Physics: Lab A2 – Investigating Uniform Acceleration (2%)

The purpose of this lab is experience uniform acceleration and to determine the shape of the resulting position – time and velocity – time graphs. .Please include the sections of Experimental Design (identification of variables), Evidence, Analysis, and Evaluation.

Problem 1

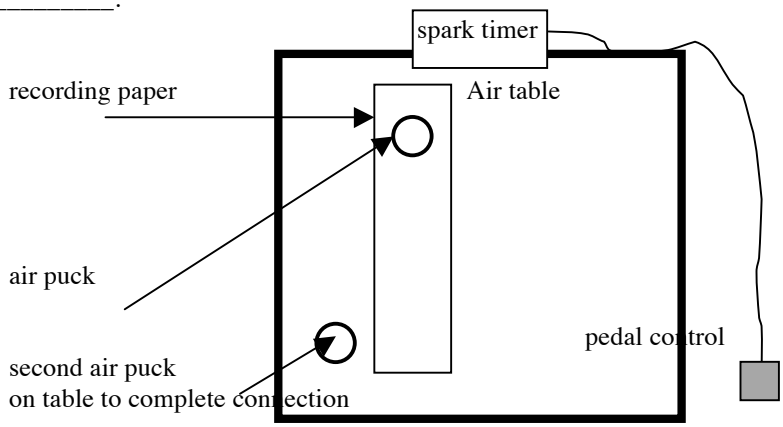
What is the shape of the position – time graph for an object travelling with uniform acceleration?

Experimental Design

An object travelling freely down an inclined plane is generally considered to be experiencing uniform acceleration. The position of an air puck will be measured for known time intervals using an air table and spark timer apparatus. The position – time and velocity – time graphs will be analyzed. The purpose of the air table is to eliminate as much friction as possible.

The manipulated variable is _____.

The responding variable is _____.



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 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. Place the puck at the top of the air table and practice releasing it so that it travels down the incline in a straight path along the recording paper. One partner is to operate the timer while another releases the puck. The timer is to be started *before* the release of the puck.

5. Place the puck on the recording paper at the top of the inclined table.

6. Start the timer by depressing the control pedal and then release the puck. Keep the timer pedal depressed until the puck has passed the edge of the paper. Release the pedal to stop timing.

7. Turn over the recording paper and inspect the spark path. It should be clear and in a straight line.

8. Repeat steps 4 to 7 until each group member has a 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 ( )	Time (s)	Position ( )	Time (s)	Position ( )
0		0.400		0.800	
0.100		0.500		0.900	
0.200		0.600		1.000	
0.300		0.700		1.100	

Analysis

1. Draw a position versus time graph for your data. Follow the guidelines for the graphing process as described in the "Process for Graphing" handout.

2. Write a sentence to answer the problem.

Problem 2
What is the shape of the velocity - time graph for an object moving with uniform acceleration?

Evidence/Analysis

1. For each interval defined by successive dots, calculate the average velocity over the interval. Provide a sample calculation.

2. Calculate the midpoint of the time interval between each pair of dots.

3. Draw a velocity – time graph for average velocity versus midpoint of time interval.

4. Write a sentence to answer the problem.

Table 2

Time interval (s)	Midpoint of interval (s)	Average velocity ( )	Time interval (s)	Midpoint of interval (s)	Average Velocity ( )
0 – 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 – 1.000		

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.

Extension

1. Calculate the slope of the velocity – time graph. What does the slope represent?

2. Compare the maximum position measured with the area under the velocity – time graph bounded by the last time interval measured