Date of Lab 9/26/2018 Date of Submission 10/3/2018

Laboratory Report FOR #1 LAB

Title Analyzing the Motion of Dynamic Cart with a Spark Timer

Homeroom	Section	Name	
11 - I	2		Mari Shibata

Lab Partners Fumino Tsuchiya

Summary

I recorded a acceleration of a Dynamic Cart descending on a slope by using a spark timer. In this experiment, I observed how the change of mass of cart or the angle of slope affected ~~of~~ the acceleration of the Dynamic Cart. Through this experiment, I learned that the acceleration changes by the angles of slope, but it doesn't change by mass of matter. By seeing the graphs, I learned that steeper slope increases the acceleration rate a lot, but gentle slope decreases the acceleration rate. Also I learned the movement of the cart is constant-acceleration movement.

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

Teacher's Comments Good summary, table, graphs and discussion

1	2	3	4	5	6	7	8	9
Due	Summary	Data copy	Results Table	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.

<Results>

Dynamic cart: 500g

Weights: 250g each

Table 1: Descending on a steep slope, without weights

Condition: Mass of cart=500g Height (h)=25cm

Length (L)=105cm

Angle of the slope :tanθ=25/105=0.24 ⇨13°

Time t (s)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Displacement x ($\times 10^{-2}$m)	0	1.5	4.3	8.4	13.9	20.7	28.9	38.4	49.4	61.8
Displacement per 0.100s Δx ($\times 10^{-2}$)		1.5	2.8	4.1	5.5	6.8	8.2	9.5	11.0	12.4
Average Velocity v ($\times 10^{-2}$m/s)		15.0	28.0	41.0	55.0	68.0	82.0	95.0	110.0	124.0
Time at central point (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 0.9m/s^2

((124.0-15.0)$\times 10^{-2}$/ (0.85-0.05)=1.36m/s^2)

Table 2: Descending on a steep slope, with 3 weights(250g×3=750g)
Condition: Mass of cart=1250g Height(h)=25cm
Length(L)=105cm

Angle of the slope :tanθ=25/105=0.24⇨13°

Time t (s)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Displacement x ($\times 10^{-2}$m)	0	1.25	3.85	8.05	13.55	21.55	30.05	40.05	51.55	64.45
Displacement per 0.100s Δx ($\times 10^{-2}$)		1..25	2.60	4.20	5.50	7.00	8.50	10.0	11.50	12.90
Average Velocity v ($\times 10^{-2}$m/s)		12.5	26.0	42.0	55.0	70.0	85.0	100.0	115.0	129.0
Time at central point (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 1.0m/s^2

((129.0-12.5)×10^{-2}/(0.85-0.05)=1.46m/s^2)

Table 3: Descending on a gentle slope, without weights

Condition: Mass of cart=500g Height (h)=20cm

Length (L)=110cm

Angle of the slope :tanθ=20/110=0.18⇨10.5∘

Time t (s)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Displacement x ($\times10^{-2}$m)	0	1.2	3.2	6.3	10.3	15.5	21.5	28.3	36.2	45.1
Displacement per 0.100s Δx ($\times10^{-2}$)		1..2	2.0	3.1	4.0	5.2	6.0	6.8	7.9	8.9
Average Velocity v ($\times10^{-2}$m/s)		12.0	20.0	31.0	40.0	52.0	60.0	68.0	79.0	89.0
Time at central point (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 1.4m/s^2

($(89.0-12.0)\times10^{-2}/(0.85-0.05)=0.96m/s^2$)

Table 4: Descending on a gentle slope, with 3 weights(250g×3=750g)

Condition: Mass of cart=1250g Height (h)=20cm

Length (L)=110cm

Angle of the slope :tanθ=20/110=0.18⇨10.5°

Time t (s)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Displacement x ($\times 10^{-2}$m)	0	0.8	2.3	4.8	8.3	12.8	18.3	24.8	32.4	41.o
Displacement per 0.100s △x ($\times 10^{-2}$)		0.8	1.5	2.5	3.5	4.5	5.5	6.5	7.6	8.6
Average Velocity v ($\times 10^{-2}$m/s)		8.0	15.0	25.0	35.0	45.0	55.0	65.0	76.0	86.0
Time at central point (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 1.33m/s^2

