Name: _____

Distance, Displacement, Speed and Velocity

Background – Remember graphs are not just an evil thing your teacher makes you create, they are a means of communication. Graphs are a way of communicating by using pictures and since a picture is worth a thousand words knowing how to make and interpret graphs will save you a lot of writing.

Go to www.libbyteach.net and click on SC20PB.
Select **Displacement, Velocity and Acceleration** in the Labs/Activities section.
Then click on "The Moving Man"

Getting started. After "The Moving Man" is open leave the position graph (distance vs. time graph) open. But close the velocity graph and the acceleration graphs by clicking on the blue minus buttons in the right upper corner of that graph. When finished, your screen should look like Figure 1 below.

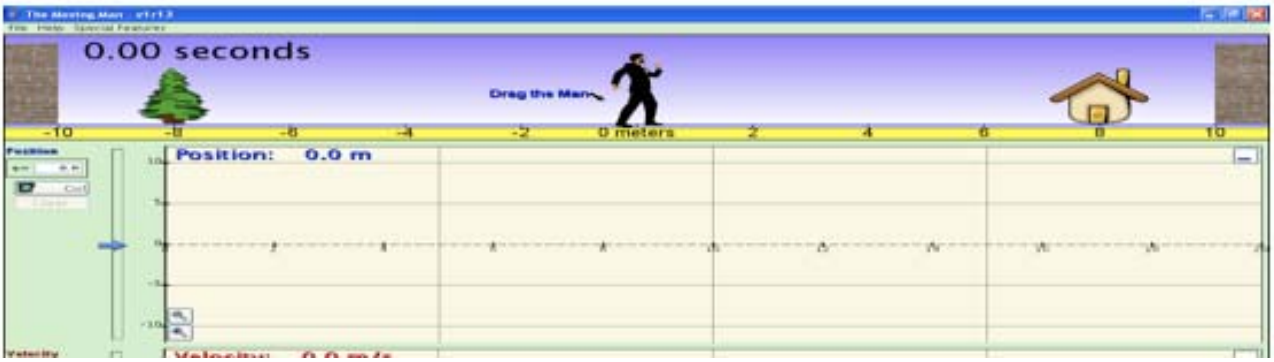


Figure 1

Part A: Distance and Displacement

Making Observations about Distance

1. What number and unit are written directly under the moving man? Number _____ Unit_____

2. The position under the walking man which is labeled "0 meters" is called the "Reference Point". It is the point from which all motion will be referenced. The amount of a certain unit between the reference point and an object is called the ***DISTANCE***. Distance **does not** tell you anything about the direction from the reference point. It only has an amount and a unit.

   Record the distances below in meters:

   (a) Distance from the reference point to the house. _____

   (b) Distance from the reference point to the wall. _____

   (c) Distance from the reference point to the tree. _____

Making Observations about Displacement

3. You may have noticed that the distance to the tree has been given a negative value while the distance to the house has been given a positive value. Stop and think for a moment. Why do you suppose this has been done?

4. When we add a **"-"** or a **"+"** to the number we are indicating a ***direction***. A **"-"** sign means "backward or behind" and a **"+"** sign means "forward or in front". They indicate the direction of an object from the chosen reference point. Adding the **"+"** or **"-"** sign indicates ***displacement.*** Displacement, like distance has an amount and a unit, but displacement also has a **direction**. Distance does NOT have a direction. When we want to indicate direction in more than two directions (e.g. forward and backward), we use words like north, south, east, west, northwest etc.

   Record the displacements below in meters. Use "-" and "+" to indicate direction from the reference point.

   (a) Displacement from the reference point to the house. _____

   (b) Displacement from the reference point to the wall. _____

   (c) Displacement from the reference point to the tree. _____

5. What is the difference between an object's distance and its displacement?

   _____

Part B: Speed and Velocity

When an object changes position over a period of time we say that it is in motion. When an object changes position (moves), there are several things we can measure about the motion:
We can measure how much distance the object traveled as it changed position.
We can measure how much time it took for it to change position.
We can describe the direction it went as it changed position.
We can measure its speed as it changed position.
We can describe its velocity as it changes position.

1. What is the difference between an object's speed and its velocity?

   _____

2. The unit of distance in the moving man is _____ (yellow bar)

3. The unit of time used in the moving man is _____ (blue sky)

4. Set the moving man's velocity (speed) to 1meters/sec and hit go. Watch the moving man.
5. Set the moving man's velocity (speed) to 4 meters/sec and hit go. Watch the moving man.

6. At which of the two velocities did he move faster? _____ (Watch them both again if you need to.)

7. Set the moving man's velocity (speed) to 1 m/s. Before hitting go, locate the clock again. You are going to let the moving man go for 2 seconds and then hit pause. Now hit go. If he goes more than 2 seconds, simply grab the blue bar and back it up until the clock says 2 seconds. Record the distance covered in the table below.

8. Set the moving man's velocity (speed) to 4 m/s. Again let him go for 2 seconds only and record the distance covered in the table below as well.

