Survey of Physics

Lab 2: One Dimensional Motion

Name:_____

partner name(s):_____

Theory:

In this lab, you will observe the motion in one dimension: a cart moving along a track.

Notes on using the Motion Detector:

- The motion detector will measure the cart's position. "Position" means the distance from the motion detector. The face of the motion detector is a position of $x = 0\ \mathrm{m}$. 1 m in front of the motion detector is a position of $x = +1\ \mathrm{m}$, 2 m in front of the motion detector is a position of $x = 2\ \mathrm{m}$, and so on.
- The motion detector detects the closest object directly in front of it. This means it will record your hands, clothes or other objects that get between the sensor and the cart.
- Always keep the cart at least 10 cm away from detector. The detector gets confused when the distance is too small.

Notes on using Logger Pro:

- To nicely scale a graph, select the graph you want to affect (click it), and click the auto-scale button (labeled “A”).

Equipment:

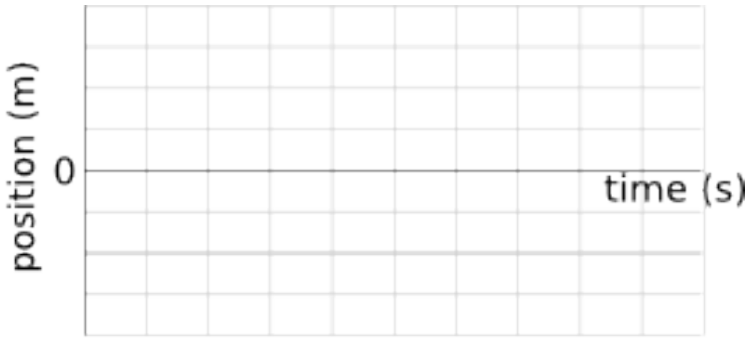
Computer running Logger Pro, Vernier interface and motion detector, track, Low friction cart, Fan

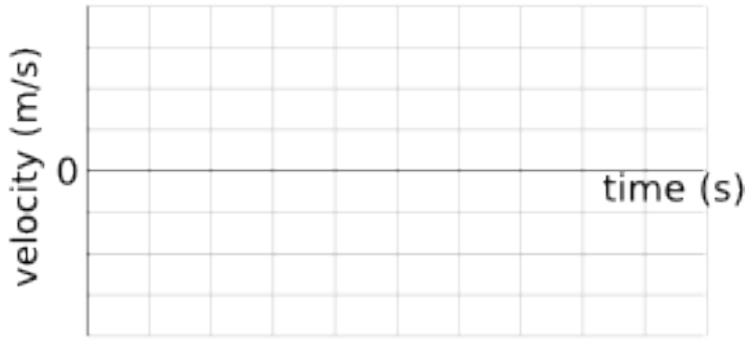
Procedure:

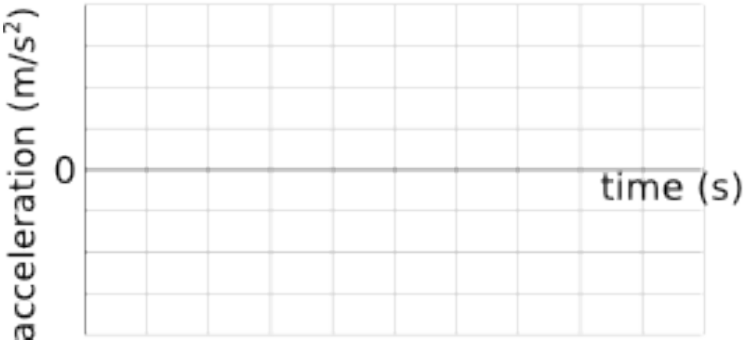
Part 1: Speeding up, moving away

1. After discussion with your lab partner, predict the position, velocity, and acceleration graphs that you would see if you release the cart from rest at a distance of 10 cm from the detector and allow it to speed up (with the fan) as it moves away from the detector.

   Make sure you take account of the sign (+ or --).





