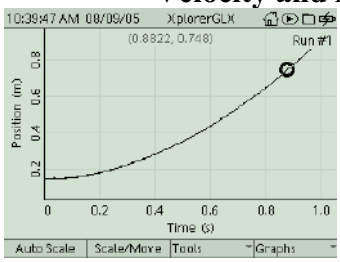
Velocity and Acceleration with the GLX



Purpose:
In this experiment, students study velocity and acceleration.

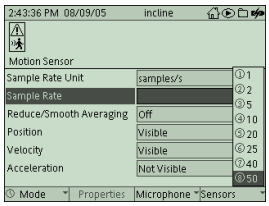
Equipment:

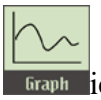
- GLX and Motion Sensor
- Cart
- Constant Speed Buggy
- Ramp
- Meter Stick

Setup:

1. Turn on the GLX.
2. Connect the GLX to the Motion Sensor.

3. Move the switch at the top of the Motion Sensor to the Cart icon.
4. Press the Home button to get to the Home screen.
5. Press F4 or navigate to the Sensors icon Sensors.



6. Change the **Sample Rate** to 50 as in the picture above.
7. Press the Home button to get to the Home screen.
8. Press F1 or navigate to the Graph 

icon.

Part 1a: The Buggy Moving Away Data Collection Procedure:

1. Place the Buggy 15 cm away from the Motion Sensor pointing away from the Motion Sensor.
2. Turn on the Buggy and press the Start Button on the GLX.
3. When the Buggy has traveled about 1 m, press the Stop Button.

Part 1a: The Buggy Moving Away Analysis:

1. Press F3 and select the Linear Fit tool.
2. Manipulate the region of the Linear Fit, if necessary, by pressing F3 and selecting "Swap Cursors."
3. Sketch the graph below. Make sure to include the proper units, the slope, and the vertical intercept.

Graph 1:

Part 1b: The Buggy Moving Toward Data Collection Procedure:

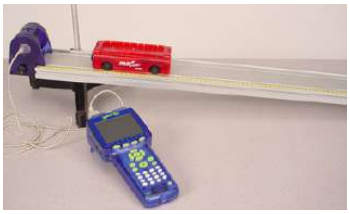
1. Place the Buggy 1.5 m away from the Motion Sensor pointing toward the Motion Sensor.
2. Turn on the Buggy and press the Start Button on the GLX.
3. When the Buggy has traveled about 1 m, press the Stop Button and turn off the Buggy.

Part 1b: The Buggy Moving Toward Analysis:

1. Press F3 and select the Linear Fit tool.
2. Manipulate the region of the Linear Fit, if necessary.
3. Sketch the graph below. Make sure to include the proper units, the slope, and the vertical intercept.

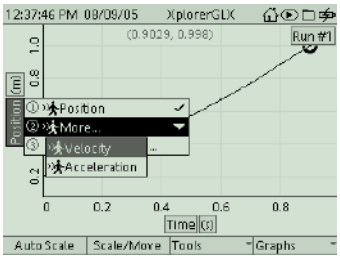
Graph 2:

Part 2: The Cart on the Incline Data Collection Procedure:



1. Lay the Motion Sensor on the ramp.
2. Set the track on an incline as in the picture above.
3. Release the cart from the top of the ramp and press the Start Button.
4. Just before the cart reaches the end of the ramp, press the Stop Button.

Part 2: The Cart on the Incline Analysis:



1. Press the Check Button twice to highlight and change the vertical intercept.
2. Select "Velocity" as in the picture above. The data is converted to a Velocity vs. Time graph.
3. Press F3 and select the Linear Fit tool. Manipulate the region of the Linear Fit, if necessary
4. Sketch the graph below. Make sure to include the proper units, the slope, and the vertical intercept.

Graph 3:

Conclusions:
Part 1: The Buggy

1. For the graph of the Buggy going away from the Motion Sensor, what physical property does each of the following represent?
    a. Slope.

    b. Sign of the Slope.

c. Vertical Intercept.

2. For the graph of the Buggy going away from the Motion Sensor, write a linear equation (y=mx+b) using the proper units and variables.

3. For the graph of the Buggy going toward the Motion Sensor, what physical property does each of the following represent?
    a. Slope.

    b. Sign of the Slope.

    c. Vertical Intercept.

4. For the graph of the Buggy going toward the Motion Sensor, write a linear equation (y=mx+b) using the proper units and variables.

Part 2: The Cart on the Incline

5. For the graph of the cart going down the track, what physical property does each of the following represent?
    a. Slope.

    b. Sign of the Slope.

    c. Vertical Intercept.

6. For the graph of the cart going down the track, write a linear equation (y=mx+b) using the proper units and variables.

7. How would the graph differed if you would have measured the acceleration of the cart going up the inclined ramp with a push from you?

8. How do you think the slope of the velocity versus time on a graph relates to acceleration?

9. What is the relationship between velocity and acceleration?

Vocabulary: Use the textbook to define these terms.

Acceleration:

Constant or uniform acceleration:

Velocity: