Date of Lab 09/26/2018 Date of Submission 03/10/2018

Laboratory Report Cover for #1 Lab

Title Analyzing the Accelerating Motion with a Spark Timer

Homeroom	Section	Name	
11K			Yuko Iwata

Lab Partners Riku Ikeda

Summary

The purpose of this lab was to investigate how the change in mass of a car affect the acceleration it obtains as it deceuds down the slope, using a spark timer. ok

Moreover, we have tested to see the result with different slope, changing the steepness of the track from maximum to lower.

Our hypothesis was that the acceleration will remain constant, even with different mass and slope.

Our results showed that although acceleration remained constant throughout the fall of each car, the magnitude of the acceleratio were all different in the 4 trials.

Therefore, I concluded that bigger the mass, bigger the acceleration ? and steeper the slope, bigger the acceleration, from this data.

・Meet a deadline ・Write logically ・Write clearly ・Write with your own words

Teacher's Comments Beautiful table and graphs and reasonable and clear discussion. However your conclusion in the nice summary is apparently different from the description in ~~the~~ your report content. why?

1	2	3	4	5	6	7	8	9
Due	Summary	Data copy	Results Tables	Fig. Graphs	Results Summary Table	Discussion & Opinions	Clearness	General

* Use this form as a cover sheet.
* Submit your reports by the seventh day after your lab.

upside down

Acceleration rate should be obtained using the slope of v-t graph not using two points.

Introduction

Objective

1. Record the movement of a Dynamics Cart descending on a slope
2. Investigate the relations between acceleration and mass

Hypothesis

The movement of a cart is constant-acceleration motion

Preparation

Materials Used

- Spark Timer
- Thermal Sensitive Tape
- Dynamic Cart (500 g)
- Weights (250 g x 3)
- Track
- Scale
- Extension Cord
- Scissors
- Glue
- Graph Paper

Experiment

1. Set the Thermal Sensitive Tape in the Spark Timer
2. Attach the Thermal Sensitive Tape to the Dynamic Cart
3. Turn the Spark Timer on, and let the Dynamic Cart go down the slope
4. Change the Thermal Sensitive Tape and repeat step 1-3 with weights and changing the angle of the slope
5. Cut the Thermal Sensitive Tape by 6 dots and stick them to graphing paper

Results

Graph 1 : Steep slope, without Weights

Time t [s]	0	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900
Displacement x [× 10^{-2} m]	0	1.20	3.39	6.54	10.68	15.86	22.05	29.20	37.36	46.48
Displacement per 0.100s Δx [× 10^{-2} m]		1.20	2.19	3.15	4.14	5.18	6.19	7.15	8.16	9.12
Average velocity v [× 10^{-2} m/s]		12.00	21.9	31.5	41.4	51.8	61.9	71.5	81.6	91.2
Time at central point t [s]		0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85

From this table, the Acceleration is 91.2-12.0/0.85-0.05 = 99.0 **99.0 m/s^2**

Graph 2 : Steep slope, with 3 Weights (250 g)

Time t [s]	0	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900
Displacement x [× 10^{-2} m]	0	1.42	3.82	7.49	12.28	18.19	25.18	33.3	42.48	52.7
Displacement per 0.100s Δx [× 10^{-2} m]		1.42	2.40	3.67	4.79	5.91	6.99	8.12	9.18	10.22
Average velocity v [× 10^{-2} m/s]		14.2	24.0	36.7	47.9	59.1	69.9	81.2	91.8	102.2
Time at central point t [s]		0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85

From this table, the Acceleration is 102.2-14.2/0.85-0.05 = 110 **110 m/s^2**

Upside down,

Graph 3 : Lower, gentle slope, without Weights

Time t [s]	0	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900
Displacement x [× 10^{-2} m]	0	0.70	1.93	3.82	6.24	9.26	12.84	16.97	21.68	26.91
Displacement per 0.100s Δx [× 10^{-2} m]		0.70	1.23	1.89	2.42	3.02	3.58	4.13	4.71	5.23
Average velocity v [× 10^{-2} m/s]		7.00	12.3	18.9	24.2	30.2	35.8	41.3	47.1	52.3
Time at central point t [s]		0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85

