Date of Lab 9/27 Date of Submission 10/6

Laboratory Report

Title Analyzing the Motion of a Dynamics Cart with a Spark Timer

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Summary

The lab was done to determine the relationships between acceleration and different factors. The factors we used in the lab this time was mass and slope. From the experience ? the change in mass doesn't change the acceleration. This means, mass doesn't affect a lot in acceleration. However, the change in slope, meaning the change of the angle (θ) changed the acceleration a lot. This means, slope affects a lot in acceleration. ?

You must write what you observed and discussed.

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

Teacher's Comments

A good report with beautiful English.

1	2	3	4	5	6	7	8	9
Due	Summary	Intro.	Method.	Results	Table/Fig.	Discussion	Clearness	General
+					++	+	+	+++

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

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

- Spark Timer
- Dynamic Cart (500g)
- Weights (250g each)
- Track
- Scale
- Wood board
- Cramp
- Extension Code
- Scissors
- Glue
- Graph Paper
- Thermal Recording Tape

Experiments

1. Measure the mass of a Dynamic Cart
2. Measure the height (h) and length (L) of the track to obtain the angle of the trackθ (the angle of the trackθ can be measured by $\tan\theta = h/L$)
3. Check if the frequency of the Spark Timer is 60Hz.
4. Set the Thermal Recording Tape in the Spark Timer
5. Turn the Spark Timer on, and let it go down the slope with the Thermal Recording Tape.

6. Do this for 4 times; using weights and changing the angle of the slope.
7. After the Thermal Recording Tape comes out, make marks every six dots: the time of 6 dots corresponds to 0.100 s and the length corresponds to the displacement. (Dots are printed every 1/60 s.)
8. Cut at the marked places and put the pieces on graph paper (NOT handing it in)

Results

Graph 1: Descending on a steep slope, without weights

Height (h)=24 cm Length (L)=106cm Angle of the Slope (θ)=12.76°

Cart Weight=500g

Time (t) 〔s〕	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Displacement (x) 〔x 10^{-2}m〕	0	1.5	4.6	9.1	15.25	22.9	32.2	43.05	55.55	69.45
Displacement per 0.100s (Δx) 〔x 10^{-2}m〕		1.5	3.1	4.5	6.15	7.65	9.3	10.85	12.5	13.9
Average Velocity (v) 〔x 10^{-2}m/s〕		15	31	45	61.5	76.5	93	108.5	125	139
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 Figure 1, the acceleration is 1.39-0.15/0.8= 1.55 1.55 m/s^2

OK.

Graph 2: Descending on a steep slope, with 2 weights

Height (h)=24 cm Length (L)=106cm Angle of the Slope (θ)=12.76°

Cart Weight=1000g

Time (t) 〔s〕	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Displacement (x) 〔x 10^{-2}m〕	0	1.4	4.5	9.25	15.6	23.6	33.25	44.5	57.4	71.85
Displacement per 0.100s (Δx) 〔x 10^{-2}m〕		1.4	3.1	4.75	6.35	8	9.65	11.25	12.9	14.45
Average Velocity (v) 〔x 10^{-2}m/s〕		14	31	47.5	63.5	80	96.5	112.5	129	144.5
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 Figure 1, the acceleration is 1.445-0.14/0.8=1.63 1.63 m/s^2

Graph 3: Descending on a gentle slope, without weights

Height (h)=18.9cm Length (L)=108cm Angle of the Slope (θ)=9.926

Cart Weight=500g

Time (t) 〔s〕	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Displacement (x) 〔x 10^{-2}m〕	0	0.85	2.9	6.05	10.35	15.7	22.2	29.25	37.9	47.65
Displacement per 0.100s (Δx) 〔x 10^{-2}m〕		0.85	2.05	3.15	4.3	5.35	6.5	7.05	8.65	9.75
Average Velocity (v) 〔x 10^{-2}m/s〕		8.5	20.5	31.5	43	53.5	65	70.5	86.5	97.5
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 Figure 1, the acceleration is 0.975-0.085/0.8=1.11 1.11 m/s^2

Graph 4: Descending on a gentle slope, with 2 weights

Height (h)=18.9cm Length (L)=108cm Angle of the Slope (θ)=9.926

Cart Weight=1000g

Time (t) 〔s〕	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Displacement (x) 〔x 10^{-2}m〕	0	1.3	3.75	7.35	12.25	18.25	25.45	33.85	43.4	53.6
Displacement per 0.100s (Δx) 〔x 10^{-2}m〕		1.3	2.45	3.6	4.9	6	7.2	8.4	9.55	10.2
Average Velocity (v) 〔x 10^{-2}m/s〕		13	24.5	36	49	60	72	84	95.5	102
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 Figure 1, the acceleration is 1.02-0.13/0.8= 1.11 1.11 m/s^2

