

BODY MOTION

Walking in front of a motion detector

Can a person walk at constant speed?

How can you discover the speed of a motion? What is the difference between speed and velocity?

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A. Preparation

Paper & pencil activity: Use a coordinate system with the origin at far left and positive distances increasing to the right.

- 1) Sketch the distance vs. time graph for each of the following situations:
 - a) An object at rest
 - b) An object moving in the positive direction with constant speed
 - c) An object moving in the negative direction with constant speed
 - d) An object that is accelerating in the positive direction, starting from rest
- 2) Sketch the velocity vs. time graph for each of the situations described above.

distance vs. time graphs	corresponding velocity vs. time graphs

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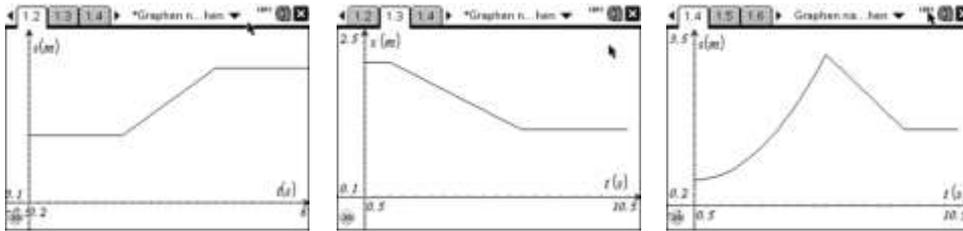
B. Observation of an experiment

Preliminary experiments: Place the motion detector so that it points toward an open space at least 2 m long and then connect the motion detector to an interface.

- 1) Make a graph of your motion when you walk away from the detector with constant speed. Describe the graph and make connections between the displayed data and your own motion.
- 2) Sketch, what the distance vs. time graph will look like if you walk slower away from the detector. Check your prediction with the motion detector. In order you were not right, explain what mistakes you made.
- 3) Sketch, what the distance vs. time graph will look like if you walk faster away from the detector. Check your prediction with the motion detector. In order you were not right, explain what mistakes you made.
- 4) Sketch, what the distance vs. time graph will look like if you start 2 m in front of the detector and walk for 2s very slowly but with constant speed toward the detector and then stop for 3s. Check your prediction with the motion detector. In order you were not right, explain what mistakes you made.

C. Modeling the situation in the laboratory

Try to match the shape of the distance vs. time graphs (see document *graphs.tns*)



1) Write down how you would walk to produce each target graph.

- a)
-
- b)
-
- c)
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2) Test your prediction as you walk in front of the motion detector and look at the displayed graph. Describe and explain your results:

- a)
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- b)
-
- c)
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3) If you were not successful, repeat the process until your motion closely matches the graph on the screen. Describe what you did wrong previously and how you were able to succeed?

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4) Extension: Sketch a velocity vs. time graph for each of the motions above and test your prediction with the collected data as you display the velocity vs. time graphs.

D. Evaluating the data obtained

1) Describe how you walked for each of the graphs you matched.

a)

b)

c)

2) Explain the significance of slope of a distance vs. time graph. Include a discussion of positive and negative slope.

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3) What type of motion is occurring when the slope of a distance vs. time graph is zero?

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4) What type of motion is occurring when the slope of a distance vs. time graph is constant?

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5) What type of motion is occurring when the slope of a distance vs. time graph is changing? Describe how you tested your answer using the motion detector.

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6) Extension 1: What type of motion is occurring when the slope of a velocity vs. time graph is zero?

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7) Extension 2: What type of motion is occurring when the slope of a velocity vs. time graph is not zero? Test your answer using the motion detector.

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E. Show your results

Create a graph-matching challenge. Sketch a distance vs. time graph on a piece of paper and challenge another student to match your graph. Have the other student challenge you in the same way. Document your activities and considerations.

Write general conclusions

Returning to the main question of this activity:

How can a person walk at constant speed? How she/he can manage this? How she/he can find out if doing right? Is there more than one way to find this out?

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Questions

a) It was easy for our group to design our own experiment and find an appropriate solution to the given task. Tick a number 1, 2, 3, 4 or 5 (1: strongly agree 5: strongly disagree)

Please explain your answer.....

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b) The guidance in the worksheet helped us to perform the experiment and analyze the data in order to understand the physics behind and apply physics concepts to everyday life situations. Please, tick a number 1, 2, 3, 4 or 5 (1: strongly agree 5: strongly disagree) and explain your answer:

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