from two points

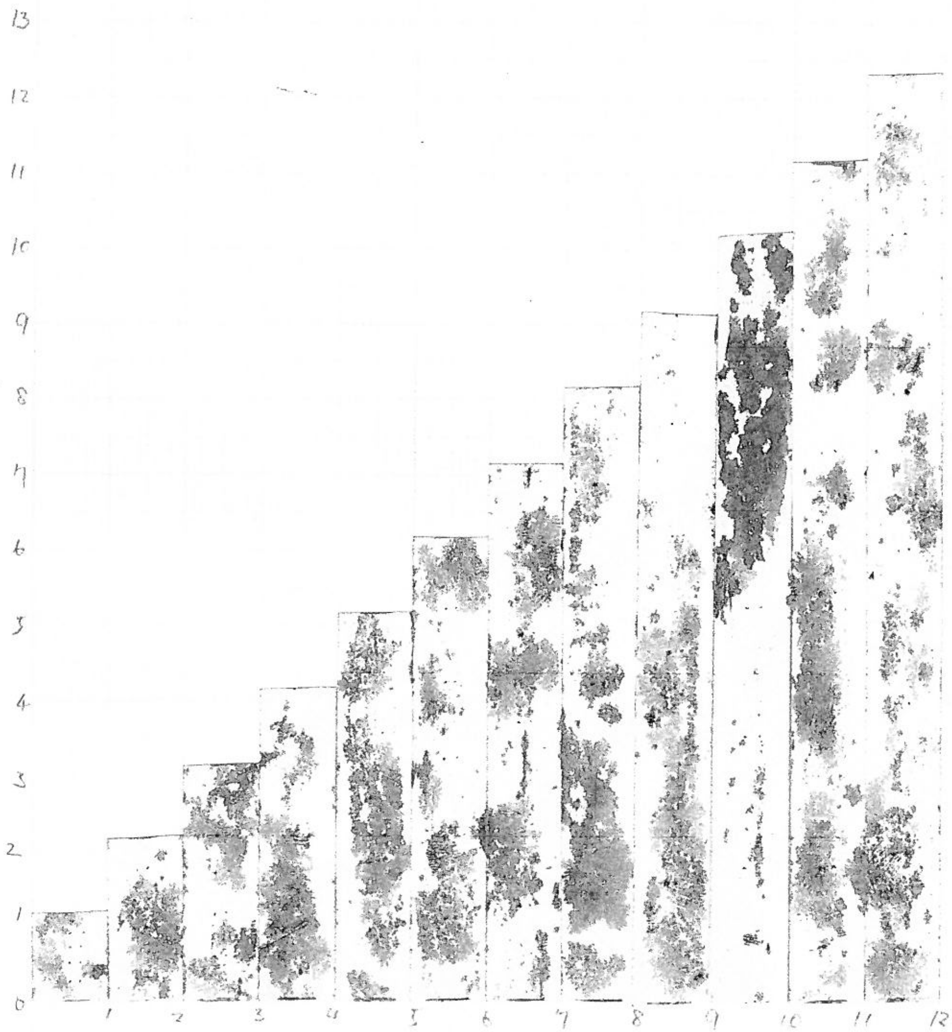
From this table, the Acceleration is 52.3-7.00/0.85-0.05 = 56.625 **56.6 m/s²**

from the slope of the line → $\frac{53.5 - 6.0}{0.85 - 0.05} = 59.4$

Graph 4 : Lower, gentle slope, with 3 Weights (250 g)

Time t [s]	0	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900
Displacement x [× 0.01m]	0	1.80	4.22	7.33	11.03	15.41	20.4	25.97	32.18	39.07
Displacement per 0.100s Δx [× 0.01m]		1.80	2.42	3.11	3.70	4.38	4.99	5.57	6.21	6.89
Average velocity v [× 0.01m/s]		18.0	24.20	31.10	37.00	43.80	49.90	55.70	62.10	68.90
Time at central point t [s]		0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85