((86.0-8.0)$\times 10^{-2}$/(0.85-0.05)=0.98 m/s^2)

Table 5

Test	Mass(g)	Angle(°)	Acceleration (m/s^2)
①	500g	13°	0.9m/s^2
②	1250g	13°	1.0m/s^2
③	500g	10.5°	1.4m/s^2
④	1250g	10.5°	1.33m/s^2

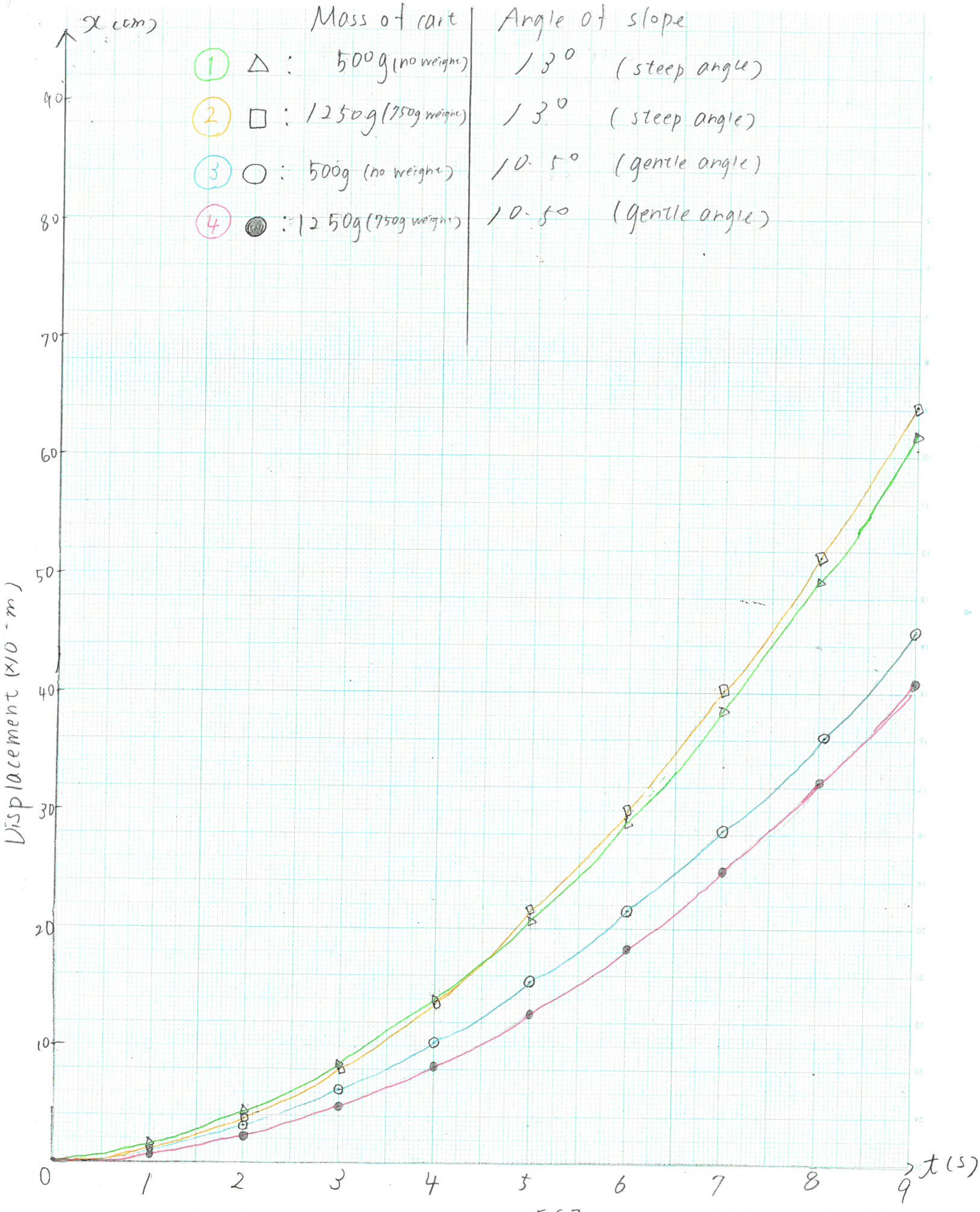


