Physics 20 Lesson 4 Graphing Activities

I. Graphing Constant Velocity

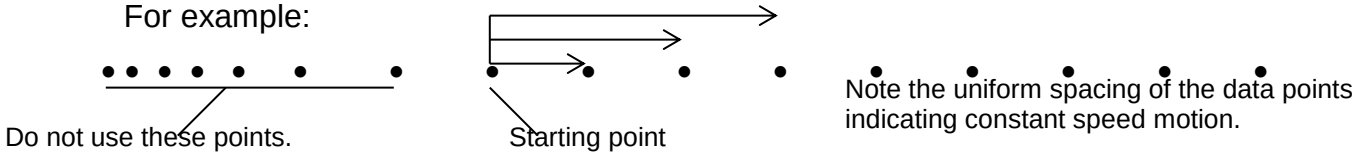
Investigation:

A. What is the position-time graph for objects moving at constant velocity?
B. What is the velocity-time graph for objects moving at constant velocity?

Materials: air table unlined paper graph paper rulers

Procedure:

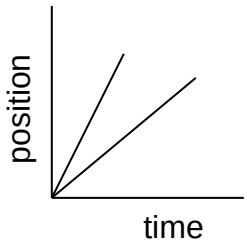
1. Set the spark timer to 0.020 s.
2. Depress the foot pedal and give the puck a small push across the table. Do the same process a second time with a different speed. When you leave the air table you should have two sets of data – slow speed and fast speed.
3. For this activity we are interested in the puck's motion after it left your hand. Do not use the data points that were made when you were pushing the puck. You should choose a starting point when the puck was in motion after you released it. For example:



4. Measure the total distance *from the starting point to each successive point*. **We are not interested in the distance between points**. Use every point up to a maximum of 10 points. (You may want to check what you are doing with your teacher.)
5. Record your measurements in a suitable distance/time data table.

Graphs and Calculations:

1. Ask your kind and benevolent teacher for the appropriate graph paper.
2. On <u>one</u> sheet of graph paper, plot position-time graphs for each set of data (do not use a computer). Draw a line of best fit for each data set.
3. Calculate the speed of each puck.
4. On <u>one</u> sheet of graph paper, plot velocity-time graphs for each set of data (do not use a computer).



Analysis and Interpretation:

1. Using sketches/diagrams, explain why a line-of-best-fit or a curve-of-best-fit represents the motion of objects better than a "connect-the-dots" graph.
2. What is the relationship between speed and the slope of a position–time graph for constant speed motion? Explain.

Your write-up should include:

- ⇒ a statement of the purpose of this activity
- ⇒ data tables and observations
- ⇒ graphs
- ⇒ slope calculations including units
- ⇒ answers to the analysis and interpretation questions

II. Graphing Accelerated Motion

Investigation:

A. What is the position-time graph for an object with constant acceleration?

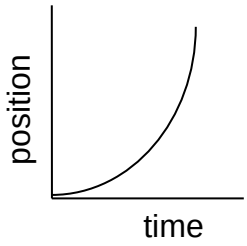
Materials: air table unlined paper graph paper rulers

Procedure:

1. Set the spark timer to 0.020 s.
2. Tilt the air table up slightly by placing two biology text books under the single leg under the air table. Hold the puck at the top of the paper, depress the foot pedal and release the puck.
3. Measure the total distance *from the starting point to each successive point*. **We are not interested in the distance between points**. Use every point.
4. Record your measurements in a suitable distance/time data table.

Graph:

1. Ask your kind and benevolent teacher for the appropriate graph paper.
2. On the sheet of graph paper, plot a position-time graph (do not use a computer). Draw a curve of best fit.



Analysis and Interpretation:

1. Describe how the position-time graph would appear if the air table had a
   a. greater slope
   b. smaller slope.
2. Describe how the velocity changed as the puck accelerated down the table.
3. Was the acceleration constant? Explain.
4. Compare and contrast constant speed motion and accelerated motion.

Your write-up should include:

- ⇒ a statement of the purpose of this activity
- ⇒ data tables and observations
- ⇒ graph
- ⇒ answers to the analysis and interpretation questions