

Lab A2 – Investigating Uniform Acceleration

Problem 1: What is the shape of the position – time graph for an object travelling with uniform acceleration?

Experiment Design: See lab hand out.

For Position –Time:

Manipulated Variable is: Time

Responding Variable is: Position

For Velocity – Time:

Manipulated Variable is: Time

Responding Variable is: Velocity

Materials: See lab hand out.

Procedure: See lab hand out.

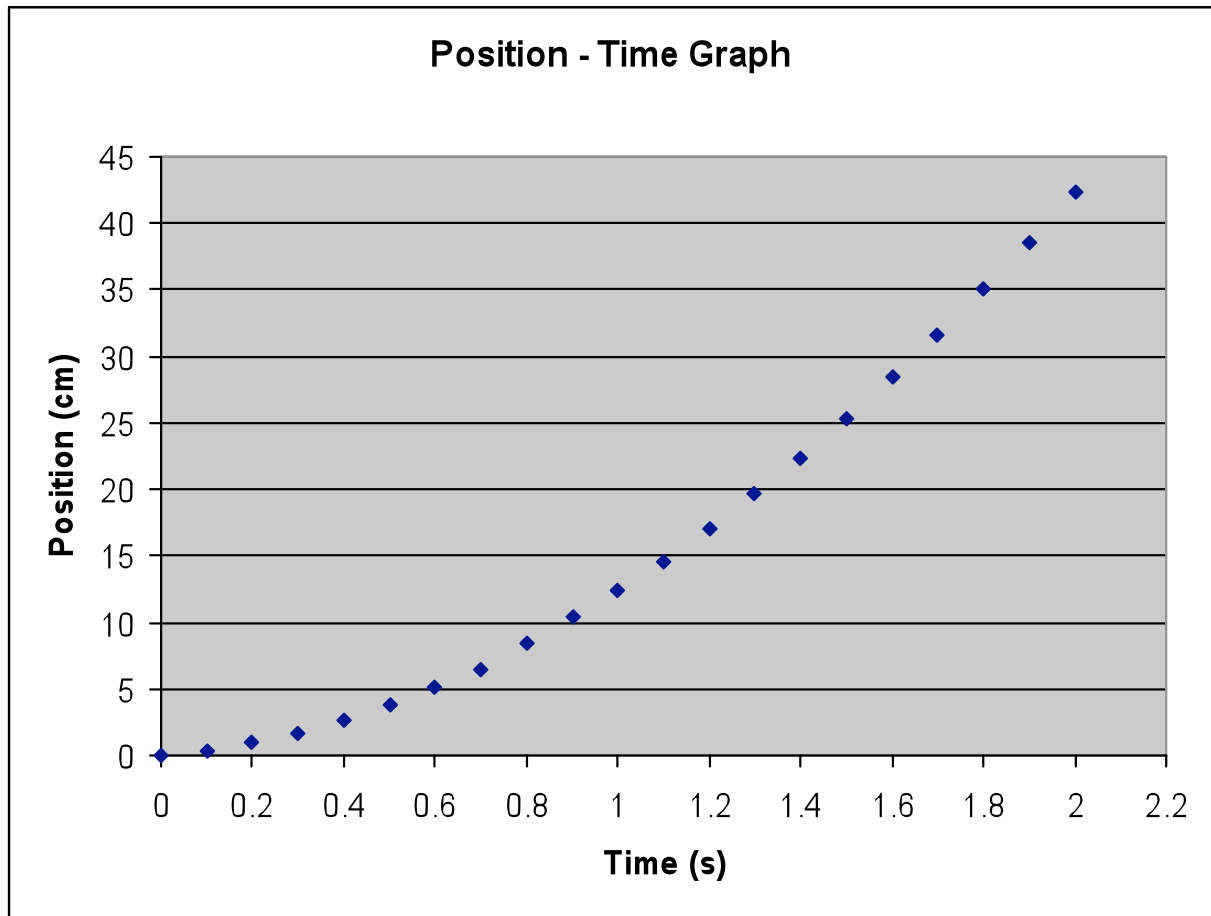
Evidence: **Table 1: Position Time Data**

Time (s)	Position (cm)
0	0.00
0.100	0.40
0.200	1.00
0.300	1.70
0.400	2.60
0.500	3.80
0.600	5.10
0.700	6.70
0.800	8.50
0.900	10.3
1.000	12.4
1.100	14.6
1.200	17.1
1.300	19.7
1.400	22.4
1.500	25.3
1.600	28.4
1.700	31.6
1.800	35.0
1.900	38.6
2.000	42.4

Analysis:

1.

Graph 1: Position – Time Graph



4. The shape of the position – time graph for an object travelling with uniform acceleration is an upward curve. The slope of the tangents increases as the time intervals increases.

Problem 2: What is the shape of the velocity – time graph for an object travelling with uniform acceleration?

