

Name: \_\_\_\_\_

## Investigating Accelerated Motion

### Brief Introduction

In this investigation of your motion while walking you will be collecting data in two ways. Again, you will be using motion detectors and DataStudio data collection software. You will use DataStudio to create graphs of position vs. time, velocity vs. time, and acceleration vs. time. The second type of data you will be collecting will be motion maps, which you will create.

### Pre-Lab

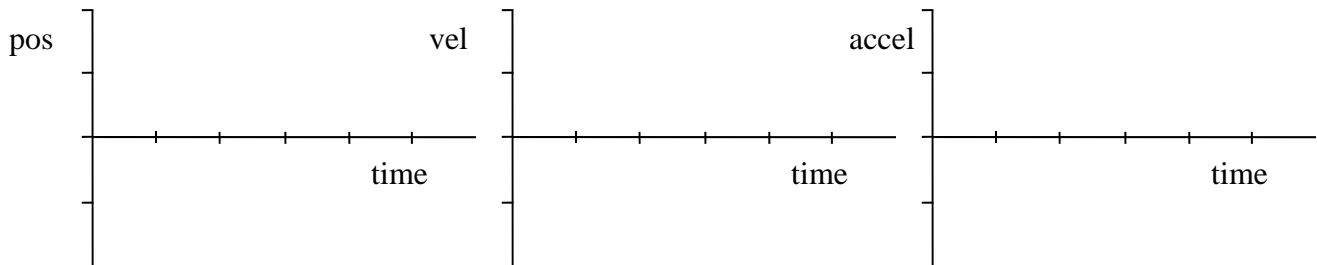
Before turning on the computer connect the Motion Detector to the USB Link. Plug the USB Link into the USB port on the computer. After all hardware is connected, turn on the computer. Open the file "Investigating Accelerated Motion.ds". Be certain the switch on top of the Motion Detector is set to the stick figure (this increases the distance the Motion Detector can 'see').

### Data Collection

After completing each trial you should make a sketch of the following:

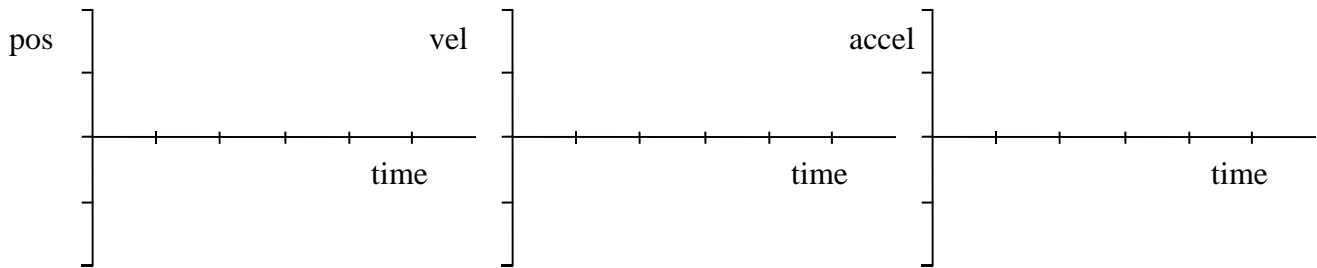
1. A motion map
2. The position vs. time graph
3. The velocity vs. time graph
4. The acceleration vs. time graph

Trial #1: Beginning from rest, walk in a straight line away from the motion detector, slowly increasing your pace at a constant rate.



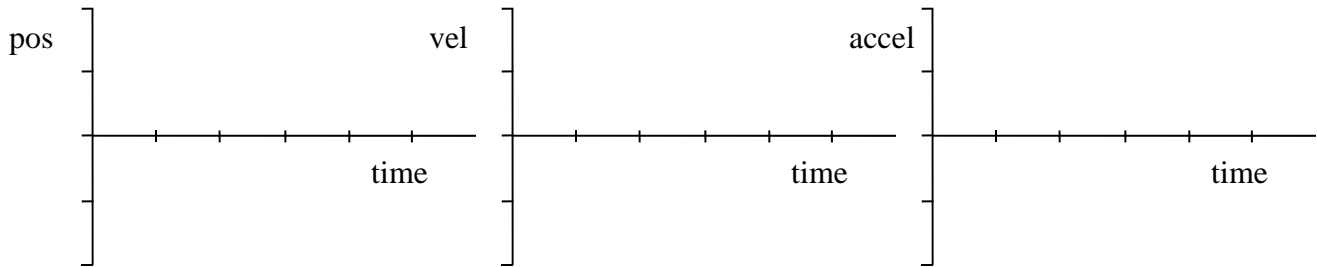
Motion Map for Trial #1

Trial #2 Beginning from a fast pace, walk in a straight line, away from the motion detector, slowly decreasing your pace at a constant rate.