Trial	Speed	Time	Distance Covered
A	1 meter/sec (slower)	2 seconds	
B	4 meter/sec (faster)	2 seconds	

9. In both of the above trials you gave the man 2 seconds to run. At what velocity did he cover more distance? _____

10. Speed is calculated by dividing the distance by the time. Calculate the speed for each trial.

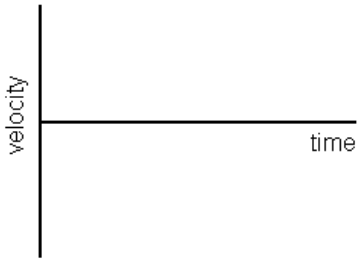
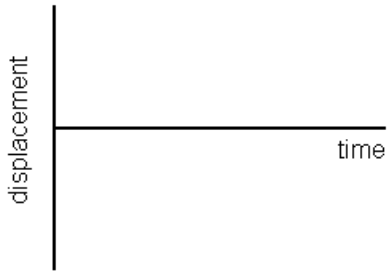
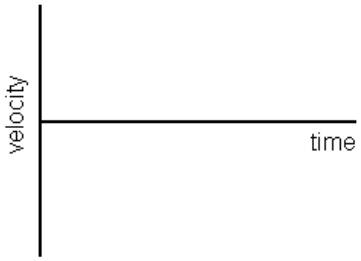
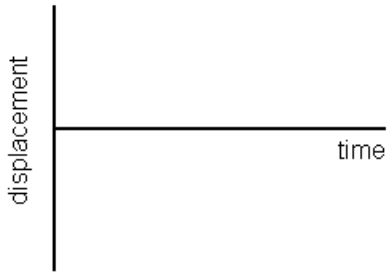
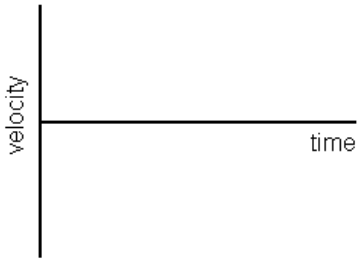
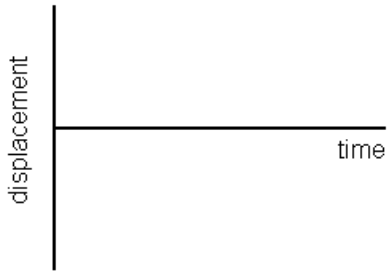
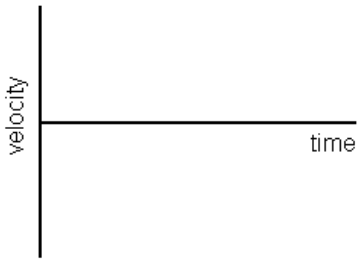
    (a) A: _____ meters divided by _____sec = _____ m/sec

    (b) B: _____ meters divided by _____sec = _____ m/sec

Part C: Graphing

1. By either clicking on the man or the slider, cause the man to move back and forth and observe what shows up on the graphs.

2. Using the axis provided below make sketches of "Distance vs. Time" and "Velocity vs. Time" graphs for each of the actions described.

A man moving from 0m to 10m at a slow steady pace.		
A man moving from 0m to 10m at a fast pace.		
A man standing still at 4 m		
A man moving from 0m to 10m at a steady fast pace then moving back to 0 m at a steady slow pace.		

Part D: Apply what you learned.

1. What does a "distance vs. time" graph look like for an object moving at a constant speed?

_____

2. What does a "distance vs. time" graph look like for an object moving with changing speed?

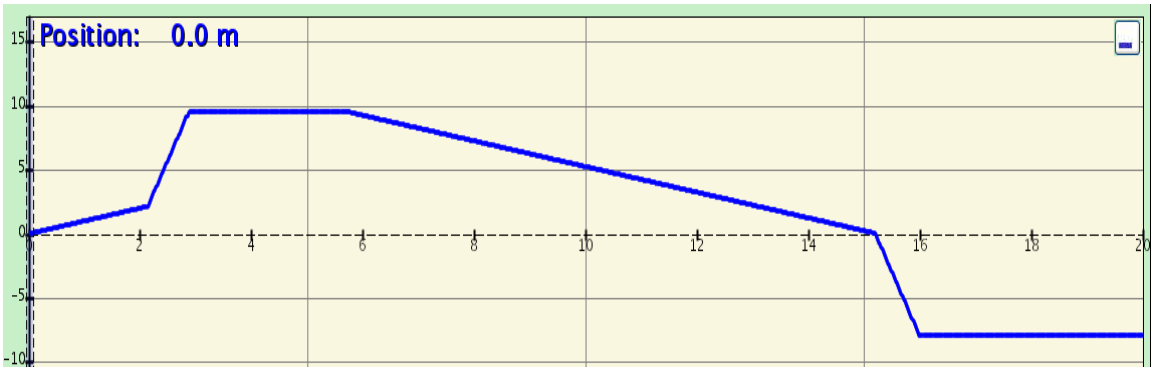
_____

3. If the slope of a line on a "distance vs. time" graph is steep. What is different about the motion then when it is not steep?

_____

_____

4. Consider the following distance vs. time graph:



(a) Calculate the average speed between 6 and 15 seconds by finding the slope of the line.

(b) Explain what is happening during each of the followin periods of time.

(i) 0 – 2 seconds _____

(ii) 3 – 6 seconds _____

(iii) 15-16 seconds _____