Physics: Lab A1 – Investigating Uniform Motion

The purpose of this lab is to practice using the air table, experience uniform motion and to determine the shape of the position versus time graph for the evidence collected. Please include the sections of Experimental Design (identification of variables), Evidence, Analysis, and Evaluation.

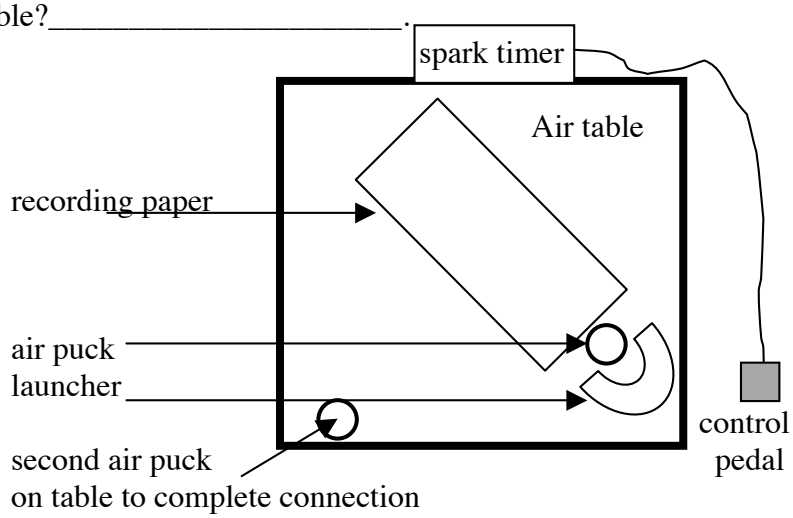
Problem

What is the shape of the position – time graph for an object traveling with uniform motion?

Experimental Design

An air puck will be launched across a horizontal air table surface and the distance traveled by an air puck will be measured for intervals of 0.100 s using the spark timer apparatus. The resulting position versus time graph generated can be compared with the theoretical one describing uniform motion. The purpose of the air table is to eliminate as much friction as possible. The diagram below details the equipment set up.

1. What is the manipulated variable? _____.
2. What is the responding variable?_____.



Materials

-Air table and spark timer apparatus
-Sheet of recording paper
-Ruler
-Graph paper

Procedure

1. The air table and spark timer will be set up for you. Make sure that the tubes from the pucks are not twisted. Place the puck that will not be used near the bottom corner of the table on the carbon paper. Both pucks must be on the carbon paper in order to complete the electric circuit. **Electric Shock Hazard!** *Make sure that you do not touch any metal parts while operating the spark timer.*
2. Set the timer to 10.0 Hz. At this setting the timer "fires" 10 dots per second and therefore the time interval between successive dots is 0.100 s.
3. Turn on the power supply to the compressor and spark timer.
4. Practice launching the puck gently. Aim diagonally across the table. Launching with high speed may damage the equipment. One partner is to operate the timer while another launches the puck. The timer is to be started just after the release of the puck in order to eliminate the initial acceleration of the puck.
5. Aim the puck diagonally across the table, pull back with the launcher and release the puck gently. Start the timer by depressing the control pedal just after the puck is released. Keep the pedal depressed until the puck has passed the edge of the paper. Release the pedal to stop timing.
6. Turn over the recording paper and inspect the spark path. The dots should be clear, relatively equally spaced, and in a straight line.
7. Repeat steps 4 to 6 until each group member has a valid set of results.

Evidence

1. Number the dots on your data paper starting from 0. Label each dot with the corresponding time using intervals of 0.100 s. (0.00 s, 0.100 s, 0.200 s, etc.)
2. Using the "zero" dot as a reference, measure the position of each dot. Record the value beneath the dot. Always measure from the "0" dot, not the distance between dots. **Include appropriate units for your measurement and record values to the appropriate precision.**

Table 1

Time (s)	Position (cm)	Time (s)	Position (cm)	Time (s)	Position (cm)
0.00		0.400		0.800	
0.100		0.500		0.900	
0.200		0.600		1.00	
0.300		0.700		1.10	

Analysis

1. On a sheet of graph paper, draw a position versus time graph for the puck. Follow the guidelines for the graphing process as described in the "Graphing" handout.
2. Write a sentence to answer the problem.

3. Determine the slope of the graph. Include units in your calculation.

   i) What does the slope of the position versus time graph represent?

4. For each interval defined by successive dots, calculate the average velocity over the interval (Table 2). Include units for your calculations. Provide a sample calculation in the space below.

5. Calculate the midpoint of the time interval between each pair of dots.
6. One a sheet of graph paper, draw the velocity-time graph for average velocity over each interval vs. midpoint of each time interval.
7. Desribe the velocity-time graph. Is this what you expected? Explain.

Table 2

Time interval (s)	Average velocity ( )	Midpoint of interval (s)	Time interval (s)	Average Velocity ( )	Midpoint of interval (s)
0.00 – 0.100		0.0500	0.500 – 0.600		
0.100 – 0.200			0.600 – 0.700		
0.200 – 0.300			0.700 – 0.800		
0.300 – 0.400			0.800 – 0.900		
0.400 – 0.500			0.900 – 1.00		

Evaluation

1. Identify at least three sources of uncertainty for this lab.

2. How confident are you in the results obtained for this lab? Explain.