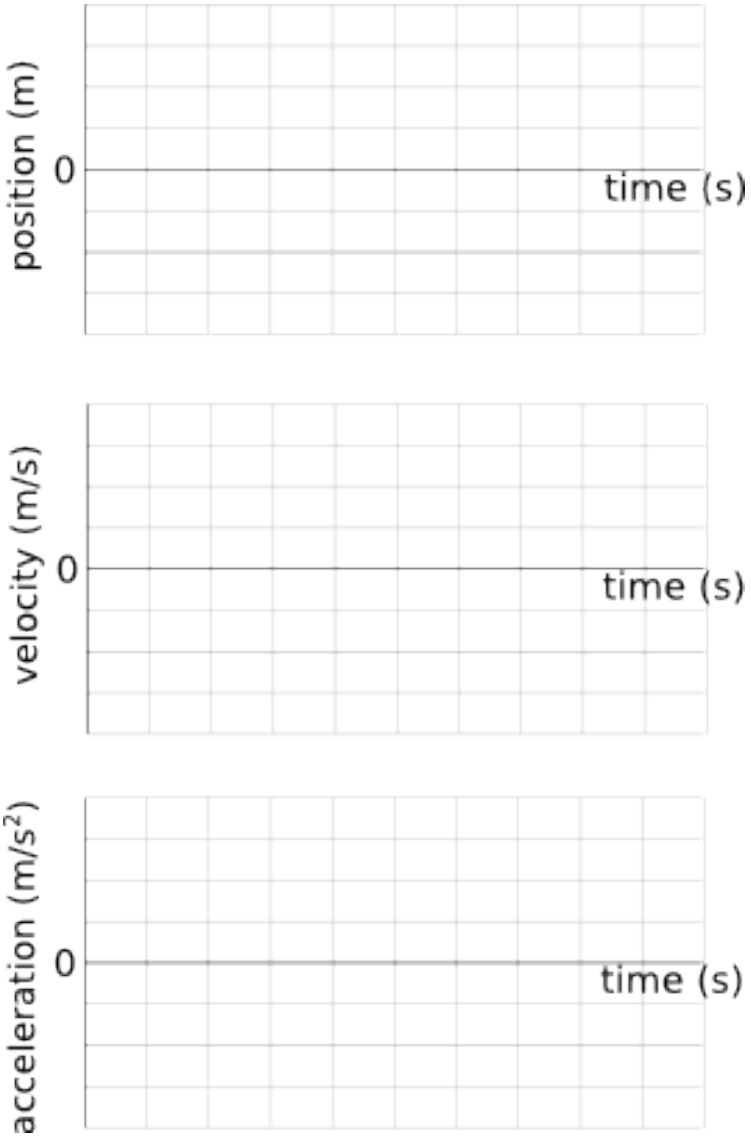


2. Set up the track with the motion detector at the end of the track. Make sure the track is level (you may need to added folded paper under one end). Turn on the fan and hold the cart with your hand, getting ready to start data collection at the computer. Release the cart from rest and start data collection at nearly the same time, and be ready to stop the data collection before the cart runs off the end of the track. Take a few trial runs to get a good graph.

3. You want a graph that ***only includes free cart motion*** – no hands or crashing. (see the Logger Pro notes on the first page for how to remove data).

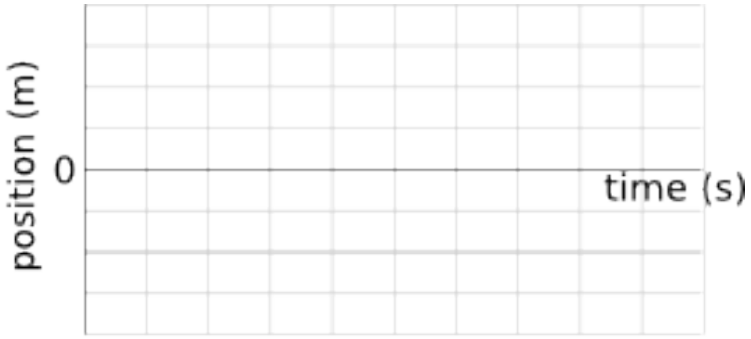
   Remove the data that is outside of the free cart motion. Select the data to remove (click-and-drag on a graph or in the data table) and in the "Edit" menu select "Strike Through Data Cells".

4. Sketch the position, velocity and acceleration graphs here.



Part 2: Speeding up, moving toward the detector

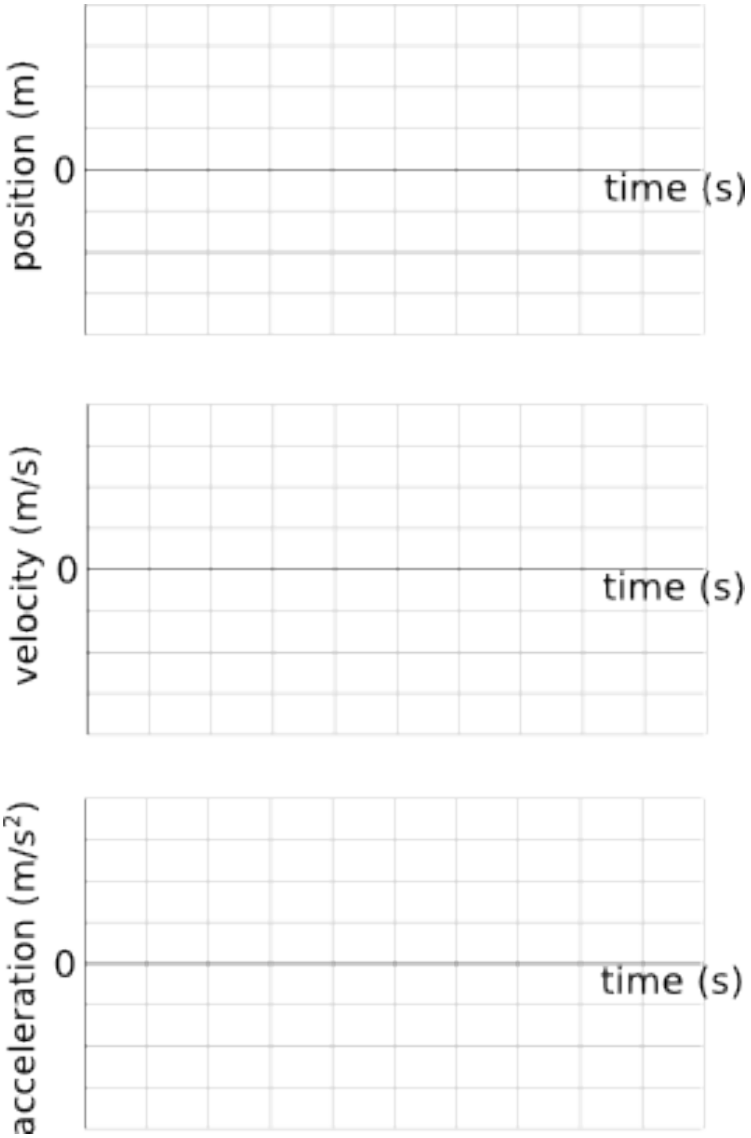
1. After discussion with your lab partner, predict the position, velocity, and acceleration graphs that you would see if you release the cart from rest at the far end of the track and allow it to speed up moving toward the detector. Consider the sign (+ or –) of the values you expect.