Discussion

As you can see from graphs 1 and 2, or graphs 3 and 4, or figure 1, the slope of the graph is very similar, or almost the same between those two. This means that the acceleration is very similar, or no big difference between graphs 1 and 2, or 3 and 4. When you think of each of those two graphs as pairs, the only difference in each of the pairs are the weight of the cart. The cart weight in graphs 1 and 3 are lighter compared to the cart weight in graphs 2 and 4. From this, weight doesn't OK become a factor of affecting the acceleration. On the other hand, when you think graphs 1 and 3, 2 and 4 are pairs, the difference in each of the pairs are the angle of the slope, used to descend the cart. When you look at those graphs, slopes with steep angles are much faster and displaces more from the beginning than the ones with gentle angles. This shows us that although weight doesn't affect a lot in acceleration, angles of the slope affect a lot.

Conclusion

- The movement of a cart is a constant acceleration motion OK.
- Weight doesn't affect a lot in acceleration
- Changing the angles of the slope is a big factor of changing the acceleration

Opinion

Although this assignment is a little bit straight-forward, because this was my first time writing a lab report in physics class, it was hard to organize information and conclude it with numerical evidence. The teacher's website helped me a lot on writing the lab report such as graphs, and the previous copy of the former students' lab reports helped me a lot to understand what to do. I think I can improve this more by organizing information during each experience and actually understand it so I could come up with a better quality lab report.

Totten!

Reference

Lab Report of Marina Kofukugawa (2014 J)
Lab Report of Ryo Hasegawa (2015 J)
Lab Report of Shunsuke Takeda (2016 J)

