Minds•On Physics Activity 16

Solving Constant-Velocity Problems Using Different Methods

Purpose and Expected Outcome

In this activity, you will analyze a situation and answer questions about it using three different representations of motion: a strobe diagram, algebraic equations, and position vs. time graphs. After completing the activity you should understand that there is usually more than one way to solve a problem, and that some ways are easier than others.

Prior Experience / Knowledge Needed

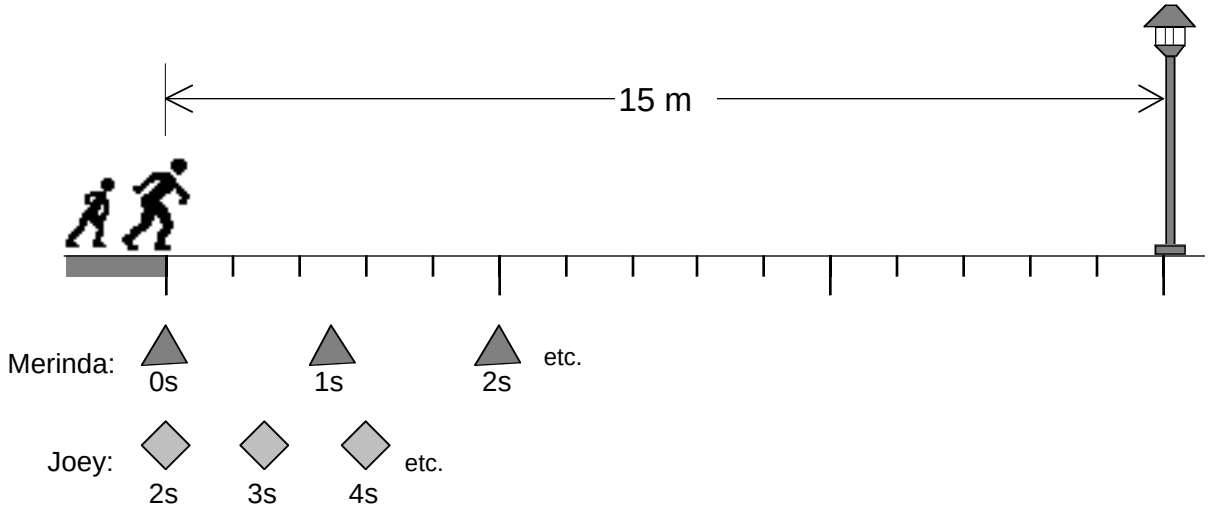
You should know and understand the following: how to draw and interpret strobe diagrams, how to apply kinematic equations to constant-velocity situations, and how to draw and interpret position vs. time graphs.

Explanation of Activity

Consider the following situation: Merinda and her little brother Joey are having a foot race from the edge of a road to a street lamp and back. At t = 0 seconds, Merinda starts; she runs at 2.5m/s all the way to the street lamp and back to the starting point. Joey is not yet ready at t = 0s, and doesn't start running until t = 2s; then he runs at 1.5m/s to the street lamp and back. (A drawing is provided below.)

METHOD A: Using Strobe Diagrams to Analyze Motion

A1. Make a strobe diagram by drawing symbols to show the positions of Merinda and Joey every second. We have drawn the first few symbols for you. Then use your strobe diagram to answer question A2.



A2. While Joey is still running towards the street lamp, Merinda will pass him on her way back to the sidewalk.

(a) How far from the street lamp will this happen?

(b) At what time will this happen?

(c) What is their position relative to their starting point when this happens?

METHOD B: Using Algebra To Analyze Motion

Using only kinematic equations and algebra, answer the following questions about Merinda and Joey.

B1. (a) Find the position of Merinda and Joey when they pass each other.

(b) When does this occur?

(c) Do your answers agree with your results using method A?

B2. Where is Joey when Merinda reaches the street lamp?

METHOD C: Using Graphs to Analyze Motion

C1. Draw two position vs. time graphs, one for Merinda and one for Joey, from the time Merinda starts toward the street lamp until Joey returns to the sidewalk.

C2. (a) What is their position when they pass each other?

(b) When does this occur?

(c) Do your answers agree with your results using methods A and B?

C3. Where is Joey when Merinda reaches the street lamp? Does your answer agree with your result using method B?

C4. Where is Merinda when Joey reaches the street lamp?

C5. How far apart are Joey and Merinda when Merinda gets back to the starting point?

Reflection

R1. Of the three methods used in this activity…

(a) … which is easiest to work with?

(b) … which contains the most information?

(c) … which would you use to show someone else how to do these problems?

(d) … which would you like to learn better how to use?

(e) … which would you recommend others use to answer these types of questions?

R2. Does the expression "constant velocity" as used in this situation mean that all velocities are the same? If not, how many different velocities were used, and what were they? What does the expression "constant velocity" mean in this context?

A Final Note

We now have three methods for solving constant-velocity problems. In this context, using algebra was not the easiest. However, in some cases, you may still prefer to use algebra. The message is that you should choose your method before attempting to solve a problem. As you solve more problems, and think about how to solve them, choosing the easiest method will become more intuitive. Practice helps, and in the long run, this will save you time and frustration!