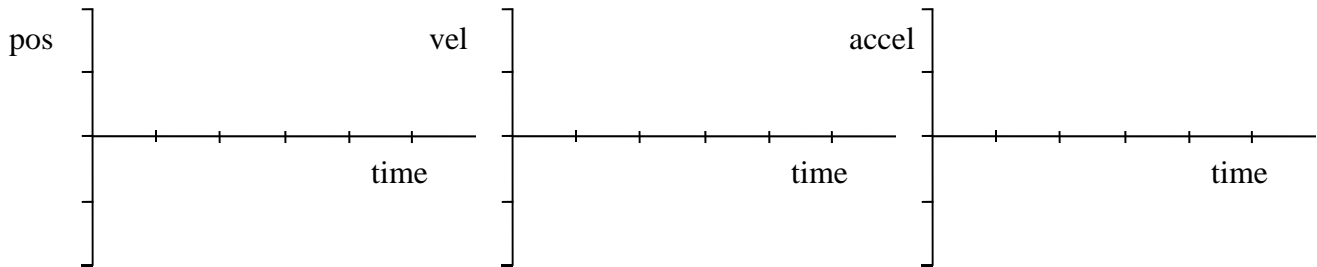
Motion Map for Trial #2

Trial #3: Beginning from rest, walk in a straight line, away from the motion detector, quickly increasing your pace at a constant rate.



Motion Map for Trial #3

Trial #4: Beginning from a fast pace, walk in a straight line, away from the motion detector, and quickly slow your pace at a constant rate.



