Moving Man – LAB #2

Total Time: __________ Name: ______________________________
Start Time: __________ Date: ___________
Finish Time: __________ Period: ________

PRINT THESE PAGES AND TURN THEM IN BEFORE OR ON THE DUE DATE GIVEN IN YOUR EMAIL.

POSITION

Background — Graphs are not just an evil thing your teacher makes you create, they are a means of communication. In this activity you will learn to speak and read “graph”.

Learning Goals – The students will:
  • Develop a general knowledge of distance time graphs.
    o What a graph of a person standing still would look like
    o What a graph of a person moving away from an observer would look like.
    o What a graph of a person moving towards an observer would look like.
    o How differences in speed appear on the graph

Procedure – do the following activity using this web site
http://phet.colorado.edu/simulations/sims.php?sim=The_Moving_Man
Then click on “Run Now!”

1. Getting started. After “Moving Man” is open leave the position graph open but close all of the other graphs, velocity and acceleration. Your screen should look like screen 1.

2. Making observations. By either clicking on the man or the slider cause the man to move back and forth and observe what shows up on the graph. Using the axes provided below make a sketch of the graph that is produced by each action described next to each axis.

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 4m.

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

A man moving from 0m to 5m at a slow steady pace, then moving back to 0m at a slow steady pace.

A man moving from 0m to -10m at a slow steady pace.

Apply what you learned. Look at the graph below and for the different parts of the graph that are marked write a statement about what is happening. Be sure to include the direction of motion and the speed of motion.
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.

Learning Goals – The students will:
- Develop a general knowledge of “Velocity vs. Time” graphs and “Distance vs. Time” graphs
  - What graphs of a person standing still would look like
  - What graphs of a person moving away from an observer at a constant speed would look like.
  - What graphs of a person moving towards an observer at a constant speed would look like.
  - How differences in speed appear on the graphs

Procedure – Do the following activity using this web site
http://www.colorado.edu/physics/phet/simulations-base.html
Then click on “Run Now!”

3. Getting started. After “The Moving Man” is open leave the position graph and the velocity graph open but close the acceleration graph. Your screen should look like screen 1.

4. Making observations. 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. Using the axis provided below make sketches of Distance vs. Time and Velocity vs. Time graphs for the actions described next to each axis.

<table>
<thead>
<tr>
<th>Part</th>
<th>Description of direction and speed</th>
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<tbody>
<tr>
<td>A</td>
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</tbody>
</table>
A man moving from 10 to 0 at a fast pace.

A man moving from 0 to 10 at a slow steady pace.

A man moving from 0 to 10 at a fast pace.

A man standing still at 4 m
Apply what you learned. Look at the Distance vs. Time graph below and for the different parts of the graph that are marked by the dotted lines make the corresponding Velocity vs. Time graph directly below each part.
Questions

You will need to use the Moving Man Exploration [http://www.colorado.edu/physics/phet/simulations-base.html](http://www.colorado.edu/physics/phet/simulations-base.html). As you work through these problems focus on making sense of the motion graphs and discuss your reasoning with your peers! What is the graph really telling you about the motion? Graphs are used in science and many other areas to record and convey a whole lot of information, just like a photo of the foothills conveys a whole lot of information about the area we live in. They provide a compact way to tell the whole history of an object's motion. In the space below write your discussion.

1) (0.5 pts) First, orient yourself to the Moving Man tool by selecting the “accelerate” motion from the choose motion list. With the moving man starting at a position of -8 m, set him to “accelerate” at 1 m/s² from an initial velocity of 0. Observe the motion. Also notice that the tool comes equipped with a playback feature and a double-bar cursor that you may move with the mouse to probe position, velocity, and acceleration along the graph.

What is his velocity when he crosses the origin (the position of 0 meters)?

2) (0.5 pts) Below is a graph of a balls motion. Use the Moving Man Applet to reproduce the shape of this graph. Which of the following sentences gives the best interpretation of the ball’s motion?

- The ball moves along a flat surface. Then it moves forward down a hill, and then finally stops.
- The ball doesn't move at first. Then it moves forward down a hill and finally stops.
- The ball is moving at constant velocity. Then it slows down and stops.
- The ball doesn't move at first. Then it moves backwards and then finally stops.
- The ball moves along a flat area, moves backwards down a hill, and then it keeps moving.
- Not answered
3) (1 pt) In class, we looked at how human motions could be represented on position versus time and velocity versus time graphs by using a motion detector to collect data. Use Moving Man to simulate the following scenario: A man starts at the origin, walks towards the tree slowly and steadily for 6 seconds, then stands still for 6 seconds, and then turns around and walks towards the house steadily about twice as fast for 6 seconds.

a) Which of the following velocity versus time graphs conveys this type of motion:

[Diagrams of velocity versus time graphs A through H]

A □ B □ C □ D □ E □ F □ G □ H □ Not answered

b) Which of the following position versus time graphs also conveys this motion?