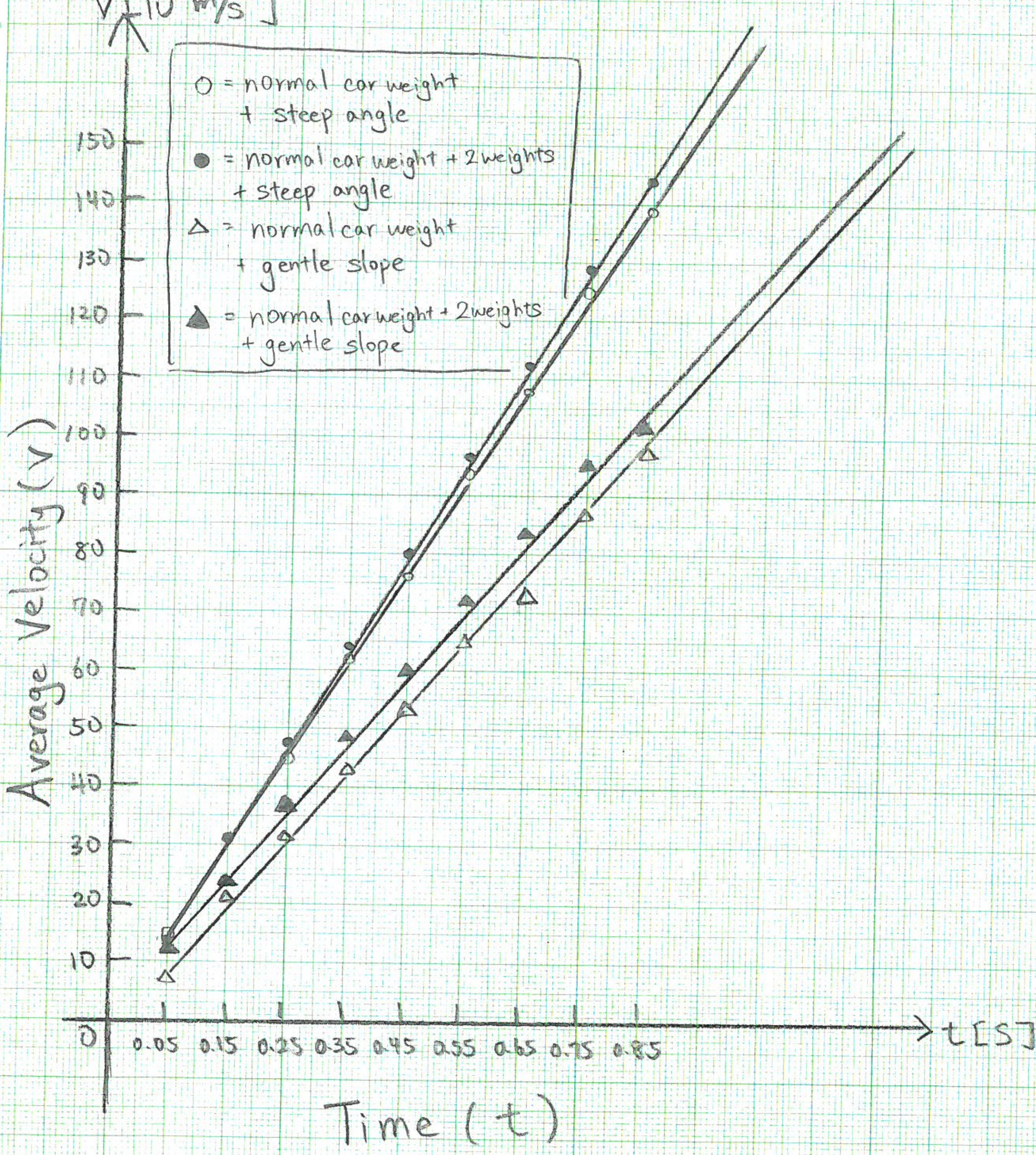

Figure 1 v-t graph

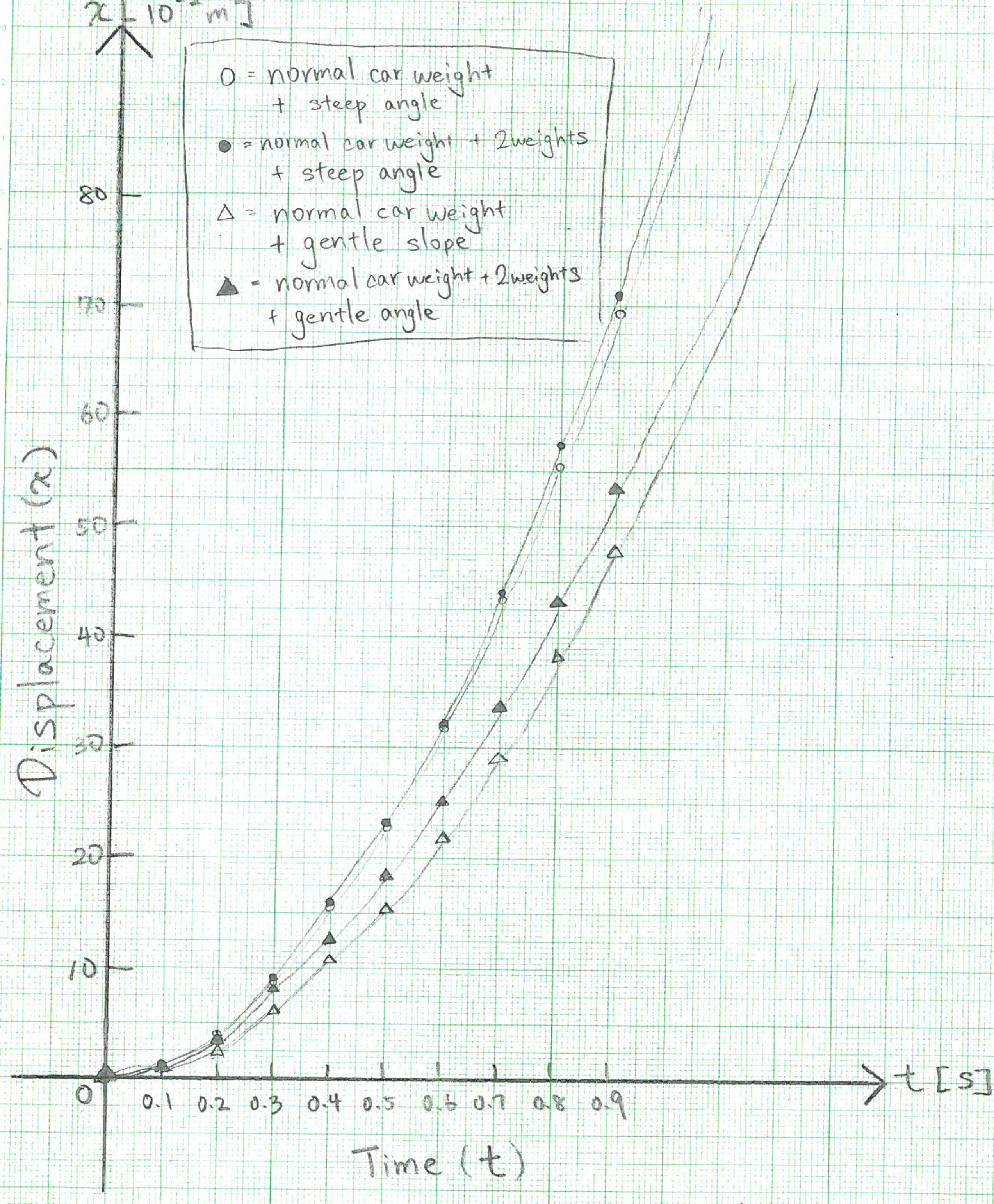

Figure 2 x-t graph

JIS A4 1mm 250×180 コクヨ ホ-19