From this table, the Acceleration is 68.90-18.0/0.85-0.05 = 63.625 **63.6 m/s²**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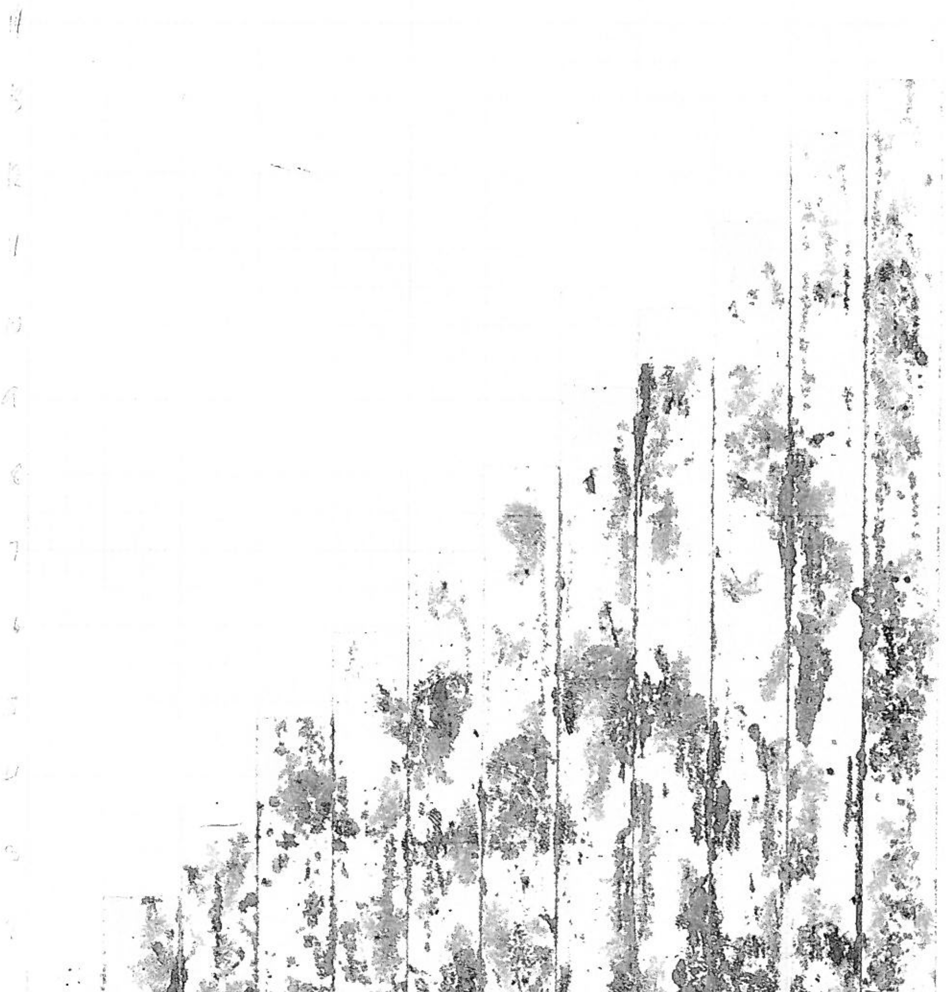