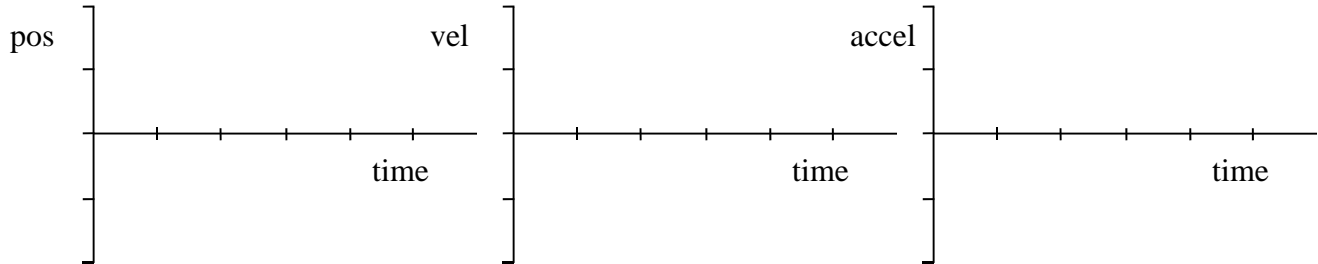
Motion Map for Trial #4

### Questions about Trials 1-4

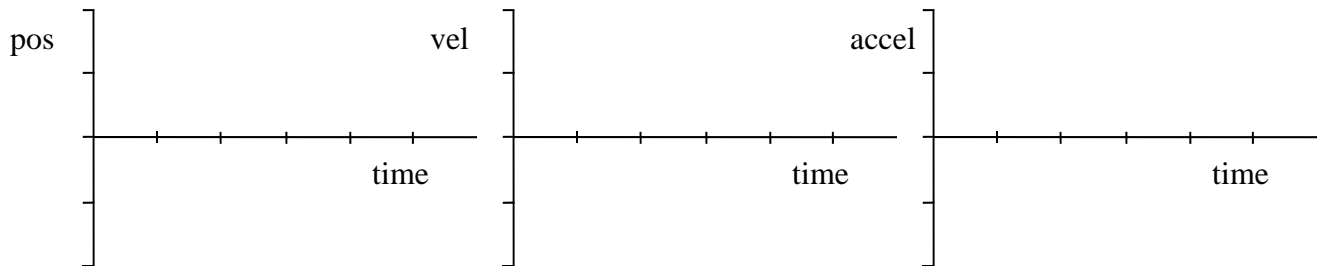
1. In each of the Trials 1-4, you are asked to either constantly speed up or constantly slow down. Were you able to do this? How can you tell you were speeding up or slowing down constantly?
2. Using the motion maps as well as the three graphs for each trial, how are Trials 1 and 2 different?
3. Using the motion maps as well as the three graphs for each trial, how are Trials 1 and 2 similar?
4. Using the motion maps as well as the three graphs for each trial, how are Trials 1 and 3 different?
5. Using the motion maps as well as the three graphs for each trial, how are Trials 1 and 3 similar?
6. What is the key difference between Trials 1-4 and the trials from the Investigating Constant Motion activity?

Trials 5-8 will be nearly identical to Trials 1-4, but in Trials 5-8, you will be walking towards the motion detector. On this page, predict the outcomes of Trials 5-8.

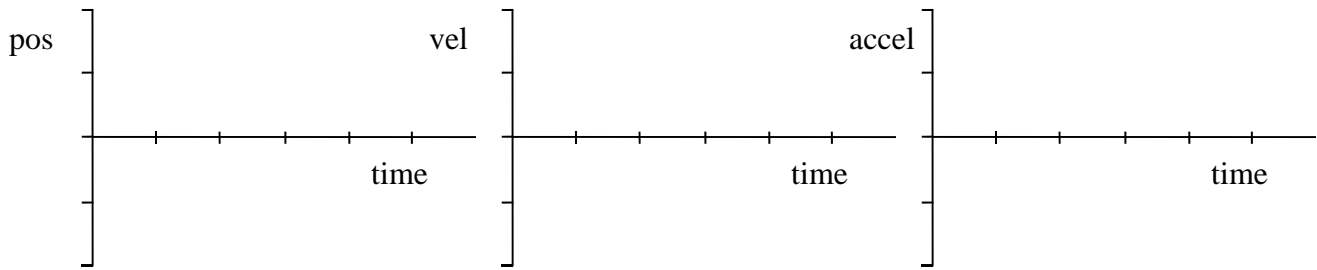
Prediction for Trial #5: Beginning from rest, walk in a straight line, toward the motion detector, slowly increasing your pace at a constant rate.



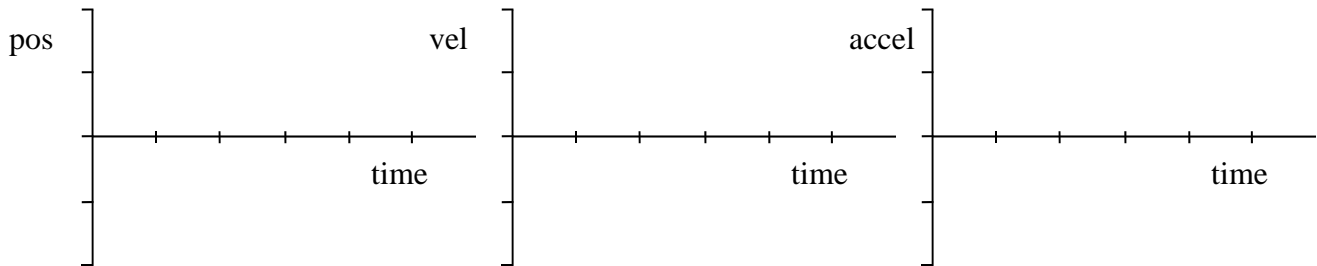
Prediction for Trial #6: Beginning from a fast pace, walk in a straight line, toward the motion detector, slowly decreasing your pace at a constant rate.



