

Speedometer Lab

Teacher's Guide

Topic:

One Dimensional Kinematics

The following information is provided to the student:

Question:

What is the speed of my *constant motion*, battery-powered car?

Purpose:

To determine the speed of a *constant motion*, battery-powered car.

A complete lab write-up includes a Title, a Purpose, a Data section, and a Conclusion. The Data section should include collected data for several trials; column headings should be labeled and units shown. One sample calculation should be shown. Speed values for all the trials (except those which are obvious *outliers*) should be averaged; *outliers* should be indicated as such in the Data section (a *cross-out* is a wholly scientific means of doing so). The Conclusion should respond to the question raised in the Purpose of the lab.

Materials Required:

Battery-powered car, meter stick, stopwatch or timing device.

Description of Procedure:

After having explained what speed is (or even without any explanation of what speed is), challenge students to find the speed of a battery-powered car. Allow students to devise their own procedure which will certainly involve measuring the time for the car to move a designated distance or measuring the distance traveled in a designated time.

Alternative Materials and Procedure:

Many science supply catalogues advertise constant motion vehicles. While these may be pricey, it is possible to find inexpensive wind-up and non-uniform motion toy vehicles at a dollar store or discount store (or like I have done, in your child's toy box). If using a non-uniform motion vehicle, you might change the Question and the Purpose statements to reflect this - "to determine the speed which a toy car averages during the course of its motion." If a sufficient quantity of vehicles are not available, students could be the object that moves. They could pick a variety of types of motion (one-legged hop, crabwalk, backward walk, baby steps, etc.) and their speed for the various movements could be determined.

Safety Concern:

There is always a higher than usual level of risk associated with working in a science lab. Teachers should be aware of this and take the necessary precautions to insure that working environment is as safe as possible. Student *horseplay* (especially the use of meter sticks as swords) and off-task behaviors should not be tolerated.

Suggestions, Precautions, Notes:

The Laboratory

1. Since most high school students have already been exposed to the concept of speed, it is advisable to provide as little directions as possible for this lab. Some students may want to know answers to questions such as "How many trials should we do?", "How much time should we run the car?", or "What distance should we use?" A good standard answer is "It's entirely up to you". The post-lab session then offers a great opportunity to discuss such topics as precision, reproducibility of results and the difference between independent variables, dependent variables, and constant quantities.
2. A concept which often surfaces a result of this lab is the distinction between average speed and instantaneous speed; this distinction ought to be one of the topics in the post-lab session.
3. If your room is small and your administration allows science labs to be done in the hallways, then this is a great hallway lab.
4. Two other labs proposed for this unit - Interpreting the Slope Lab and The Dune Buggy Challenge - make use of the constant-motion car. It is advisable to number or somehow label the cars to insure that students use the same car in these other labs.
5. If conducting the procedure on a tabletop, remind students of the obvious: that moving objects sometimes leave the tables and strike the floor below.

Auxiliary Materials:

None

Scoring Rubric:

K1. Speedometer Lab	Score
___ Included, labeled and organized all parts of the lab report.	
___ Data section includes a table of data for several trials; column headings and units are shown. Work for one calculation is shown and labeled. Average value is reported using all valid trials; results are reasonably accurate.	___/___
___ Conclusion states the speed of the object; units are included.	

Connections to The Physics Classroom Tutorial:

The following reading is a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/Class/1DKin/u111d.cfm>

Connections to Minds on Physics Internet Modules:

Sublevels 3 and 6 of the Kinematic Concepts module is a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/mop/module.cfm>