Name _____ Physics Lab

Lab Partner _____

Introduction to Motion: Graphs of Your Motion

To Find Out: How you can measure your motion with a motion detector

Materials: Data Studio Software
Computer
Pasco Interface and Motion Detector

Introduction: In this investigation, you will use a motion detector to plot a distance (position) – time graph of your motion. As you walk (or jump, run), the graph on the computer screen displays how far away from the detector you are.

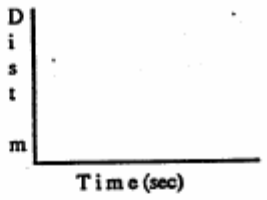
- ✓ "Distance" is short for "distance from the motion detector"
- ✓ The motion detector is the origin from which distances are measured
- ✓ It detects the closest object directly in front of it (including your arms if you
- ✓ swing them arms you walk)
- ✓ It will not correctly measure anything closer than 0.5 meter. When making your graphs don't go closer than 0.5 meter from the motion detector

Activity 1: **Making Distance – Time Graphs**

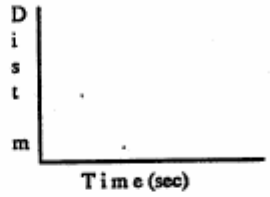
1. Attach the interface and motion detector to the computer, as shown by your instructor
2. Click on the ***Data Studio icon*** on the desktop
3. Click on ***Create a New Experiment***
4. Verify the interface is found by the software
5. Under Sensors in the Experiment Setup window, Scroll down to ***Motion Detector*** and select. It will be added to the interface
6. Under ***Displays*** on the left side of the screen, click on Graphs
7. Select Position, Ch 1&2 (m)
8. Adjust the settings on the graph to best match your data (see instructor). Do a practice run and verify the interface is working by clicking on the ***Start*** button
9. Run the experiment and record your data on this lab. Have fun!

Part A: Use the motion detector and software to act out the directions for each task. Sketch the graph you make in the space provided.

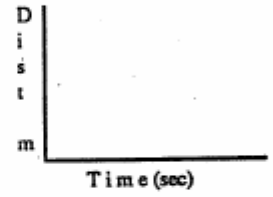
a. Start at the 1/2-meter mark and make a distance/time graph, walking away from the detector (origin) *slowly and steadily.* Sketch the graph on the right.



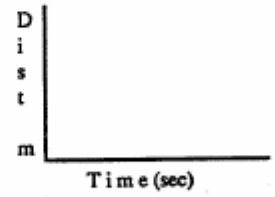
b. Make a distance/time graph, walking away from the detector (origin) *medium fast and steadily.* Sketch the graph.



c. Make a distance/time graph, walking toward the detector (origin) *slowly and steadily.* Sketch the graph.



d. Make a distance/time graph, walking toward the detector (origin) *medium fast and steadily.* Sketch the graph.



Questions

Describe the difference between the graph you made by walking away slowly and the one made by walking away more quickly. (Q1)

_____

_____

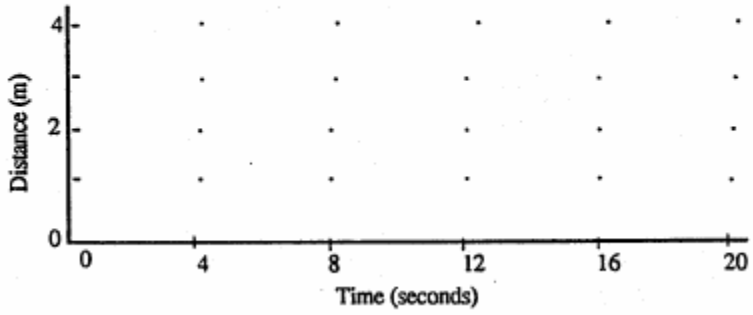
Describe the difference between the graph made by walking toward and the one made walking away from the motion detector. (Q2)

_____

_____

Part B: Make a distance vs. time graph

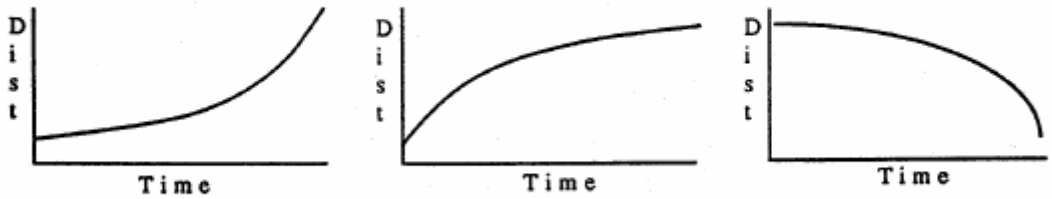
1. Make up your own distance(postition)-time graph. Use straight lines, no curves. Sketch the graph below with a dashed line. Now see how well someone in your group can duplicate this graph on the screen.