[Diagrams of position versus time graphs A through H]

A □ B □ C □ D □ E □ F □ G □ H □ Not answered
4) (4.5 pts total) A car is traveling along a road. Its velocity is recorded as a function of time and is shown in the graph below.

Use the Moving Man Simulation to reproduce the shape of this graph. You’ll find that there are a variety of approaches for recreating this type of motion within the applet, these include among others:
• reproducing the motion using the walk motion and the velocity slider control,
• reproducing the motion using the accelerate motion and acceleration slider control, or
• reproducing the motion using direct mouse control over the walking man. Note: This method is hard!

a) (1 pt) Describe in your own words the motion of the car and give a everyday life scenario in which the car’s velocity would resemble the plot shown above. Explain your reasoning by relating your description to what you see in the graph of the velocity vs time.

b) (0.5 pts) From this graph, what do you know about the position of the car at time equals 0 seconds?

c) (0.5 pts) How far does the car travel between 0 and 3 seconds?
d) (0.5 pts) The graph of the velocity of the car over this time period tells you how fast the car is going and what direction it is traveling at any time during this period. This information also tells you how the position of the car is changing during over that time period. Which of the following graphs of position versus time of the car is consistent with the velocity of the car as a function of time?

- A
- B
- C
- D
- E
- F

Not Answered

e) (1 pt) During which of the following times is the car accelerating? (Check all that apply)
- between 0 and 3 seconds
- for only a brief instant at 3 seconds
- between 8 and 13 seconds
- for only a brief instant at 13 seconds
- between 13 and 17 seconds
- for only a brief instant at 17 seconds
- between 17 and 20 seconds
f) (1 pt) What is the...

i) average acceleration between 0 and 3 seconds

ii) average acceleration between 3 and 8 seconds:

5) (2 pts) The moving man applet allows you to set him into “Walk” mode and control the velocity at which the man walks. Play around with this control until you gain an intuition as to how the motion of the moving man relates to the velocity setting.

☐ True  ☐ False  ☐ Not answered  If the velocity is negative, the man is walking towards the tree under all conditions.

☐ True  ☐ False  ☐ Not answered  If the velocity is positive, the man’s position is always greater than zero.

☐ True  ☐ False  ☐ Not answered  If the velocity is negative, the acceleration is negative.

☐ True  ☐ False  ☐ Not answered  A negative velocity means the man is slowing down.

☐ True  ☐ False  ☐ Not answered  If the velocity is zero, the moving man is at the origin.
6) (3.5 pts total) Two cars (A and B) are moving along the same stretch of road. The figure below shows a position versus time graph for the motions of the cars.

![Position versus Time Graph]

a) (0.5 pts) Which of the following pictures best represents a snapshot of the road way at t=0 sec.

- A
- B
- C
- D
- E
- Not answered

b) At the instant time=2sec,

i) (0.25 pts) Car A is … Car B

- ahead of
- behind
- along side
- Not answered

ii) (0.25 pts) The speed of Car A is … Car B

- faster than
- slower than
- equal to
- Not answered

iii) (1 pt) Explain your reasoning for your answers to i and ii.
c) (0.5 pts) At the instant t=6sec,
   i) Car A is ... Car B
      ☐ ahead of  ☐ behind  ☐ along side ......  ☐ Not answered
   ii) The speed of Car A is ... Car B
      ☐ faster than  ☐ slower than  ☐ equal to ......  ☐ Not answered

d) (0.5 pts) Which of the following statements best describes the situation depicted in the position versus time graph?
   ☐ Car A speeds up and passes Car B, which is traveling at a constant speed.
   ☐ Car B slows down and is passed by Car A, which is traveling at a constant speed
   ☐ Car A, traveling at a constant speed, approaches and passes Car B, which is also traveling at a constant speed.
   ☐ Car A speeds up, Car B slows down, and Car A passes Car B.
   ☐ Not answered

e) (0.5 pts) What is the velocity of Car B at t=2 seconds?

7) (3.4 pts total) The motion of a walking man is recorded on the position vs time graph below. Use the Moving Man Applet in the “Walk” mode to reproduce this position vs time graph by adjusting the velocity slider as the man is walking.

a) (2.4 pts) At which of the lettered points on the graph: (Choose all that apply)
   i) is the man’s motion slowest?  ☐ a  ☐ b  ☐ c  ☐ d  ☐ e  ☐ f
   ii) is the man speeding up?  ☐ a  ☐ b  ☐ c  ☐ d  ☐ e  ☐ f
   iii) is the man slowing down  ☐ a  ☐ b  ☐ c  ☐ d  ☐ e  ☐ f
iv) is the man turning around?  □  a  □  b  □  c  □  d  □  e  □  f

b) (1 pt) Your friend is not taking physics, but wants to know how you can tell from just looking at this graph of position vs time when the man is slowing down and when he is speeding up. How would you explain it to him so that he could make sense of it (without using technical terms like slope)?