Figure 1, x - t graph

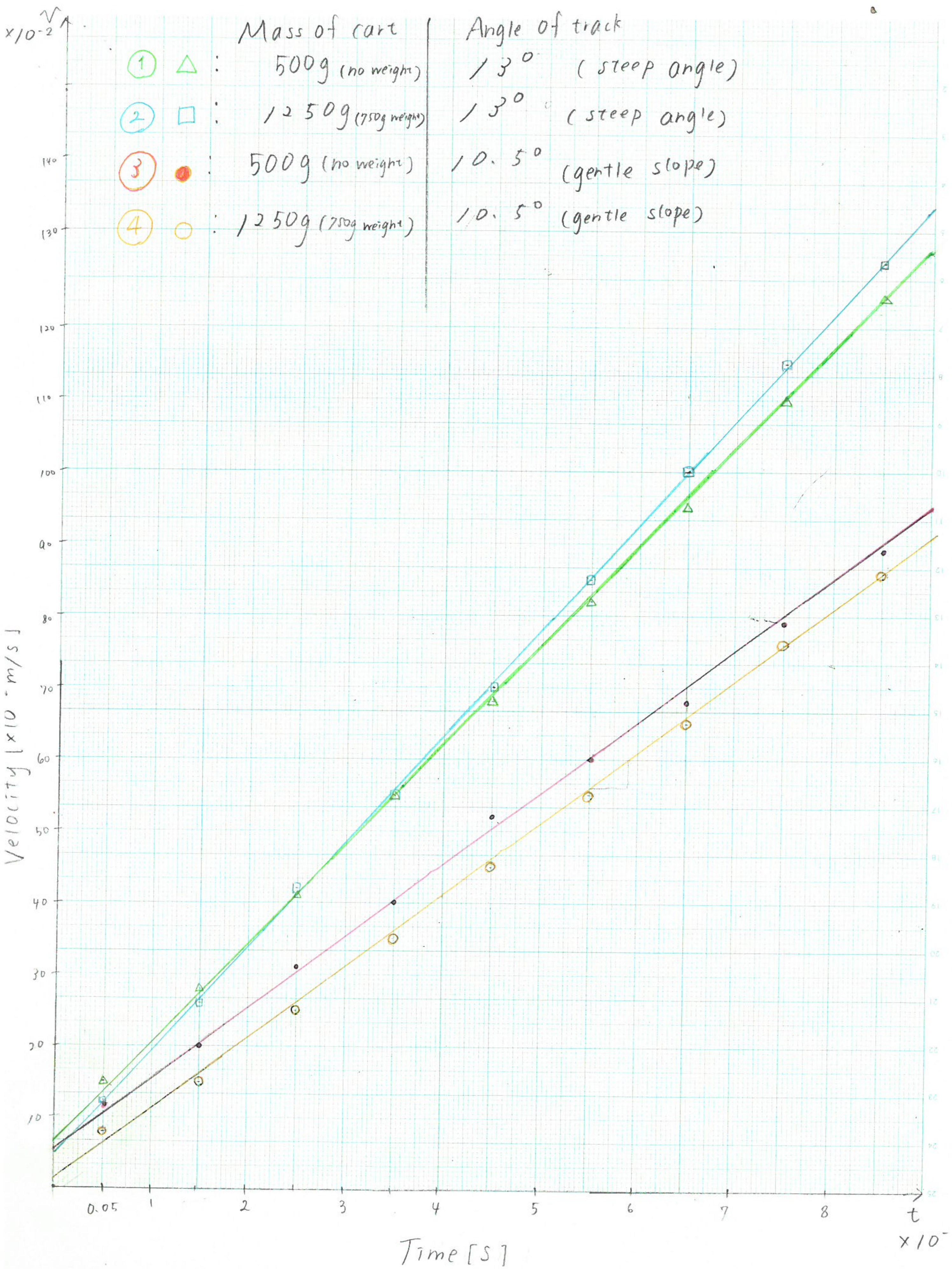
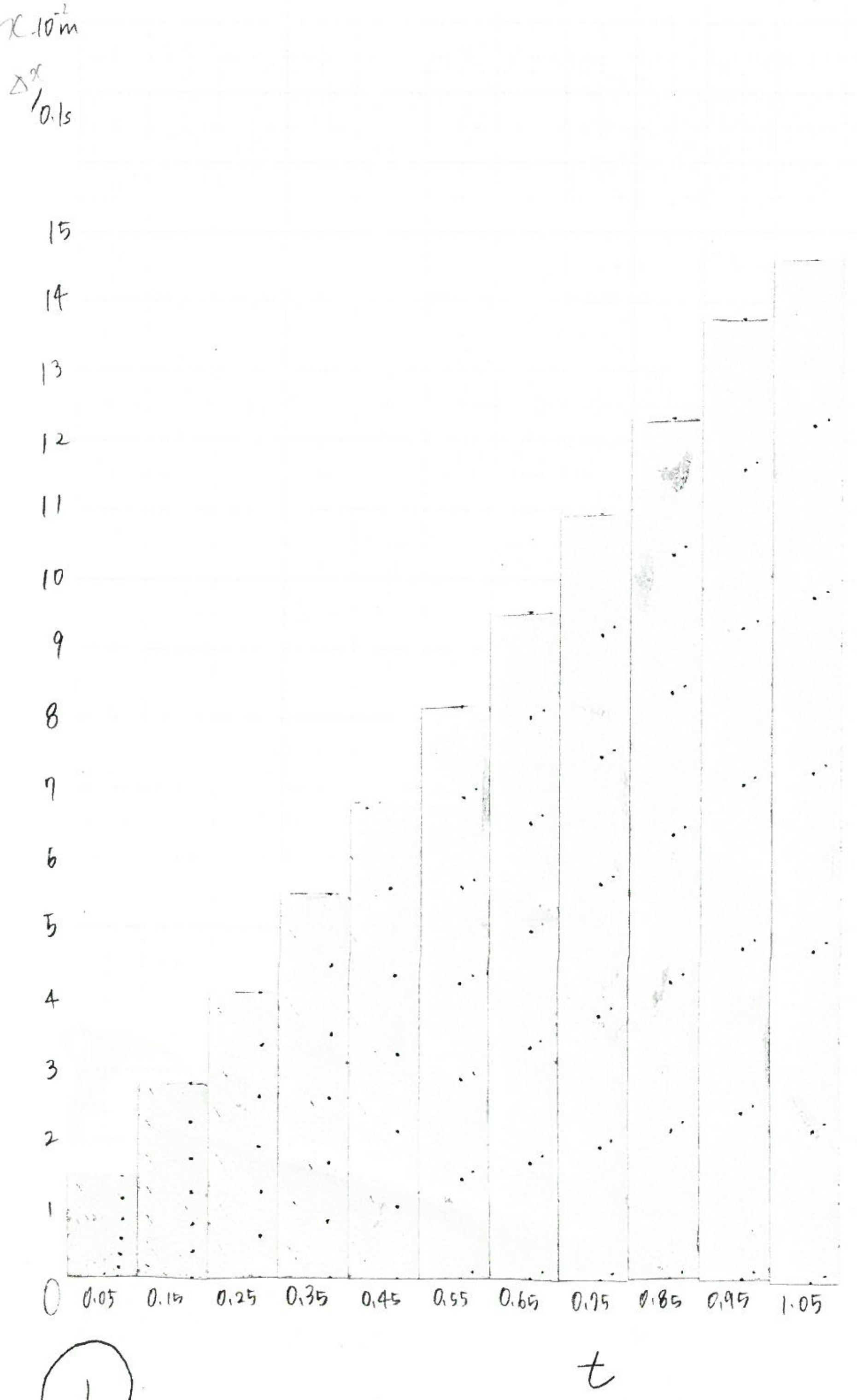


