Graphing Your Motion

Graphs made using a computer-interfaced Motion Detector can be use to study motion. A Motion Detector measures the distance to the nearest object in front of it. The computer reports the measurement as position along a line, and can calculate velocity and acceleration values. To determine distances, a Motion Detector emits and receives pulses of ultrasound. In this experiment, you will use a computer-interfaced Motion Detector to produce graphs of your own motion.

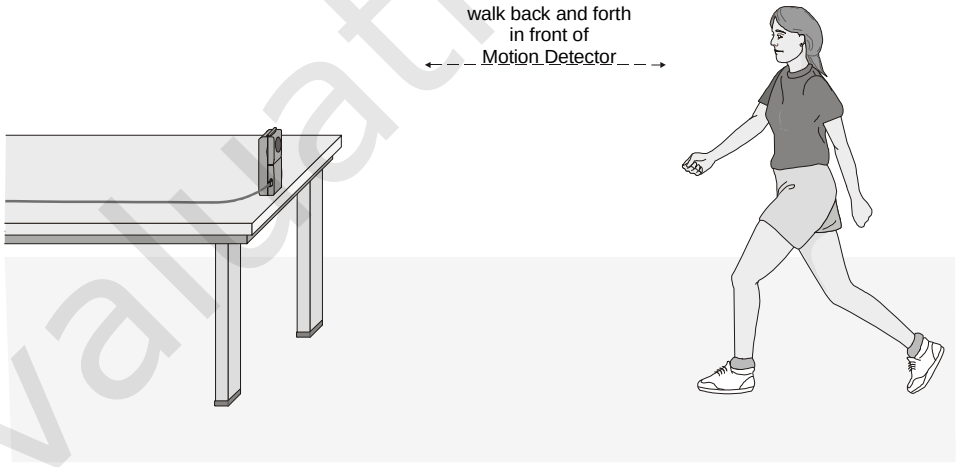
OBJECTIVES

In this experiment, you will

- Use a Motion Detector to measure position, velocity, and acceleration.
- Use a computer to produce graphs of your motion.
- Analyze and interpret motion graphs.

MATERIALS

computer
Vernier computer interface
Vernier Motion Detector
Logger*Pro*
masking tape
meter stick



PROCEDURE

Part A Distance

1. Fasten a Motion Detector to a table top facing an aisle. Connect the Motion Detector to DIG/SONIC 1 on the Vernier interface.
2. Using masking tape, tape a 4 m straight line on the floor directly in front of the Motion Detector. Mark the tape at meter intervals from the Motion Detector.

3. Prepare the computer for data collection by opening the "35a Graphing Your Motion" file from the *Physical Science w Vernier* folder. A blank position *vs*. time graph should appear on the screen.
4. Stand at the 1 m mark on the tape line facing the Motion Detector and the computer screen. Have your partner click ▶ Collect, then slowly walk backwards away from the Motion Detector. Walk along the tape line and watch the screen.
5. Choose Store Latest Run on the Experiment menu. Repeat Step 4, moving faster this time.
6. Print or sketch the graph produced on the screen.
7. Open the file "35b Graphing Your Motion." A position *vs*. time graph should appear on the screen.
8. Try to match the line by moving toward or away from the Motion Detector. Print or sketch your results. Have everyone in your group try to match the broken line.

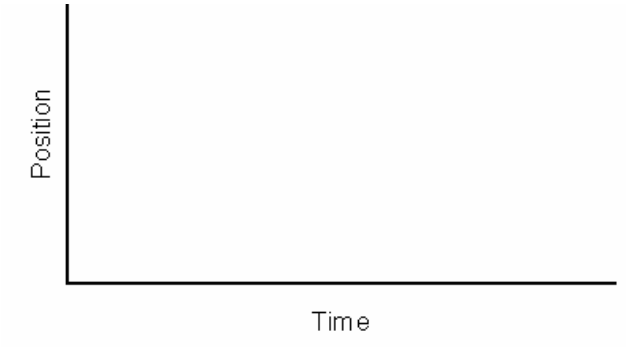
PROCESSING THE DATA (PART A)

1. Describe the difference between the two lines on your graph made in Step 6. Explain why the lines are different.

2. How would the graph change if you walked toward the Motion Detector rather than away from it? Test your answer using the Motion Detector.

3. What did you have to do to match the graph you were given in Step 7?

4. Sketch a position *vs*. time graph for a car that starts slowly, moves down the street, stops at a stop sign, and then starts slowly again.



Part B Velocity

9. Open the file "35c Graphing Your Motion." A blank velocity *vs*. time graph should appear on the screen. The vertical axis will have velocity scaled from –2 to 2 m/s. The horizontal axis will have time scaled from 0 to 3 seconds.
10. Stand at the 1 m mark on the tape line facing the Motion Detector and the computer screen. Have your partner click ▶ Collect, then slowly walk backwards away from the Motion Detector.
11. Choose Store Latest Run on the Experiment menu. Repeat Step 10, moving faster this time.
12. Print or sketch your graph.
13. Open the file "35d Graphing Your Motion." A velocity *vs*. time graph, with a line, should appear on the screen.
14. Try to match the line by moving toward or away from the Motion Detector. Print or sketch your results. Have everyone in your group try to match the line.

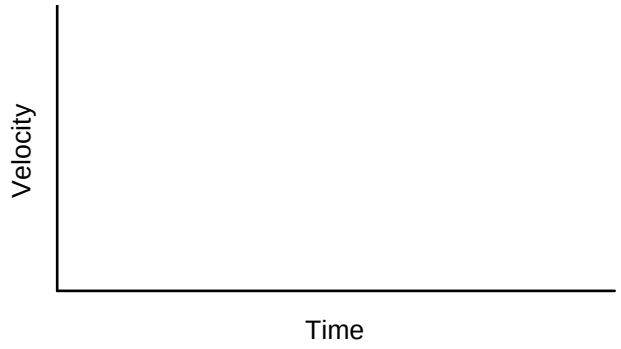
PROCESSING THE DATA (PART B)

5. Describe the difference between the two lines on the graph made in Step 12. Explain why the lines are different.

6. What is the definition of velocity?

7. What did you have to do to match the graph you were given in Step 13? How well does your graph agree with the graph provided?

8. Sketch a velocity *vs*. time graph for a person who walks, stops for a few seconds, and then starts to run.



Vernier Lab Safety Instructions Disclaimer

THIS IS AN EVALUATION COPY OF THE VERNIER STUDENT LAB.

This copy does not include:

- **Safety information**
- **Essential instructor background information**
- **Directions for preparing solutions**
- **Important tips for successfully doing these labs**

The complete *Physical Science with Vernier* lab manual includes 40 labs and essential teacher information. The full lab book is available for purchase at:
http://www.vernier.com/cmat/psv.html

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