

Name: \_\_\_\_\_  
Mr. Willis  
Conceptual Physics: \_\_\_\_\_  
Date: \_\_\_\_\_

Unit II  
Motion (Velocity/Acceleration)  
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II

## Graphing Motion (Part 1 – Distance)

**Directions:** Work in your group (2 or 3 people) on the following activity. Choose ONE group member to be the subject (the person who walks to/from motion detector). This person must be the subject in each trial run. You may and should consult with one another on the answers to the questions, but the final answer will be your own. Answer questions on a separate sheet of paper.

### **Lab Objectives:**

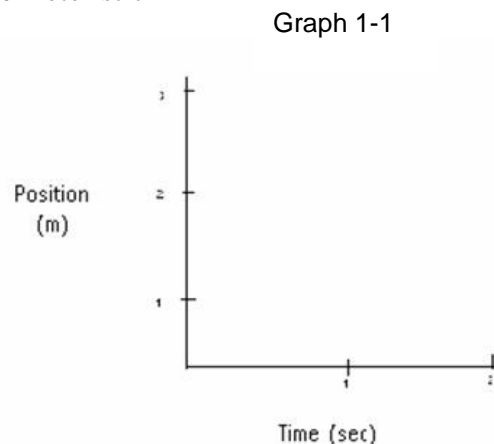
- To understand what distance, velocity, and acceleration are
- To use Probeware in making graphs of your own motion, and interpret these graphs

### **Materials:**

Xplorer GLX, Motion Detector, Masking Tape, colored pencils, & meter stick

### **Procedure:**

1. Create a tapeline on the floor that extends 4 meters from your motion sensor. Also, mark the one meter point.
2. Stand at the 1 meter mark on the tapeline facing the motion detector. Have your partner click the Collect button and then slowly walk backwards away from the motion detector to the end of the 4 meter line. Walk along the tapeline at a constant speed. Repeat this 3 times to record consistent results.
3. Sketch the final graph you obtained on *Graph 1-1* using a red colored pencil and/or label it #1.



### **Experiment:**

Question 1: What will the graph look like if you move faster? Record your prediction on a separate sheet of paper. Repeat step 2, moving faster this time.

Question 2: Again, sketch the data you obtain on *Graph 1-1* with a blue colored pencil and label it #2. Was your prediction correct? If it was not correct, stop and talk about this with your group.

Question 3: What will the graph look like if you move slower? Record your prediction. Repeat step 2, moving very slow this time. Sketch the line on *Graph 1-1* using a green colored pencil and label it #3.

Question 4: What will the graph look like if you move towards the motion detector instead of away? Record your prediction. Repeat step #1, but this time start at the 4-m mark and come forward towards the 1-m mark. Was your prediction correct? Sketch the line you obtained on *Graph 1-1* with a purple colored pencil and label #4.

Question 5: What are the dependent and independent variables in this experiment?

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## Graphing Your Motion (Part 2 - Velocity)

**Directions** for the Lab: In groups of 2 or 3, work on the following activity. Choose a group member to be the subject (the person who walks to/from motion detector). This person must be the subject in each trial run. You may and should consult with one another on the answers to the questions, but the final answer will be your own. Answer questions on a separate sheet of paper.

### **Materials:**

Xplorer Data Logger, Motion Detector, masking tape, colored pencils, & meter stick

### **Procedure:**

1. Use the tape line that you have already created in Part 1.
2. Adjust the data logger so that your y-axis is now set to collect velocity data instead of position data. Stand at the 1-m mark on the tapeline facing the motion detector. This might work best if you use your notebook or book and hold it in front of you. Have a partner click the Collect button and then slowly walk backwards away from the motion detector. Try this 3 times for consistent results
3. Sketch the final graph you obtained on *Graph 1-2* using a red colored pencil and label it #1.