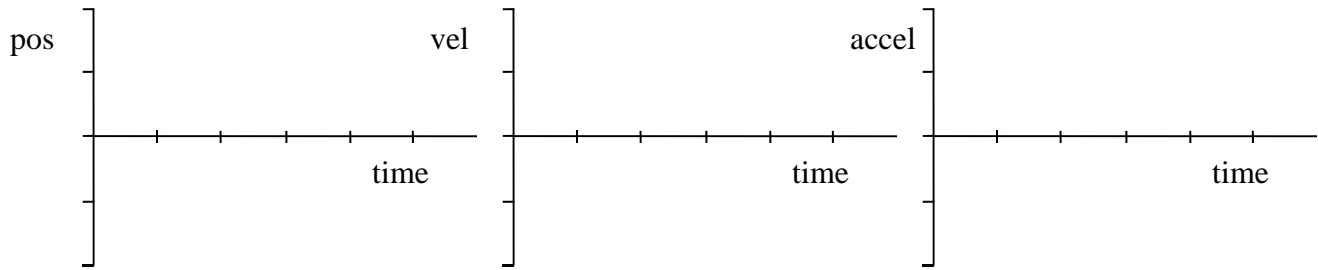
Prediction for Trial #7: Beginning from rest, walk in a straight line, toward the motion detector, quickly increasing your pace at a constant rate.



Prediction for Trial #8: Beginning from a fast pace, walk in a straight line, toward the motion detector, and quickly slow your pace at a constant rate.

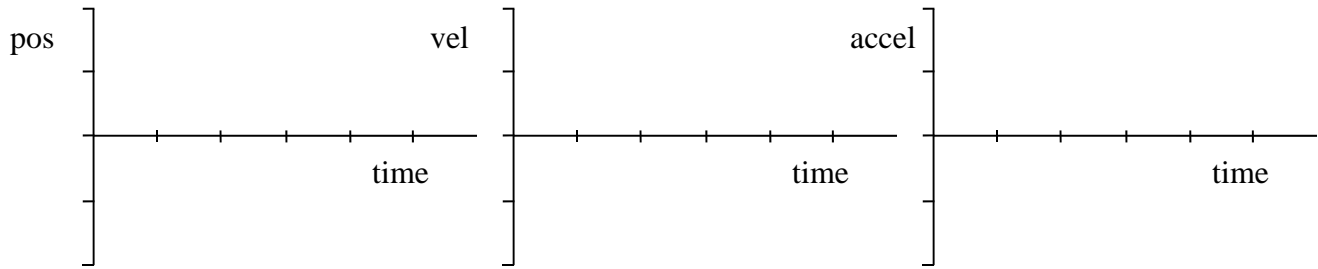


Trial #5: Beginning from rest, walk in a straight line, toward the motion detector, slowly increasing your pace at a constant rate.



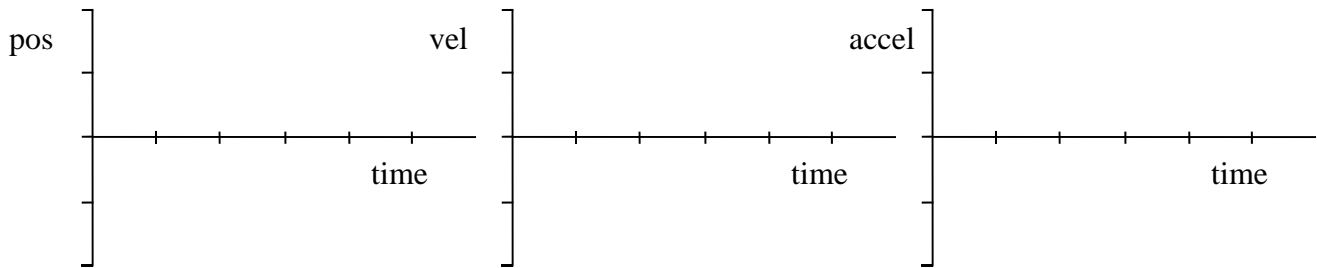
Motion Map for Trial #5

Trial #6: Beginning from a fast pace, walk in a straight line, toward the motion detector, slowly decreasing your pace at a constant rate.



