Name_____ Period_____ Date_____

CONCEPTUAL PHYSICS **TechLab**

4.7 Linear Motion: Motion Graphs

SONIC RANGER

Purpose

In this activity, you will use graphs to investigate motion. The graphs will represent your own motion and will be drawn by the computer as you move.

Required Equipment and Supplies

motion sensor (sonic ranging device)
interface device and connectors
motion sensor software
computer

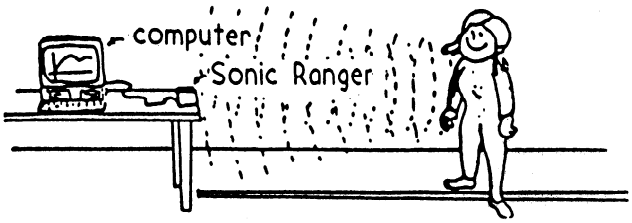
Discussion

Graphs can be used to represent motion. For example, if you track the position of an object as time goes by, you can make a plot of position vs. time. In this activity, the sonic ranger will track your position and the computer will draw a position vs. time graph of your motion. The sonic ranger sends out a pulse of high frequency sound and then listens for the echo. By keeping track of how much time goes by between each pulse and corresponding echo, the ranger determines how far you are from it. (Bats use this technique to navigate in the dark.) By continually sending pulses and listening for echoes, the sonic ranger tracks your position over a period of time. This information is fed to the computer, and the software generates a position vs. time graph.

Procedure

Your instructor will provide a computer with a sonic ranging program installed. Check to see that the sonic ranger is properly connected and operating reliably. Position the sonic ranger so that its beam is about chest high and aimed horizontally. (Note: Sometimes these devices do not operate reliably on top of computer monitors.)

The sonic ranger should be set to "long range" mode. The computer should be set to graph position vs. time. Initiate the sonic ranger and note how close and how far you can get before the readings become unreliable.



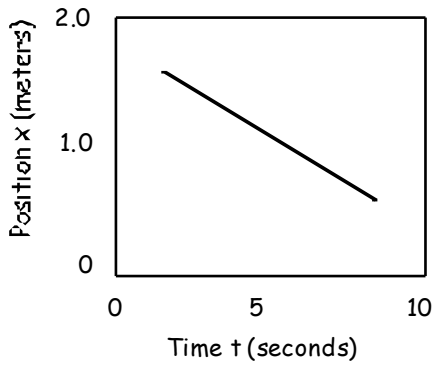
Part A: Move to Match the Graph

Generate real time graphs of each motion depicted below and write a description of each. ***Do not use the term "acceleration" in any of your descriptions.*** Instead, use terms and phrases such as, "rest," "constant speed," "speed up," "slow down," "toward the sensor," and "away from the sensor."

Study each graph below. When you are ready, initiate the sonic ranger and move so that your motion generates a similar graph. Then describe the motion in words.

Example:

Position vs. Time Graph



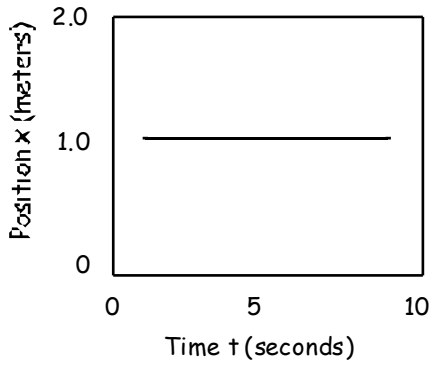
Description

Move toward the sensor at constant speed.

Make sure each person in the group can move to match this graph before moving on to the next graph.

1.

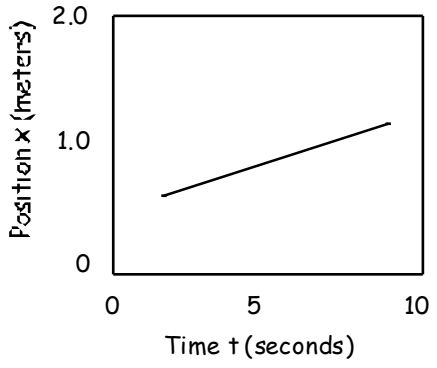
Position vs. Time Graph



Description

2.

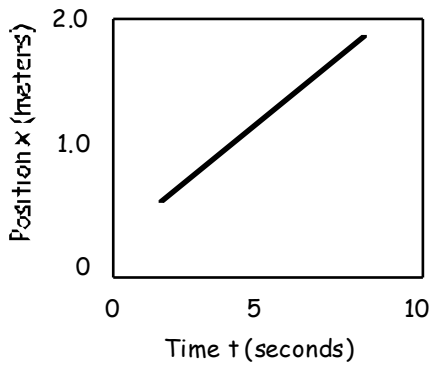
Position vs. Time Graph



Description

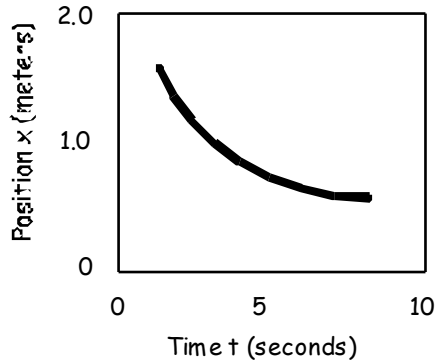
3.

Position vs. Time Graph **Description**



4.

Position vs. Time Graph **Description**



Part B: Move to Match the Words

Walk to match each description of motion. Draw the resulting position vs. time graph.

5.

Description **Position vs. Time Graph**

Move toward the sensor at constant speed, stop and remain still for a second, then walk away from the sensor with constant speed.

6.

Description **Position vs. Time Graph**

Move toward the sensor with decreasing speed, then just as you come to rest, move away from the detector with increasing speed.

7.

Description	Position vs. Time Graph
Move away from the sensor with decreasing speed until you come to a stop. Then move toward the sensor with decreasing speed until you come to a stop.	

Summing Up

1. How does the graph show the difference between forward motion and backward motion?

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2. How does the graph show the difference between slow motion and fast motion?

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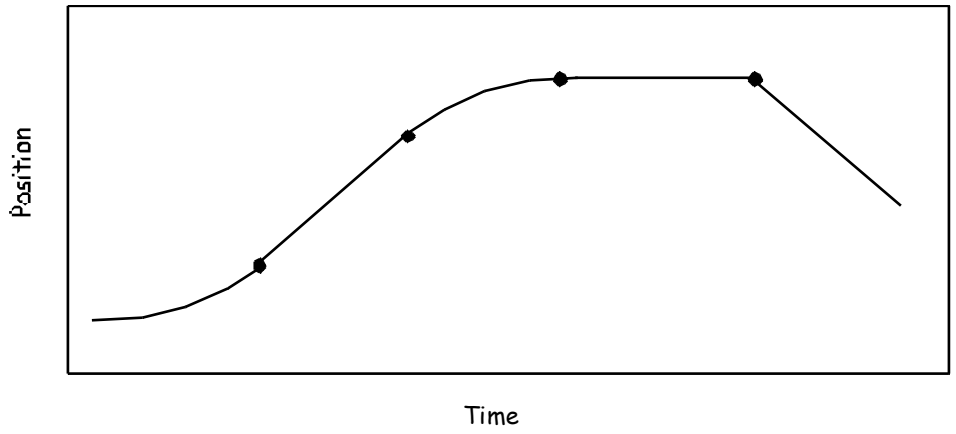
3. Study the graph of position vs. time shown below.



Label sections of the graph showing where the object is
- at rest
- moving forward at constant speed
- moving backward at constant speed
- speeding up
- slowing down