### **Experiment:**

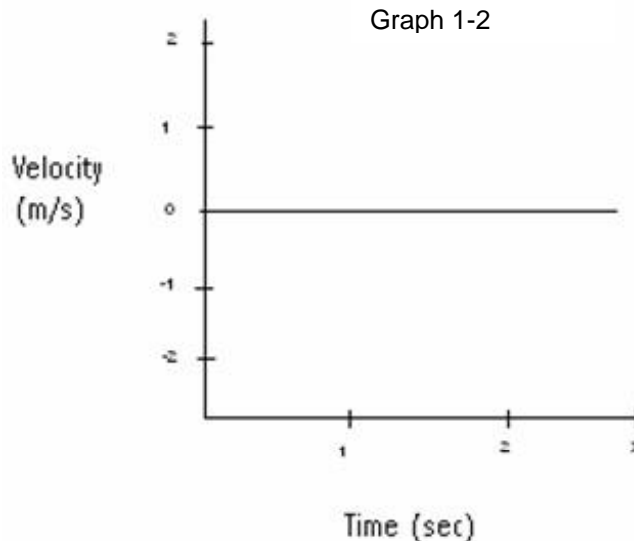
Question 1: What will the graph look like if you move faster? Record your prediction on a separate piece of paper. Repeat step #2 moving faster this time.

Question 2: Sketch the graph you obtain on *Graph 1-2* with a blue colored pencil and label it #2. Was your prediction correct? If it was not correct, stop and talk about this with your group.

Question 3: What will the graph look like if you move slower? Record your prediction. Repeat step #2 moving slowly this time. Sketch the graph on *Graph 1-2* using a green colored pencil and label it #3.

Question 4: What will the graph look like if you move towards the motion detector instead of away? Record your prediction. Repeat step 2, but this time start at the 4m mark and come forward towards the 1m mark. Was your prediction correct? Sketch the graph you obtained on *Graph 1-2* with a purple colored pencil and label it #4.

Question 5: What are the dependent and independent variables in this experiment?



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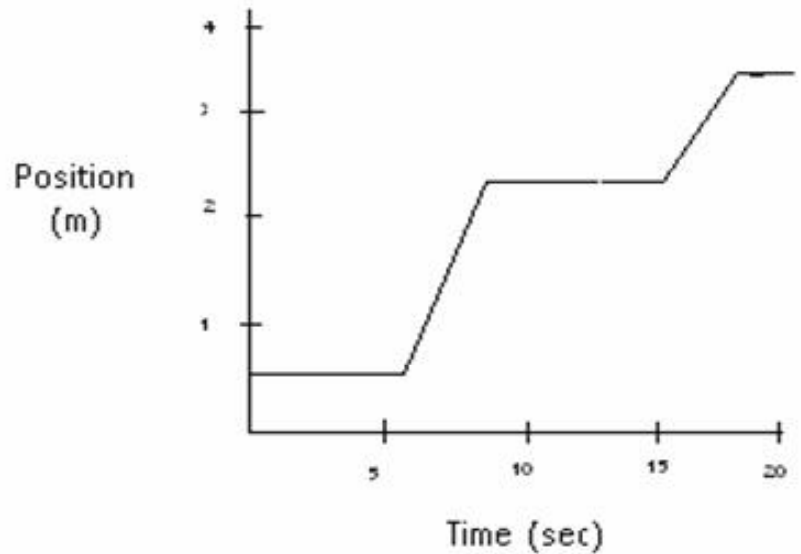
# II

## Part 3 – Fun With the Motion Detector

A. Look at the distance vs. time graph (Graph 1-3).

B. Try to match the line on this graph by moving toward or away from the motion detector. Have everyone in your group try to match the broken line. See who can get the best line. Sketch what your graph looks like on .