Fig. 2 V-t Graph



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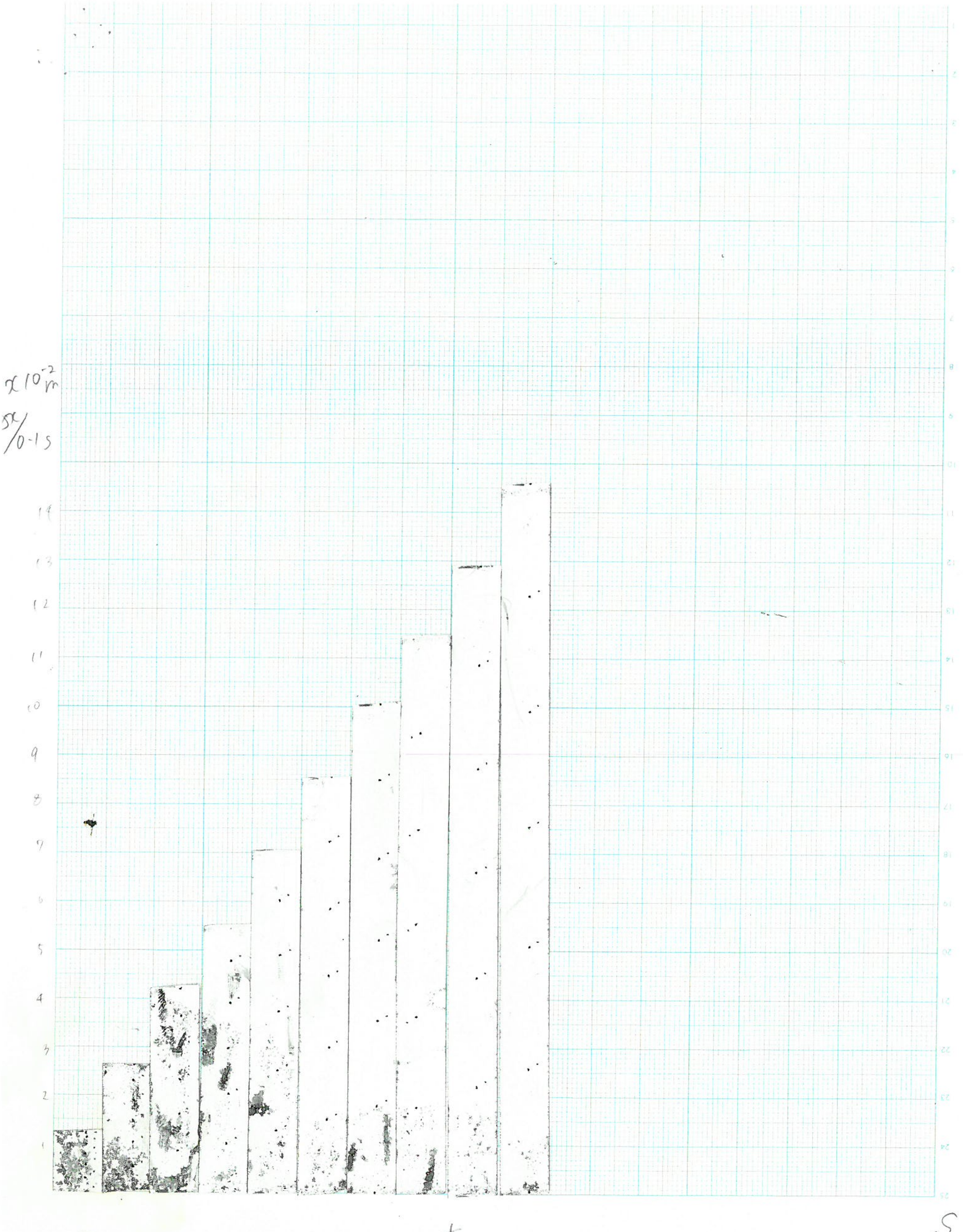
11-I 柴田 真琳 Lab no.1