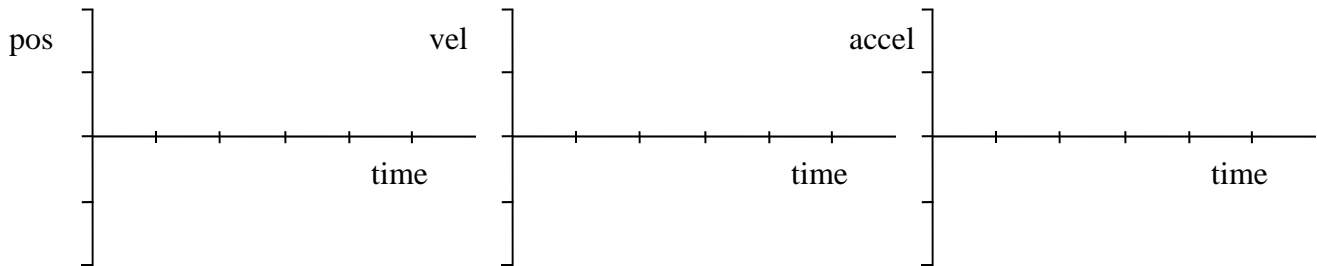
Motion Map for Trial #6

Trial #7: Beginning from rest, walk in a straight line, toward the motion detector, quickly increasing your pace at a constant rate.



Motion Map for Trial #7

Trial #8: Beginning from a fast pace, walk in a straight line, toward the motion detector, and quickly slow your pace at a constant rate.



Motion Map for Trial #8

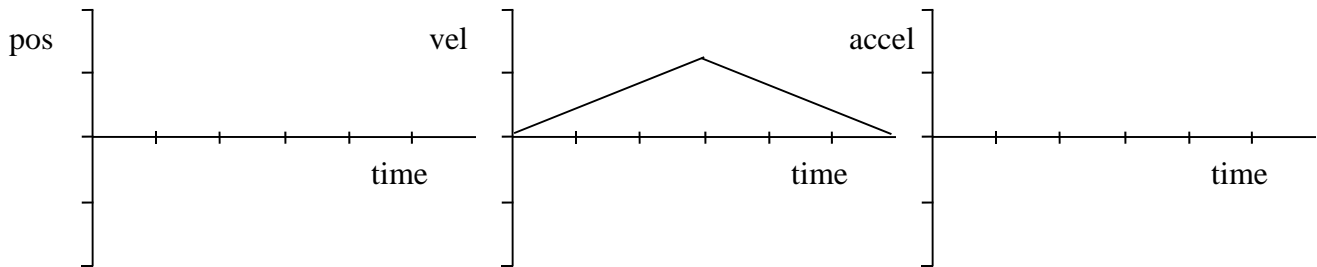
### Questions from Trials 5-8

1. Did your predicted position vs. time graphs match the data you collected? How did the data differ from your predictions?
2. Did your predicted velocity vs. time graphs match the data you collected? How did the data differ from your predictions?
3. Did your predicted acceleration vs. time graphs match the data you collected? How did the data differ from your predictions?
4. Using the data from all trials, what rules can you make about position vs. time graphs of the motion of an object that is constantly changing pace?
5. Using the data from all trials, what rules can you make about velocity vs. time graphs of the motion of an object that is constantly changing pace?
6. Using the data from all trials, what rules can you make about acceleration vs. time graphs of the motion of an object that is constantly changing pace?
7. What is the same about all eight trials?

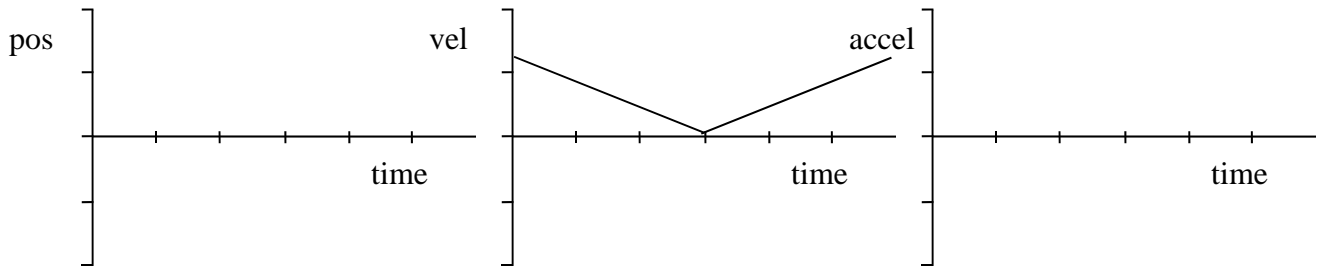


In each of the next four trials, you have to try to move in a way such that you match the given graph and fill in the other two graphs. (i.e. you are given a velocity vs. time graph and have to move to create the same velocity vs. time graph) Prior to each trial, make a prediction with a description in words how you will have to move.

