

Diagramming Motion Lab

Teacher's Guide

Topic:

One Dimensional Kinematics

The following information is provided to the student:

Question:

How do the dot diagrams for different types of motion compare to each other?

Purpose:

To compare and contrast the dot diagrams for three different types of motion: constant speed motion, slowing down motion and speeding up motion.

A complete lab write-up includes a Title, a Purpose, a Data section, and a Conclusion/Discussion. The Data section should include computer-generated dot diagrams for the three types of motion. Diagrams should be labeled to distinguish between which diagram corresponds to which motion. The Conclusion/Discussion should describe (in words) the diagrams for each type of motion, identifying the distinguishing characteristics of each diagram.

Materials Required:

Ticker tape timer, ticker tape, carbon disc, toy car (optional)

Description of Procedure:

The ticker tape should be *threaded* through the ticker tape timer. Once the timer is turned on, let the tape stay at rest for a second or two, then gradually pull the tape from rest to a moderate speed. Continue pulling at this speed for a couple of seconds, then gradually slow down to a stop. The proximity of adjacent dots to one another can then be observed and a conclusion can be drawn.

Alternative Materials and Procedure:

A track can be built using wooden boards - construct a *down ramp* (for speeding up), a level surface (for constant speed) and an *up ramp* (for slowing down). An inertia cart can be used to pull the tape through the timer. The three types of motion can be recorded on the tape. Care will have to be taken to find a means for the cart to smoothly transition from the level surface to the *up ramp*.

A computer-interfaced motion detector and the accompanying software can often be used to obtain a ticker tape like representation of an object's motion. The trick is to plot time on the vertical axis and position on the horizontal axis. Choose to collect data points every 1/10th seconds and to represent the points on the graph by large dots (if that is an option). If the vertical axis is scaled from 0 seconds to an abnormally large value (e.g., 1000 seconds), then all the plotted points will essentially be plotted in a horizontal line across the graph, spaced apart according to their position.

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* and off-task behaviors should not be tolerated.

The Laboratory

Suggestions, Precautions, Notes:

1. If you prefer not to pull the tape, then wind-up cars often exhibit the three types of motion - speeding up, constant speed, and slowing down. The speeding up phase is often short-lived.
2. An extension to this lab is to provide students with 1-meter's worth of tap and assign them the task of telling a story - a story of the motion of an object. For instance, students could describe their trip to school with all the stops, startups and constant speed phases. Students must represent the motion in words and with a dot diagram. Their dot diagram can be included on the provided ticker tape.

Auxiliary Materials:

None

Scoring Rubric:

K3. Diagramming Motion Lab	Score
____ Included, labeled and organized all parts of the lab report. ____ Data section includes dot diagrams for the three types of motion; diagrams are labeled and communicates the concept; diagrams are reasonably accurate. ____ Conclusion/Discussion describes the diagrams in words and relates the diagram to the proper motion; the distinguishing features of each diagram are identified in the discussion.	____/____

Connections to The Physics Classroom Tutorial:

The following readings are a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/Class/1DKin/u111e.cfm>

<http://www.physicsclassroom.com/Class/1DKin/u112b.cfm>

Connections to Minds on Physics Internet Modules:

Sublevel 5 of the Kinematic Concepts module is a suitable accompaniment to this lab:

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