2. Perform this experiment, taking a few trials until you obtain a nice clear graph.

3. As before, remove the data that is outside of the *free cart motion* (under influence of the fan alone).

4. Sketch the position, velocity and acceleration graphs here.



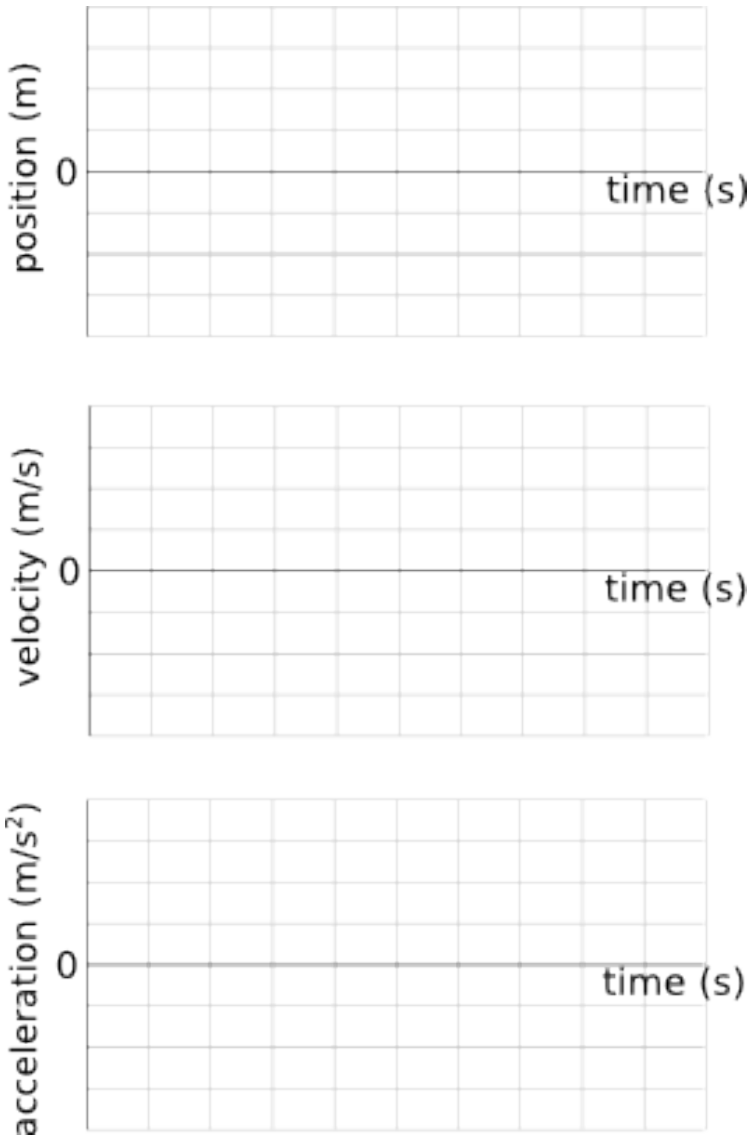
Part 3: Reversing direction

In this part, you will look at what happens when the cart slows down, reverses direction, and then speeds up in the opposite direction. The fan should push the cart in the direction of the detector, while it is released moving away. The fan will slow the cart down, turn it around, and then move it back toward the detector while speeding up.

1. After discussion with your lab partner, predict the position, velocity, and acceleration graphs that you would see in this case. For each part of the motion – *away from the detector, at the turning point, and toward the detector* – indicate in the table below whether the values of position, velocity and acceleration are positive, zero or negative.

	Moving Away	Turning point	Moving Toward
Position			
Velocity			
Acceleration			

Sketch the predicted graphs (with axis values) in the lab report using a dotted line. Consider the sign (+ or –) of the values you expect.



2. Perform this experiment, taking a few trials until you obtain a nice clear graph.

3. As before, remove the data that is outside of the *free cart motion* (under influence of the fan alone).

4. Sketch the position, velocity and acceleration graphs here.