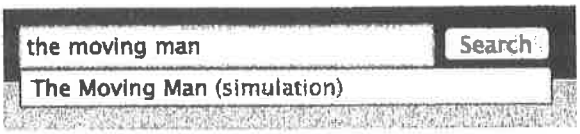
TechAct: Motivating the Moving Man

Name:	Period	Group

PURPOSE
To understand one-dimensional motion through the use of a computer simulation.

MATERIAL
computer, PhET simulation: "Moving Man" (available at http://phet.colorado.edu)



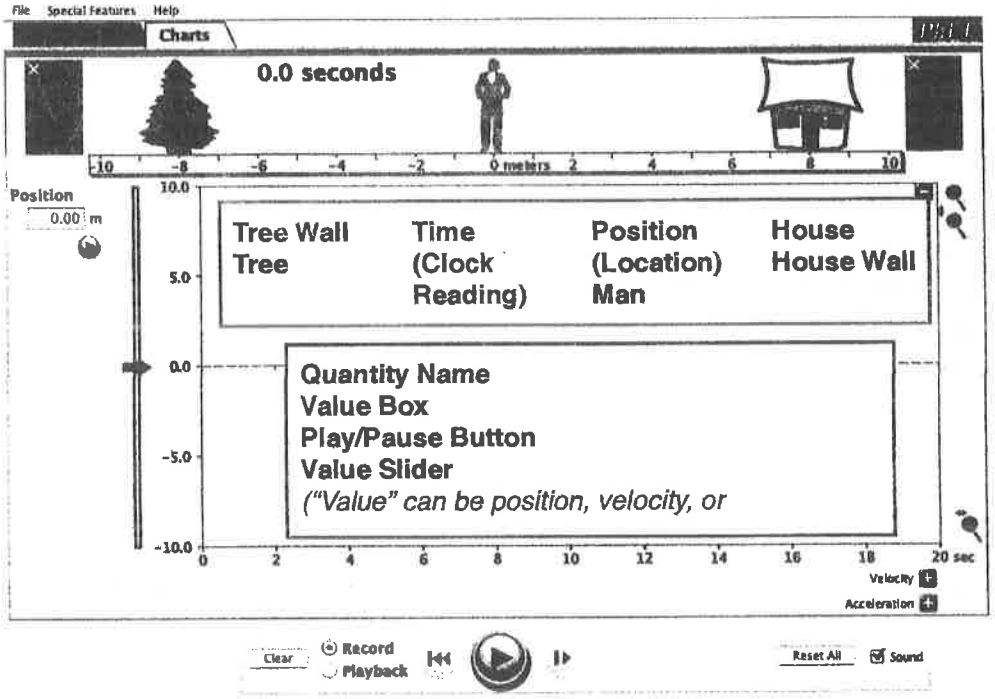
SETUP
1. Turn the computer on, log on. Open Firefox or Chrome. Go to
2. Find and start the PhET Simulation and run the Moving Man simulation. This simulation requires Java, download it if necessary.
3. Locate the time-scale expansion button. Time is the horizontal axis, not the vertical axis. **Use the time-scale expansion button to expand the time axis so that only 10 seconds can be seen. You must do this every time you click "reset".**
4. Find and use the buttons that will delete the velocity vs. time and acceleration vs. time graphs. You should be left with one graph: position vs. time. And its horizontal axis now runs from only 0 to 10 seconds.
5. Set the computer aside and read the "Discussion" section below. When you have finished reading, continue with the activity.

NOTE: Plot all graphs on pages 3 & 4. Answer all questions in spaces provided below the question.

DISCUSSION
The simulation provides us with a simple interface we can use to study motion graphs. Specifically, we can control the position, velocity, and acceleration of an object and see the graphs of position, velocity, and acceleration of an object. The simulation allows us to manually control the object by dragging it. We can also drag a position "slider" control. More importantly, we can set initial condition for the object then let its motion proceed. We can pause the motion.