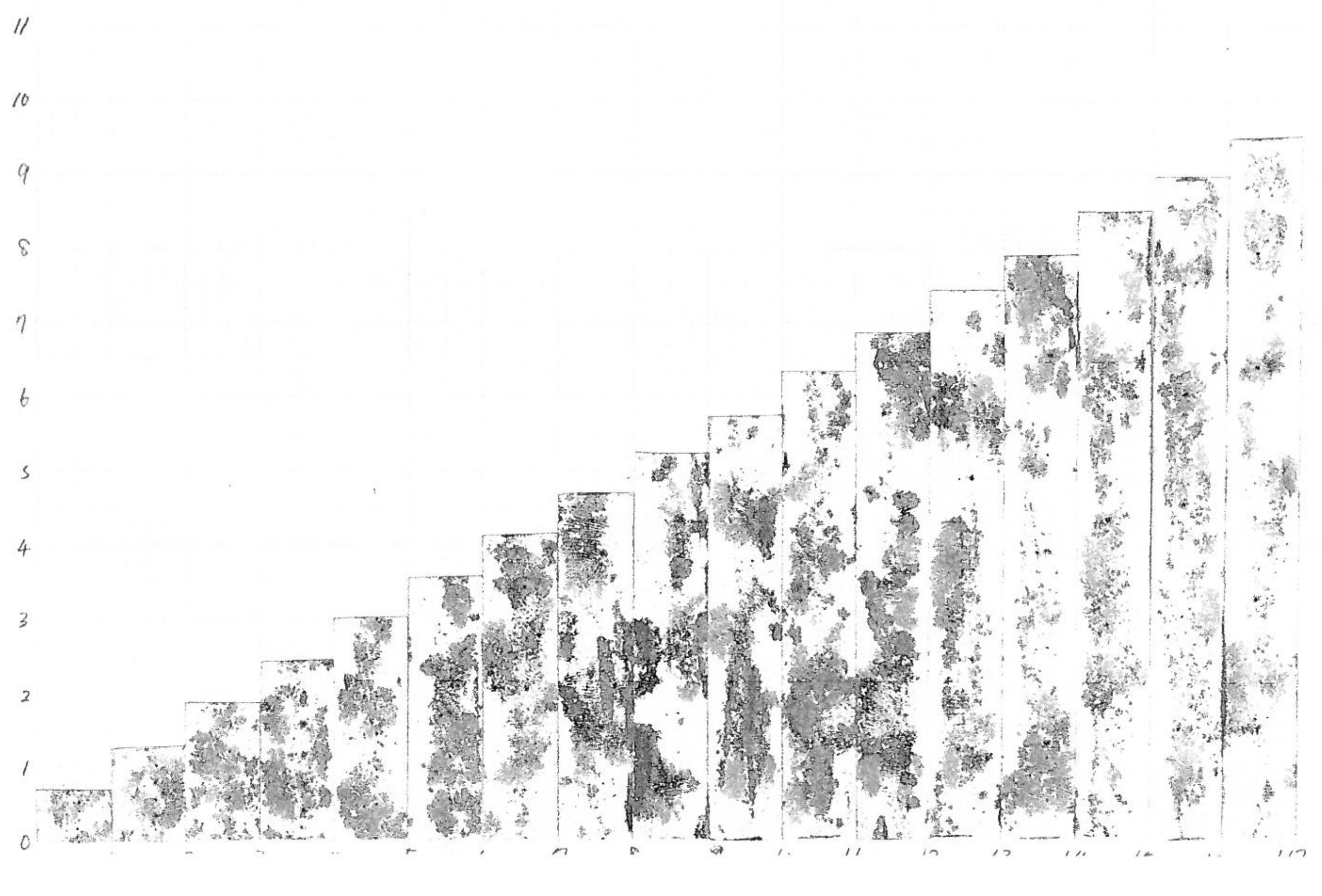
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