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Name: _____

Date of lab: _____ Due date: _____

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❑ 02 ❑ 06
❑ 03 ❑ 07
❑ 04 ❑ 08

SPH3U

Lab: Accelerated Motion Down a Ramp

Show all work clearly for full marks.

Objective

- To find the acceleration of an object down an incline using graphing techniques.

Apparatus

- Spark timer
- Ticker tape
- Cart
- Ramp
- Books
- Ruler
- Tape
- Protractor

Procedure

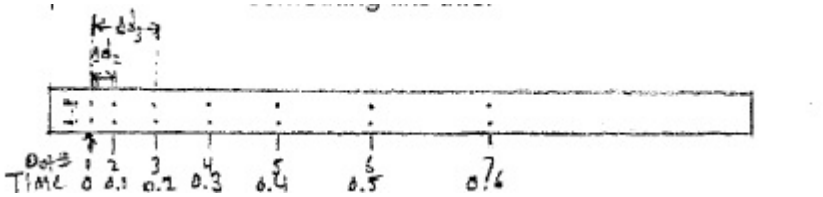
1. Feed the ticker tape through the spark timer and tape to the top of the ramp .

2. Make sure the spark timer is set to 10 Hz.

3. Turn the spark timer on and release the cart. Catch the cart BEFORE it hits the desktop. Turn the spark timer off.

4. Measure the angle of incline of the ramp using the protractor .

Your ticker tape should look something like this:



YOU MUST HAVE AT LEAST 7 DOTS O N Y OUR T APE

5. Measure the distance fr om dot #1 to every other dot (up to dot #7). Record these measurements in the "Displacement" column in Table1 below.

6. Make a position-time graph f rom Table 1. Draw a curve of best fit.

7. Draw tangents to your position-time curve at 0.20 s , 0.30 s , and 0.40s and calculate the slopes of those tangents . Show full calculations on your graph.

8. Use your three instantaneous velocities from step 7 to complete Table 2 .

9. Make a velocity-time graph from Table 2 and draw a line of best fit.

Data

Table 1

Dot #	Elapsed Time Δt (s)	Displacement $\Delta \vec{d}$ (cm)
1	0	0
2	0.10	
3	0.20	
4	0.30	
5	0.40	
6	0.50	
7	0.60	

Table 2

t (s)	$\vec{v}_{inst}$ (cm/s)
0.20	
0.30	
0.40	

Angle of incline: _____

*** Tape your ticker tape to the page in the space below. If you do not have the ticker tape, write the name of your lab partner(s).

Analysis & Discussion

1. Calculate the acceleration of the cart down the ramp from your $\vec{v}$–t graph.

2. The accepted value for acceleration down an incline is $9.8\sin\theta$ m/s^2, where θ is the angle of the incline. Calculate the accepted value of acceleration for your experiment.

3. Compare your result to the accepted result using the following formula:

$$\%\ diff = \frac{\text{exp. } value - acc.\ value}{acc.\ value} \times 100\%$$

4. Give three possible reasons for the difference between your answer and the accepted value.

Table 3

Dot #	Time t (s)	Previous Dot #	Next Dot #	Displacement between previous and next dots (cm)	Time between previous and next dots (s)	Average velocity (cm/s)
2	0.10					
6	0.50					

5. Use Table 3 to calculate the average acceleration between Dot #2 and Dot #6.

6. Compare your result in #5 to the accepted result from #2 using the percentage difference formula in Question #3.

7. Was your calculation of acceleration in #1 or #5 closer to the accepted result? Why might that method have been more accurate?

8. The $\vec{v}-t$ graph in most cases will not pass through the origin. Explain why this is so.

9. Calculate the displacement of the cart from 0 to 0.50 s using your $\vec{v}-t$ graph.

10. State the displacement of the cart after 0.50 s from Table 1 .

11. Compare your results in #9 and 10 using the following formula:

$$\%\ diff = \frac{|difference\ between\ values|}{average\ of\ values} \times 100\% \qquad \text{OR} \qquad \%\ diff = \frac{|x_2 - x_1|}{\frac{x_2 + x_1}{2}}$$

where x_1 and x_2 are your two measured values.

12. Suggest three changes to this experiment's procedure that could improve the results.

13. State a conclusion for your experiment.