

## Velocity

As you work through the steps in the lab procedure, record your experimental values and the results on this worksheet. Use the exact values you record for your data to make later calculations.

### Velocity Lab – Simulation

Open the dynamic track simulation to do this lab.

### Apparatus

1. Record the minimum and maximum positions for the cart.

### IA. Position – Motion Away From the Motion Sensor

4. What is similar about the two graphs?

5. What is different about the two graphs?

6. What does the **slope** of a position-time graph indicate about the motion of the cart?

## IB. Position – Motion Toward the Motion Sensor

1a. Upload your position vs. time graph from Part IB1a as “Vel\_IB1a.png”. (Submit a file with a maximum size of 1 MB. *You will upload this file in the WebAssign question.*)

1b. Upload your position vs. time graph from Part IB1b as “Vel\_IB1b.png”. (Submit a file with a maximum size of 1 MB. *You will upload this file in the WebAssign question.*)

4. What is similar about the two graphs?

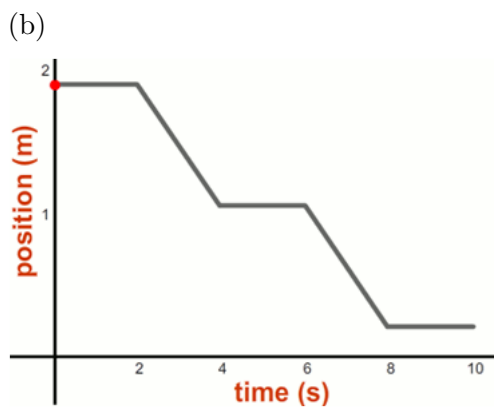
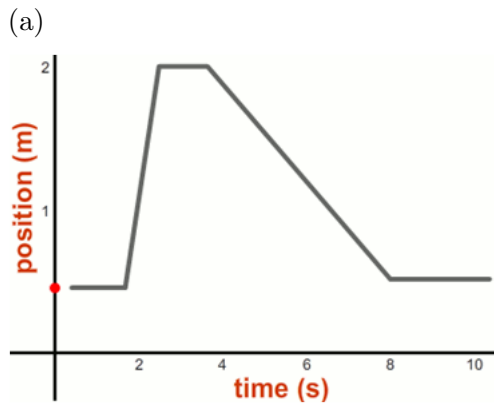
5. What is different about the two graphs?

6. What attribute of a position-time graph indicates the direction of motion?



## ID. Position – Interpreting a Graph

1. Describe the motions that would produce the graphs shown below. Be sure to discuss relative speeds (how fast or slow relative to one another) and directions (right or left). You should have a statement for each of the five line segments on each graph.



## **IIA. Velocity – Motion Away From and Then Toward the Motion Sensor**

7. What do the **slope** of the position-time graph, including its sign, and the **mean value** of the velocity-time graph (the height of the line) measure?

11. Upload your screenshot of the four-line graph as “Vel.IIA.png”. (Submit a file with a maximum size of 1 MB. *You will upload this file in the WebAssign question.*)

## **IIA. Velocity – Observations: Slow Away, Fast Away; Slow Toward, Fast Toward**

12. What is similar about the four velocity-time graphs (not the motions, the graphs)?

13. What is different about the velocity-time graphs for 20 cm/s and 50 cm/s?

14. What about the motion does a horizontal segment on a velocity-time graph indicate?

15. What about the motion does the height of a horizontal straight-line velocity-time graph indicate?

16. What attribute of a velocity-time graph indicates the direction of motion?

## IIB. Velocity – There and Back Again: From Velocity to Displacement

4. Find the  $(t, x)$  values of the three indicated positions on your graph.

**Table 1**

<b>Point</b>	<b><math>t</math> (s)</b>	<b><math>x</math> (m)</b>
<b>1</b>		
<b>2</b>		
<b>3</b>		

5. Record the displacement of the cart for the three intervals.

**Table 2**

Interval	Position-Time graph (m)	Velocity-Time graph (m)
Point 1 to Point 2 by $\Delta x_{1-2} = x_2 - x_1$		
Point 2 to Point 3 by $\Delta x_{2-3} = x_3 - x_2$		
Point 1 to Point 3 by $\Delta x_{1-3} = x_3 - x_1$		

6. What is different about the two values of  $\Delta x$  corresponding to the two horizontal lines on your velocity vs. time graph?

7. What does this difference represent about each of your chosen displacements?