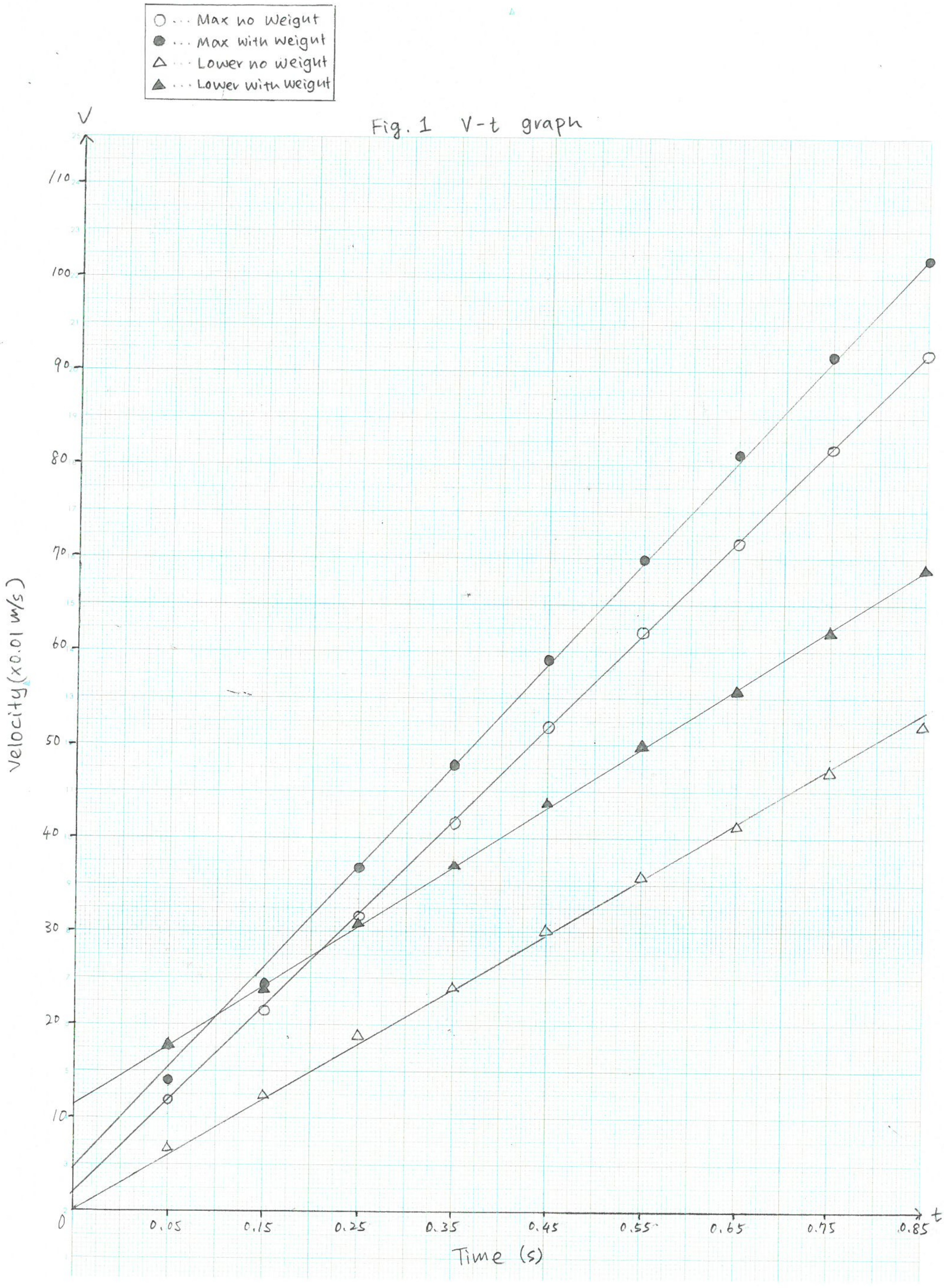
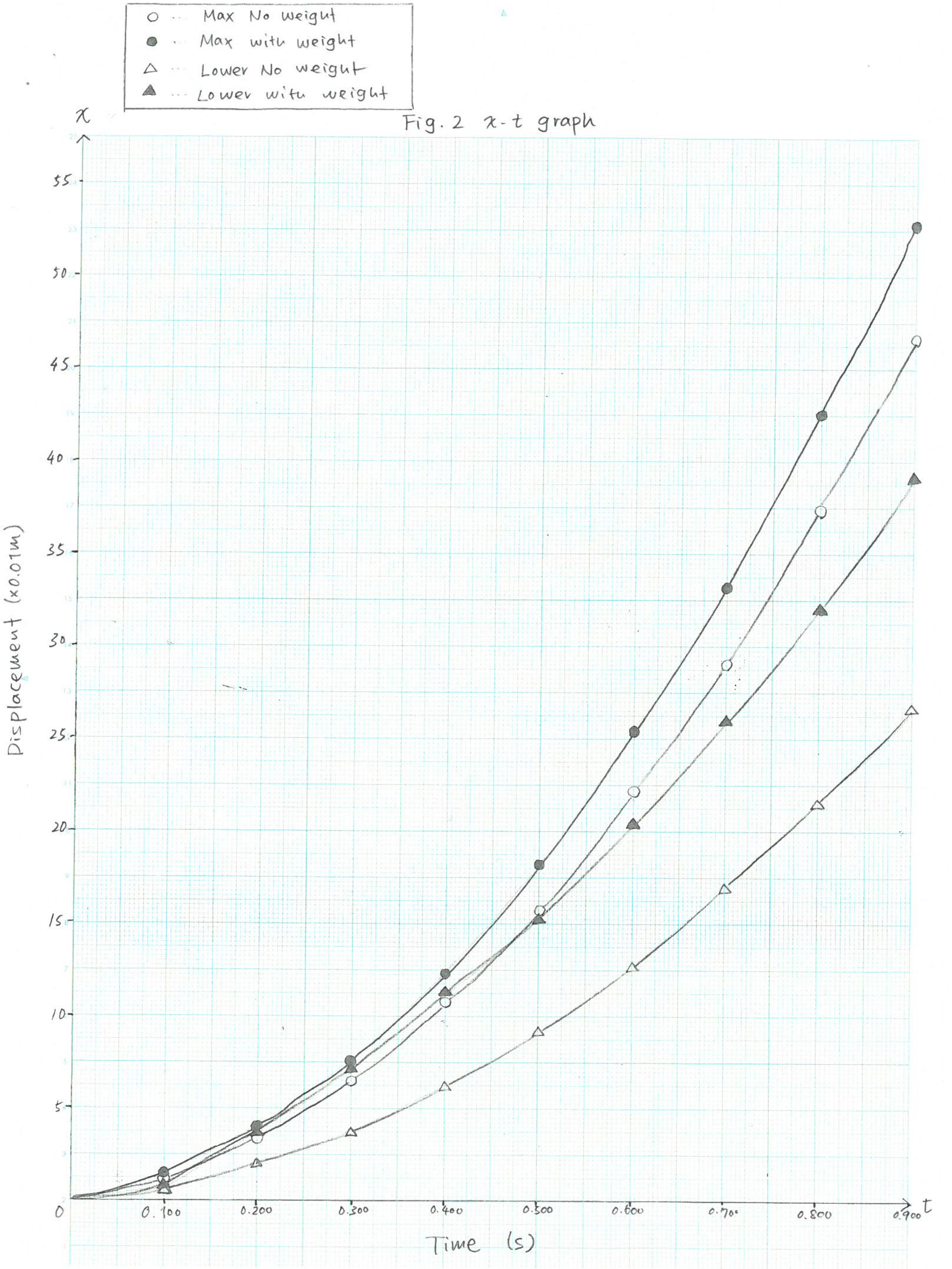