PROCEDURE

Step 1: Complete the matching exercise on the right. Use the words in the three boxes. Two in the graph, one below.
The names of many objects and buttons are listed. Draw a line connecting the name of each object or button to the object or button, itself. Your screen and Figure 1 should be very similar in that only the position vs. time graph is visible and that the horizontal (time) scale runs from 0 to 10 seconds. PhET simulations are revised from time to time, so some elements of the screen layout may have changed.



Step 2: Manual Man (Be sure to sketch following on the "Manual Man" graphs on page 3. There are two graphs, one for position one for velocity.)

a. Click on the man and drag him in the positive direction (toward the house) at a steady rate of 1 m/s to the best of your ability. Your graph won't be perfect (limitations of the computer's interface prevent this), but try to move the man as smoothly as you can at 1m/s.

b. While the graph is still on the screen, click the on-screen button to show the velocity vs. time graph. This graph plots the value of the velocity as time passes. Clear the graphs and try again. Move the man manually from 0 to 10 meters in 10 seconds—as smoothly as possible—at 1 m/s. The simulation's "stopwatch" reading indicates time.

Record	Show Velocity Graph
Playback	Show Acceleration
Step Forward	Graph
Rewind	Reset All
Clear	Sound

c. Sketch the resulting position vs. time and velocity vs. time graphs on the "Manual Man" graph on the last page of this write-up.

Step 3: Programmed Man (Sketch following on the "Programmed Man" graphs on page 3. There are two separate graphs.)

a. Make sure the position and velocity graphs are showing (with the time scale set from 0 to 10 seconds) and the **acceleration graph is hidden** (deleted). **Clear the graphs.**

b. Set the initial position of the man to 0 m. (It is easiest to type it into the value box. You may also use the slider.)

c. Set the initial velocity of the man to +1.0 m/s. (Use the slider or type it into the value box.)

d. Click an on-screen Go button and observe the resulting motion graphs.
Sketch graphs on the appropriate axes (one for Velocity, v, and one for Position, x) on the "Programmed man and Back Up the Choo-Choo" graph. In other words, sketch the position graph in x vs t, and the velocity graph in v vs. t.

e. Clear the graphs. Set the initial velocity of the man to +2.0 m/s and run the simulation again. The motion ends when the man hits the wall. Stop the simulation when that occurs. Disregard data from the wall impact and beyond.
Describe two differences in the position vs. time graph. (Hints: rise/run; duration.)

f. Add lines to your previous sketch (same set of graphs as step d) representing the +2.0 m/s motion. Be sure to label both lines now plotted. Do not include plotted data after the impact with the wall.

g. Add and label a dashed line to the graphs showing the result if the initial velocity of the man were +5 m/s. Do not do this on the simulation, you're supposed to think about how it's graph on your own.

h. Describe **two** changes that occur on the velocity vs. time graph each time you make the initial speed of the man greater.

Step 4: Back Up the ChooChoo (Be sure to sketch following on the "Programmed man and Back Up the Choo-Choo" graphs.)

a. Clear the graphs. The acceleration graph is still hidden.

b. Set the initial position of the man to 0 m. Set the initial velocity of the man to –2.0 m/s.

c. Run the simulation and observe the motion graphs. Again, the motion ends when Moving Man crashes into the wall, so stop the simulation when that happens. **Sketch the graphs on the same set of axes used for Step 3, disregarding data from the wall impact and beyond.**

d. Clear the graphs. Set the initial velocity of the man to –4.0 m/s and run the simulation.

e. **Describe** two differences in the position vs. time graph, and add a line to your previous sketch representing the –4.0 m/s motion. Be sure to label both lines now plotted.

f. Add and label a dashed line to the graphs showing the result if the initial velocity of the man were –10 m/s. (Note: Do not carry this procedure out in the simulation.)

g. Describe two changes that occur on the velocity vs. time graph each time you make the initial speed of the man greater (faster in the negative direction).

h. Click the on-screen button to show the acceleration vs. time graph. What does the acceleration vs. time graph tell you about the motions observed so far?