**** Print enough copies of this graph for each group member and staple it to this lab**

Part C: Can you make the following curved graphs?

2. Can you make a curved distance-time graph? Try to make each of the graphs shown below.



Describe how you must move to produce a distance-time graph with each of the shapes shown.

Graph 1 answer:_____

_____

_____

Graph 2 answer:_____

_____

_____

Graph 3 answer:_____

_____

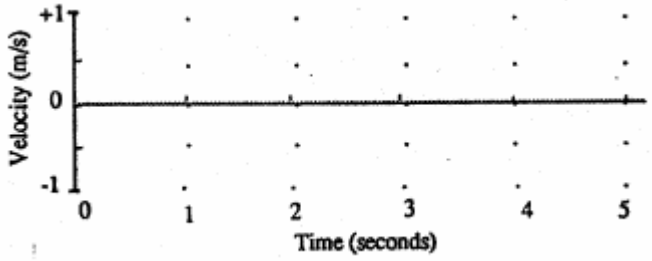
_____

Velocity and Position vs. Time Graphs

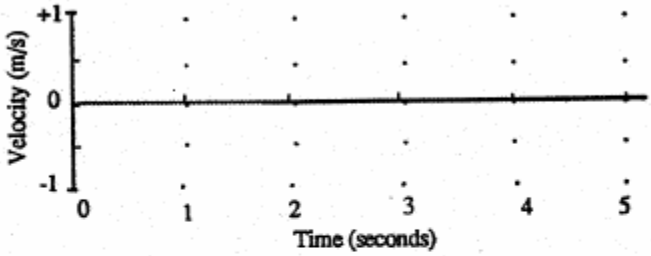
To add a velocity graph to this exercise, click on the velocity vs. time graph text in the upper left hand corner of the screen and drag it down to beneath the position vs. time graph that is currently on the screen. Both graphs should be up for this exercise.

Part A: Use the motion detector and software to act out the directions for each task. Sketch the graph you make in the space provided.

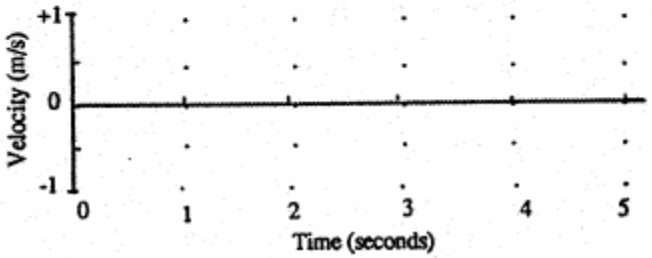
a. Make a velocity graph by walking *away* from the detector *slowly and steadily*. Try again until you get a graph you're satisfied with.



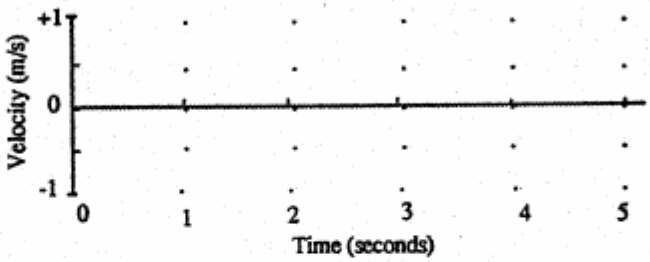
b. Make a velocity graph, walking *away* from the detector *medium fast and steadily*. Sketch your graph.



c. Make a velocity graph, walking *toward* the detector *slowly and steadily*. Sketch your graph.



d. Make a velocity graph, walking *toward* the detector *medium fast and steadily*. Sketch your graph.