○ ... Max no Weight
● ... Max with Weight
△ ... Lower no Weight
▲ ... Lower with Weight
Fig. 1 V-t graph
V
Velocity(x0.01 m/s)
110
100
90
80
70
60
50
40
30
20
10
0
0.05
0.15
0.25
0.35
0.45
0.55
0.65
0.75
0.85
t
Time (s)


○ ··· Max No weight
● ··· Max with weight
△ ··· Lower No weight
▲ ··· Lower with weight
Fig. 2 x-t graph
x
Displacement (x0.01m)
55
50
45
40
35
30
25
20
15
10
5
0
0.100
0.200
0.300
0.400
0.500
0.600
0.700
0.800
0.900
t
Time (s)

Discussion

As shown in the velocity time graph, the graph of <Steep slope Without Weight> and the graph of <Steep slope With Weight> are parallel to each other (meaning both graphs having roughly the same slope). The acceleration of the cart for steep slope without weights is 99.0 m/s^2 and the acceleration of the cart for steep slope with weights is 110m/s^2. This shows that they have almost the same acceleration, with a little bit of difference caused by small error.

Moreover, the graph of <Lower, Gentle Slope Without Weight> and <Lower, Gentle Slope With Weight> were also parallel to each other in the Velocity Time graph, meaning that the two also have roughly the same acceleration. The acceleration of the cart for gentle slope without weights is 56.6m/s^2 and the acceleration of the cart for gentle slope with weights is 63.6m/s^2. Therefore, the Velocity Time graph and the calculation of the acceleration shows that the acceleration of the movement of the Dynamic Cart is not affected by the mass.

However, when the graph of <Steep slope Without Weight> and <Lower, Gentle Slope Without Weight> are compared, it can be seen that the Dynamic Cart had a greater acceleration on the steeper slope than the gentle one. This shows that the acceleration of the movement of the Dynamic Cart is affected by the angle of the slope, and the steeper slope causes the acceleration to be greater, where gradual slope causes the acceleration to be smaller.

Conclusion

The acceleration is not affected by the Mass of the Dynamic Cart. However, it is affected by the angle of the track, or the slope. Therefore, I conclude that the movement of the cart is constant-acceleration motion.

Opinion

It was my first time using the Spark Timer in a lab, and it was very interesting to see how it left marks on the Thermo sensitive tape as the cart moved down the track. I expected the acceleration of the heavier mass to be faster than the acceleration of the lighter mass, so I was a little surprised by the result of this lab. I also enjoyed graphing the data, as it clearly showed that the acceleration was constant, and how velocity increased over time as a result.