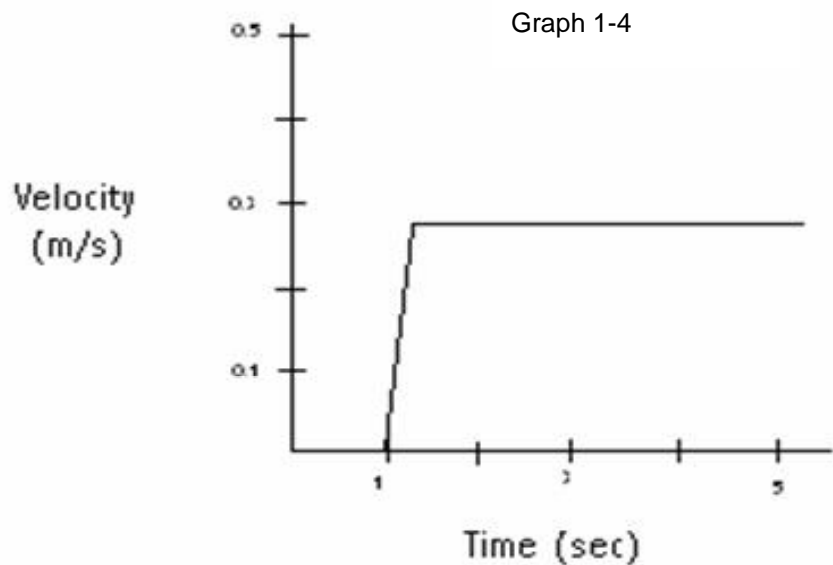
What did you have to do to match the graph on the screen?



C. Use Graph 1-4 (velocity vs. time).

D. Try to match the line on this graph by moving toward or away from the motion detector. Have everyone in your group try to match the broken line. See who can get the best line. Sketch what your graph looks like to the right.

What did you have to do to match the graph on the screen?



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## Graphing Your Motion (Part 4 – Acceleration)

### **Procedure:**

Prepare the computer for data collection by clicking File, then Open and choosing Exp 35e from the Physical Science with Computers experiment files of Data Studio. Three empty graphs should appear on the screen.

The top one is a distance vs. time graph. The middle one is a velocity vs. time graph. And, the bottom graph is an acceleration vs. time graph.

Stand at the 1-m mark on the tape line, this time with your back to the motion detector. Have your partner click Collect. Pause for about one second and then walk rapidly to the 3-m mark and stop. Say stop when you have stopped. As you say stop, your partner should click Stop.

Question 1: Sketch your 3 resulting graphs below:

Question 2: How does the acceleration vs. time graph differ from the other two graphs?

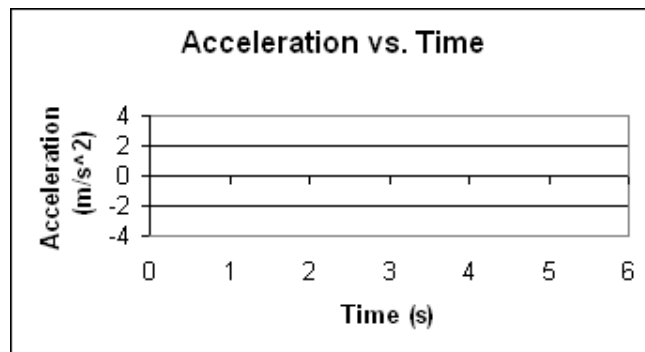
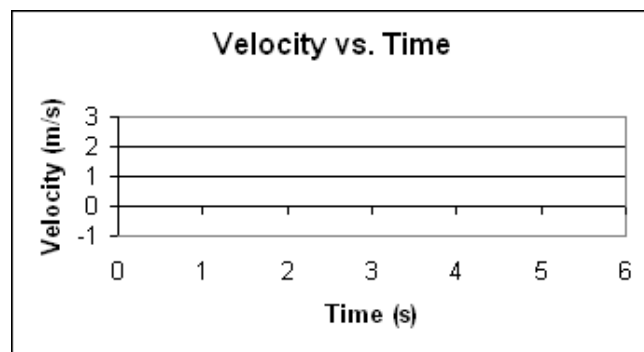
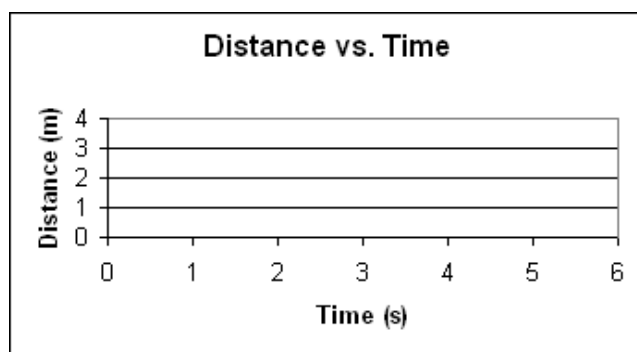
Question 3: Describe the acceleration part of your velocity vs. time graph.