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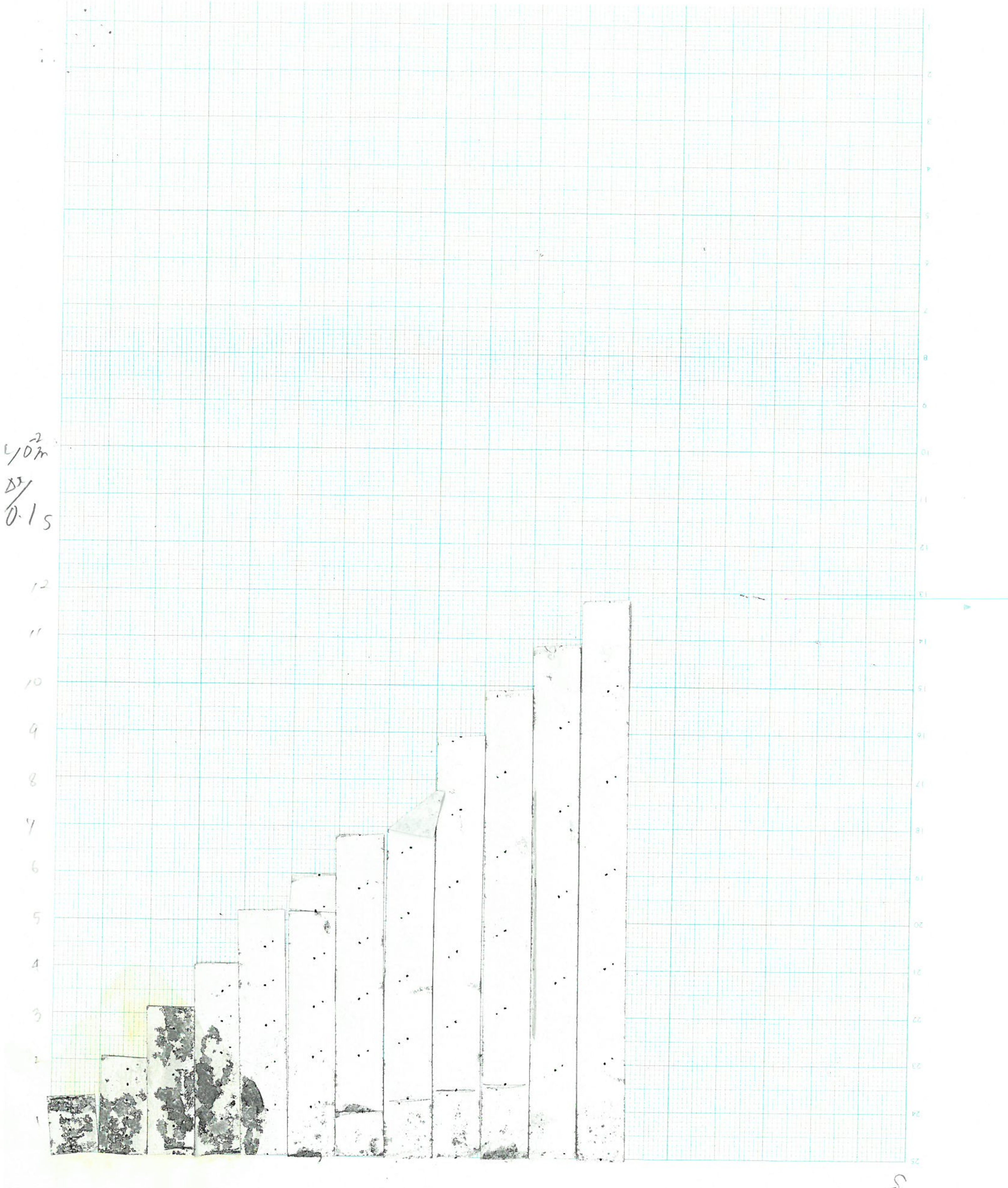