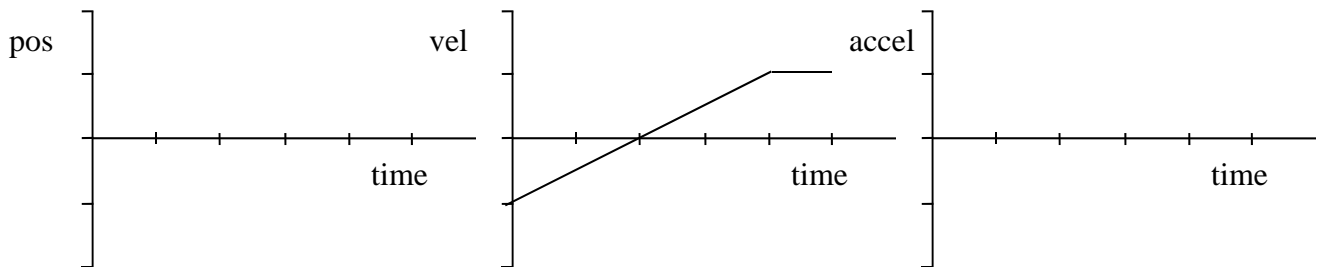
Prediction Trial #9:



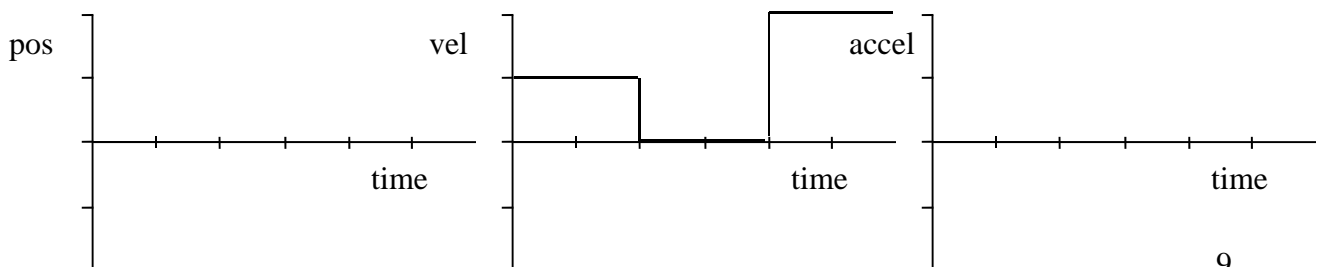
Prediction Trial #10:



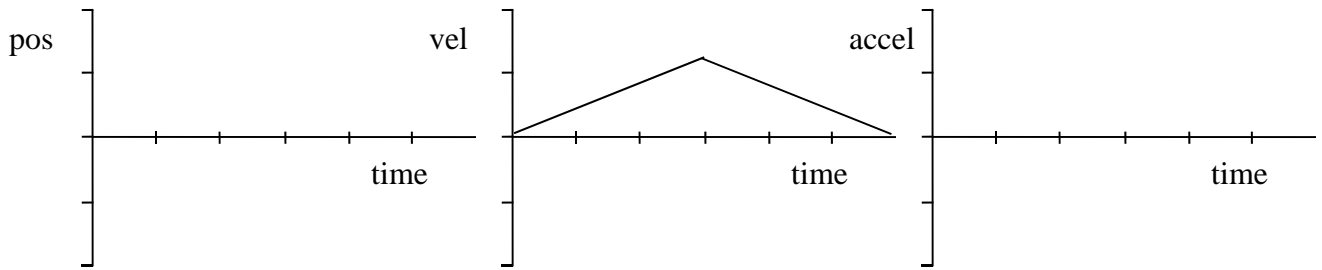
Prediction Trial #11:



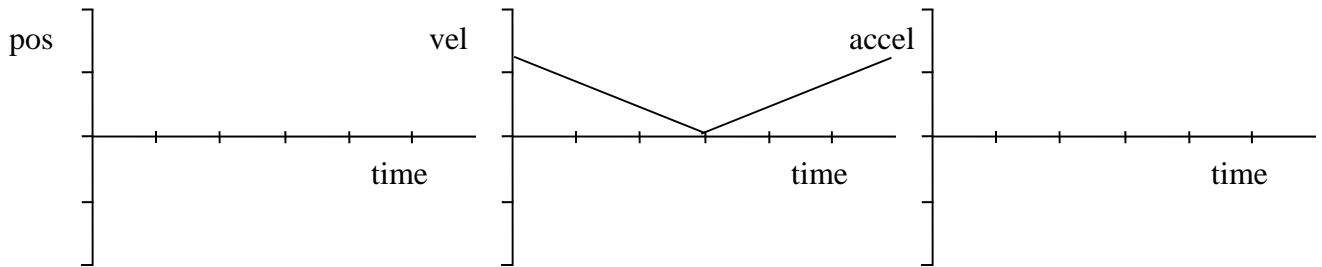
Prediction Trial #12:



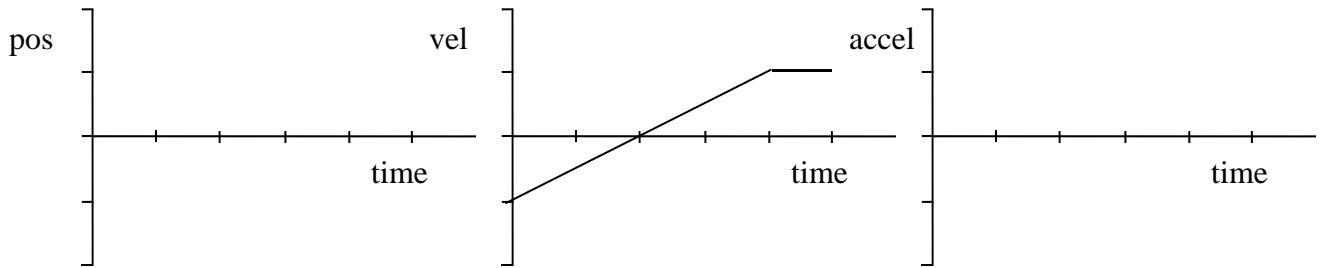
Trial #9:



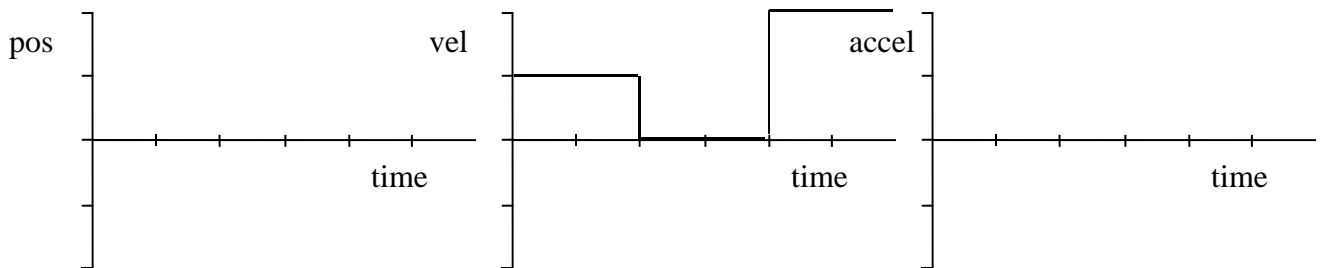
Trial #10:



Trial #11:



Trial #12:



## Questions about Trials 9-12

1. Describe the process you used to predict the position vs. time graphs.
2. Describe the process you used to predict the acceleration vs. time graphs.
3. What relationships can you identify between position vs. time and velocity vs. time graphs?
4. What relationships can you identify between velocity vs. time and acceleration vs. time graphs?
5. Why couldn't you make a graph that exactly matches Trial 12?