Question 4: Describe the acceleration part of your acceleration vs. time graph.

Question 5: Describe the deceleration part of your velocity vs. time graph.

Question 6: Describe the deceleration part of your acceleration vs. time graph.

Question 7: What is acceleration?



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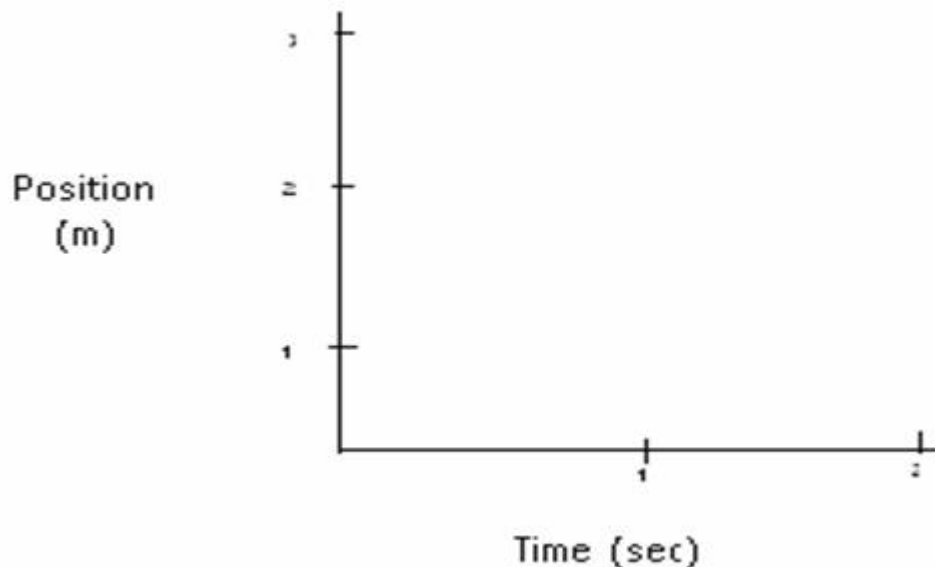
## Homework Problems – Part 1

Question 1: Look at your graph you sketched in Part 1. Describe the difference between the first line you graphed (red line labeled 1) and the second line you graphed (blue line labeled 2). Explain why the lines are different.

Question 2: Again look at your graph from Part 1, how far (in meters) did your subject move in 2 seconds?

Question 3: If your subject had traveled for 7 seconds, how far (in centimeters) would they have moved?

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



5. Why did I allow you to have only ONE group member as the subject?

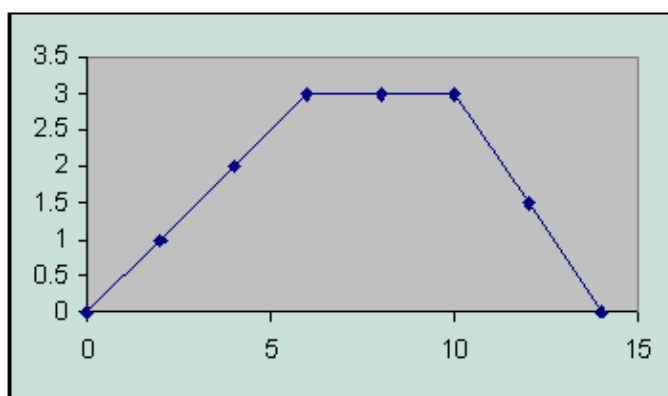
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## Homework Problems for Parts 2 and 3:

Question 1: Look at your graph you sketched for Part 2. Describe the difference between the first line you graphed (red line labeled 1) and the second line you graphed (blue line labeled 2). Explain why the lines are different.



Question 2: Why did the lines not change (They were straighter) than the lines in the distance graphs you drew in Part 1?

Question 3: What is the definition of velocity?

Question 4: Look at your graph in Part 2, how many minutes would it have taken your subject to travel 12 meters?

Question 4: Sketch a velocity vs. time graph for a person who walks, stops for a few seconds, and then starts to run.

Question 5: Describe the motion needed to make this graph:

If it is a distance vs. time graph?  
If it is a velocity vs. time graph?