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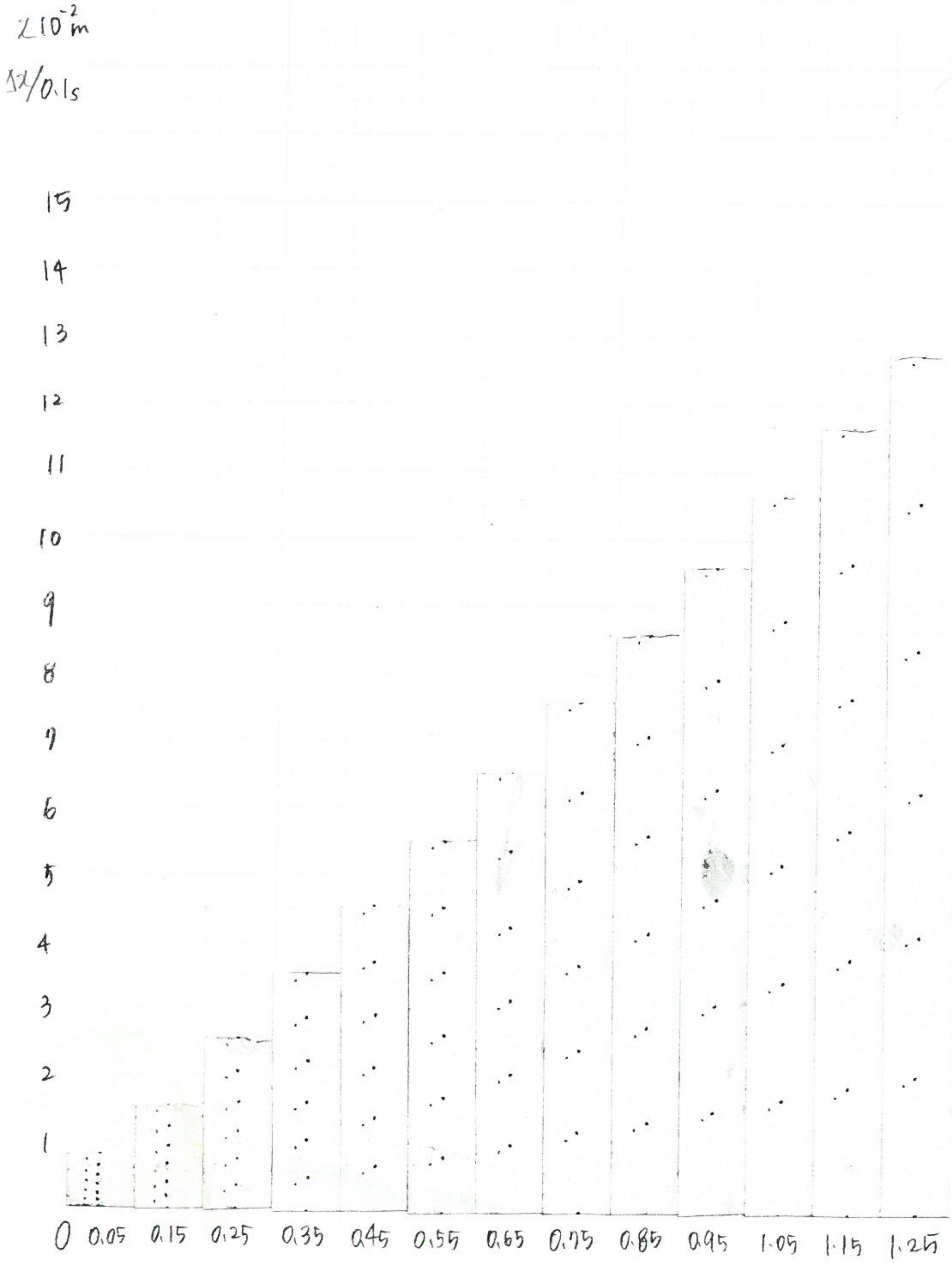

x10⁻²m
Δx/0.1s
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.05
0.15
0.25
0.35
0.45
0.55
0.65
0.75
0.85
0.95
1.05
1.15
1.25
t

4

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<Discussion >

As you can see from table 1 and 2, or table 3 and 4, there is a difference of mass but there is no big difference of their accelerations and they had same range of accelerations rate. Also as you can see from figure 1, the slope of the graph is very similar, there is no big difference, and has similar patterns. This means, the acceleration did not change by the mass. On the other hand, the acceleration changed when angles changed. When you think table 1 and 3, and 2 and 4 are pairs, there is a difference of the angle of the slope and the value of acceleration is different. Also as you can see from figure 1, slope with steep angles are much faster and displaced a lot from the start point than the slope with gentle angle. As a result, the slope with steeper angles cause the acceleration rate grater, but the slope with gentle angles cause the acceleration rate smaller. In additionally, I learned that we should obtain the value of acceleration from the slope of the line in graphs, not from only points in the tables because it is not accurate.

<Conclusion >

The acceleration does not change by the weight of the object but the angle of the slope affect a lot in acceleration. This movement of a cart is a constant acceleration motion.

<Opinion >

This was my first time to do experiment and write a lab report, so I was worried about whether I can work smoothly. However, the website of the physics class helped me and I was able to organize information and conclude my opinion. In this lab, I made some errors so I'll try to make more accurate value in next lab. It was very interesting to learn physics by not just sitting and taking a note in class. I would like to improve my skills to organize and conclude my opinion through physics experiment.

Reference

Lab Report of Ryo Sakai
Lab Report of Nagisa Shionoya