Step 5: Pickin' Up the Pace (Be sure to sketch following on the "Pickin' Up the Pace" and "Once More, With Feeling" graphs.)

a. Clear the graphs. All three graphs are now showing.

b. Set the initial position of the man to 0 m. Set the initial velocity of the man to 0 m/s. Set the acceleration of the man to +0.5 m/s^2.

c. Run the simulation and observe the motion graphs. Sketch the graphs on the graph page.

d. What does the acceleration vs. time graph tell you about the nature of this motion? (Do not refer to numerical values in your response.)

Step 6: Once More, With Feeling (Be sure to sketch following on the "Pickin' Up the Pace" and "Once More, With Feeling" graphs.)

a. Set the initial position of the man to 0 m. Set the initial velocity of the man to 0 m/s. Set the acceleration to the man to +2.0 m/s^2.

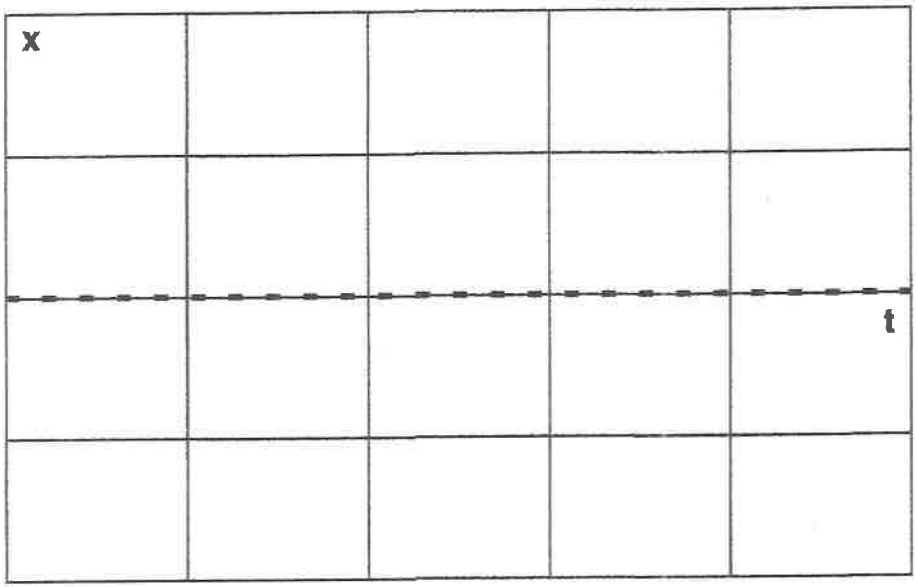
b. Run the simulation and observe the position vs. time graph.

   i. Sketch the graph on the same set of axes as part 5.

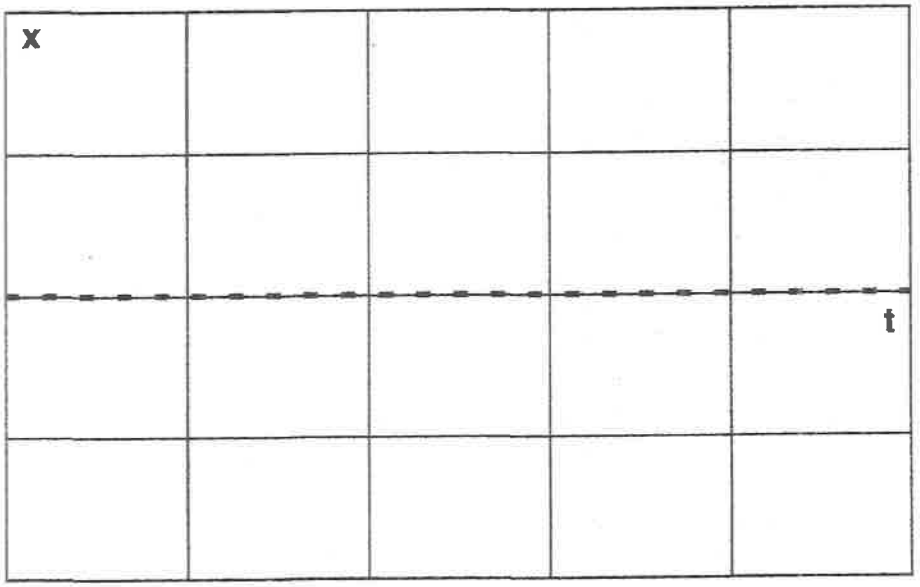
   ii. How is this position vs. time graph different from the one plotted in part 5 above?

