least 40 meters in length in which to run sprints
- Stop watches
- Tape measure or meter stick
- Lab books to record data

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## Procedures

Students will lay out a straight, 40 meter long track with intervals marked at every 10 meters. There should be sufficient space beyond the 40 meter mark to allow students to overrun the finish line at top speed. Students will rotate in shifts operating the stop watches at each interval to record the split times of each runner. After running the sprint, each student will record the split times in their own lab book.

Once every student has run the sprint, the entire class will have an opportunity to run a second time with the objective of bettering their original times. (Students should be instructed to finish out the sprint by running beyond the finish line before slowing down).

With the entire class having recorded their split times the completion of the lab may take place back in the classroom or be assigned as homework. Final figures will represent rates of speed and acceleration over the four sections of the track: 0–10m, 10–20m, 20–30m, and 30–40m. Students should also calculate their average speed over the full length of the track. This figure can be compared to the 40 yard dash times of the students favorite professional athletes for perspective.

While analyzing their data and calculations, discussion should reflect upon what factors contributed to different rates between students. Answers will vary, and may include speculation on different levels of physical fitness, stamina and endurance among the students; effectiveness of different types of shoes at increasing friction and improving traction on the track surface; the possible effects of mentally pushing one's self harder and debate about who was running as hard as they were capable of.

Graphing group data may be useful in investigating any evidence to debate theories of gender differences in athletic ability. Who were fastest overall runners? Who reached their top speed sooner or later on the course. Who achieved the greatest rates of acceleration. Students may also look for evidence of when they were accelerating or decelerating over the length of the course, and question what factors may have been involved. Accept all reasonable answers.

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## Extensions Beyond the Classroom

This activity will give students a greater understanding of concepts of speed and acceleration that they are exposed to in their lives, such as: measurements of athletic speeds in track and field events, professional sports standard of the 40 yard dash. Students will also be able to extrapolate and comprehend speeds orders of magnitude greater, such as: rates of speed in automobiles, aircraft and space travel. This activity may be useful to provide additional perspective of current athletic events such as Olympic games where similar rates are measured to determine winners in many different events.