Questions

What is the most important difference between the graph made by slowly walking away from the detector and the one made by walking away more quickly? (Q1)

_____

_____

How are the velocity-time graphs different for motion away and motion toward the detector? (Q2)

_____

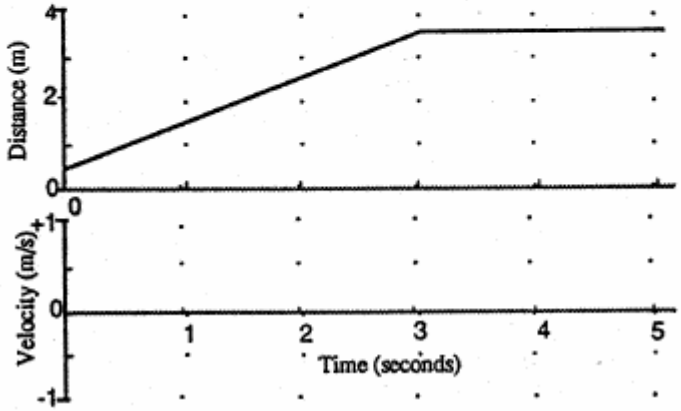
_____

Part B: Make a prediction and verify! Examine the distance vs. time graph below and sketch (with dashed lines) your prediction of the velocity vs. time graph

Make the graphs. After each person has sketched a prediction, **Start,** and do your group's best to make a distance graph like the one shown below. Walk as smoothly as possible.

When you have made a good duplicate of the distance graph, sketch your actual graph over the existing distance-time graph.

Use a *solid line* to draw the actual velocity graph on the same graph with your prediction. (Do not erase your prediction).



3. Make the graphs. After each person has sketched a prediction, **Start,** and do your group's best to make a distance graph like the one shown below. Walk as smoothly as possible.

When you have made a good duplicate of the distance graph, sketch your actual graph over the existing distance-time graph.

Use a *solid line* to draw the actual velocity graph on the same graph with your prediction. (Do not erase your prediction).

Questions

How would the distance graph be different if you moved faster? Slower? (Q1)

_____

_____

How would the velocity graph be different if you moved faster? Slower? (Q2)

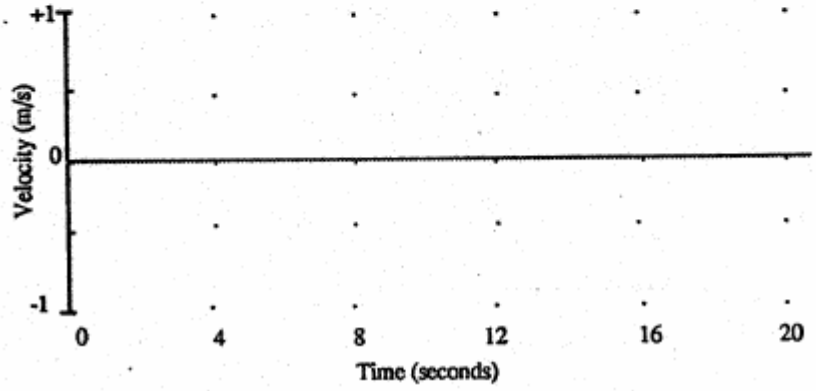
_____

_____

Part C:

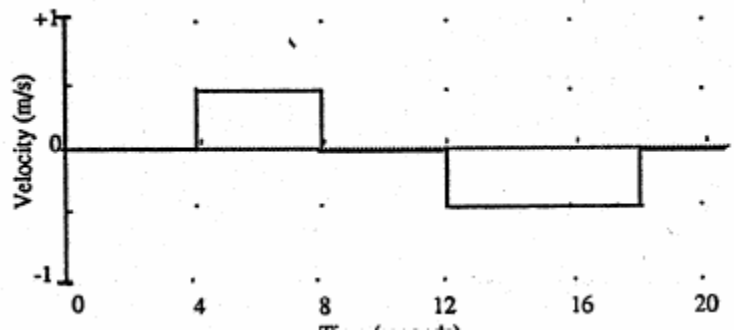
3. Predict a velocity graph for a more complicated motion and check your prediction.
   a. Each person draw below, using a *dotted line*, your *prediction* of the velocity graph produced if you—
      - walk away from the detector slowly and steadily for 10 seconds
      - stop for 4 seconds
      - walk toward the detector steadily about twice as fast as before
   b. Compare predictions and see if you can all agree. Use a solid line to draw in your group prediction.

Prediction



**** Print enough copies of this graph for each group member and staple it to this lab**

Part D: Match this graph. Try to match this graph using your motions. When you have a trial that is close to the above graph, **PRINT IT** and staple it to your lab.



Questions Describe how you moved to match each part of the graph. (Q3)

_____

_____

_____

Is it possible for an object to move so that it produces an absolutely vertical line on a velocity time graph? Explain. (Q4)

_____

_____

Directions for Submitting completed lab:

1.) Make sure you printed the (3) required graphs and stapled it to this lab report.

2.) The entire lab should be done in pencil and be neat. Sloppy work will not be graded.