Evidence Analysis:

1. Calculating the average velocity over the interval.

Example: Point 0 to Point 1

$$\frac{0.0 \text{ cm} - 0.4 \text{ cm}}{0.0 \text{ s} - 0.1 \text{ s}} = 4.0 \text{ cm/s}$$

2. Calculating the midpoint of the time interval. **(DISREGARD ERRORS IN CALCS)**

Example: Point 0 to Point 1

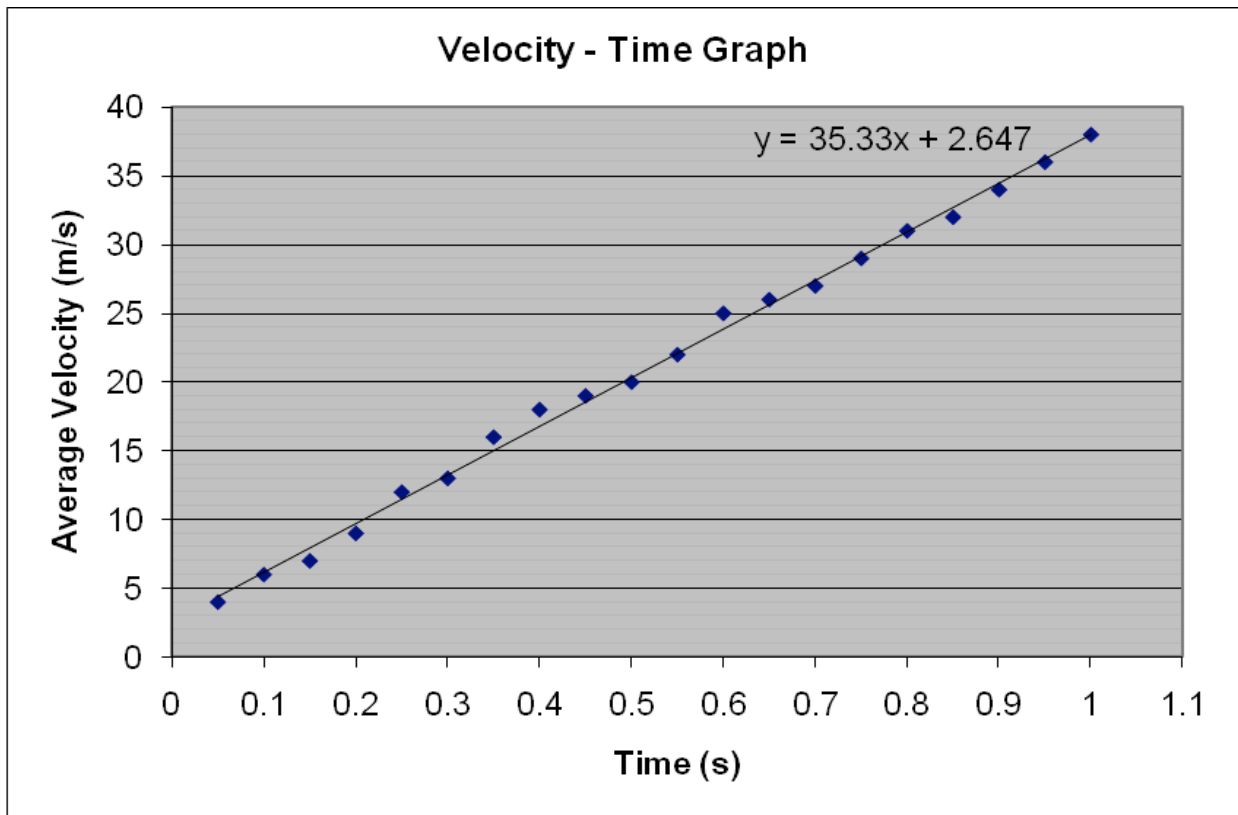
$$\frac{0.1\text{s} - 0.0\text{s}}{2} = 0.05\text{ s}$$

Table 2: Velocity - Time Data

Time Interval (s)	Midpoint of Interval (s)	Average Velocity (m/s)
0.000 – 0.100	0.0500	4.000
0.100 – 0.200	0.1000	6.000
0.200 – 0.300	0.1500	7.000
0.300 – 0.400	0.2000	9.000
0.400 – 0.500	0.2500	12.00
0.500 – 0.600	0.3000	13.00
0.600 – 0.700	0.3500	16.00
0.700 – 0.800	0.4000	18.00
0.800 – 0.900	0.4500	19.00
0.900 – 1.000	0.5000	20.00
1.000 – 1.100	0.5500	22.00
1.100 – 1.200	0.6000	25.00
1.200 – 1.300	0.6500	26.00
1.300 – 1.400	0.7000	27.00
1.400 – 1.500	0.7500	29.00
1.500 – 1.600	0.8000	31.00
1.600 – 1.700	0.8500	32.00
1.700 – 1.800	0.9000	34.00
1.800 – 1.900	0.9500	36.00
1.900 – 2.000	1.0000	38.00

3.

Graph 2: Velocity – Time Graph



4. The shape of the velocity – time graph for an object travelling with uniform acceleration is a somewhat linear line that has a positive slope.

Evaluation:

1. In this lab there were many different sources of uncertainty and error. First, there could have been an error when doing the lab and letting go of the air puck. Some people might have added a force without noticing while some could have just let go on the air puck. Second, there could have been an error when measuring the distance and recording the data. Third, there might have been an error in some calculations when doing the average velocity.
2. Based on the results obtained from this lab I am confident about my data since my data is precise but not accurate. I also double checked my measurements and made sure they were as precise as possible.

Extension:

1. Slope of the best fit line on the velocity – time graph is 35.33 cm/s^2 .

Two points on my best fit line: (38, 1) (6, 0.1)

$$\frac{38 - 6}{1 - 0.1} = 35.33 \text{ cm/s}^2$$

This slope shows that the object is accelerating positively at a constant acceleration.

2. The area under is:

$$\frac{1.0 \text{ s } 38.0 \text{ cm/s}}{2} = 19.0 \text{ cm/s}^2$$

The area under the velocity – time graph is close to the slope of the best fit line in the position – time graph.