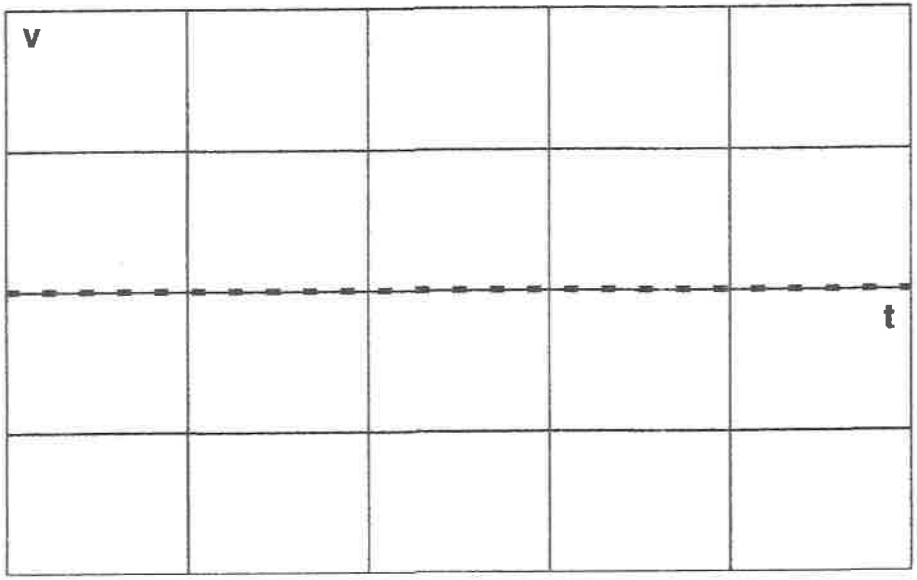
c. How does the velocity vs. time graph differ from the one produced in part 5 above? Sketch the velocity and acceleration graphs.

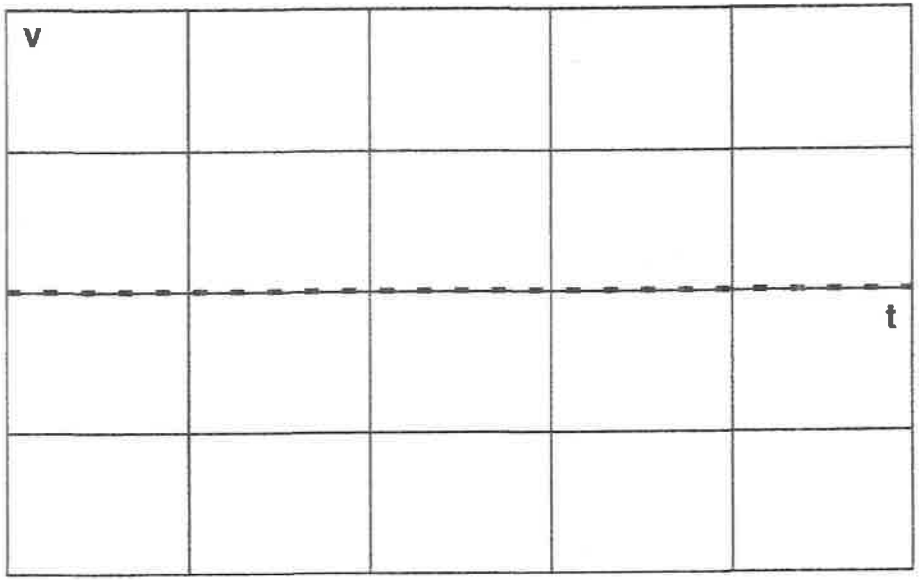
Manual Man



Programmed Man and Back Up the Choo Choo







Pickin' Up the Pace and Once More, With Feeling