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

Laboratory Report Cover for #1 Lab

Title Analyzing the Accelerating Motion with a Spark timer

Homeroom	Section	Name	
11-0	II	Fukutaro Nakashiro	

Lab Partners Kisuke Uchimmi

Summary

This lab's purpose was to find the correlation between acceleration rate and angle of slope / weight of object. The result of the experiment was that the heavier the object and steeper the slope is, it will have a higher acceleration rate. Personally, it lead to a creation of another hypothesis, "Friction is the cause that objects with different weights have different acceleration rates"

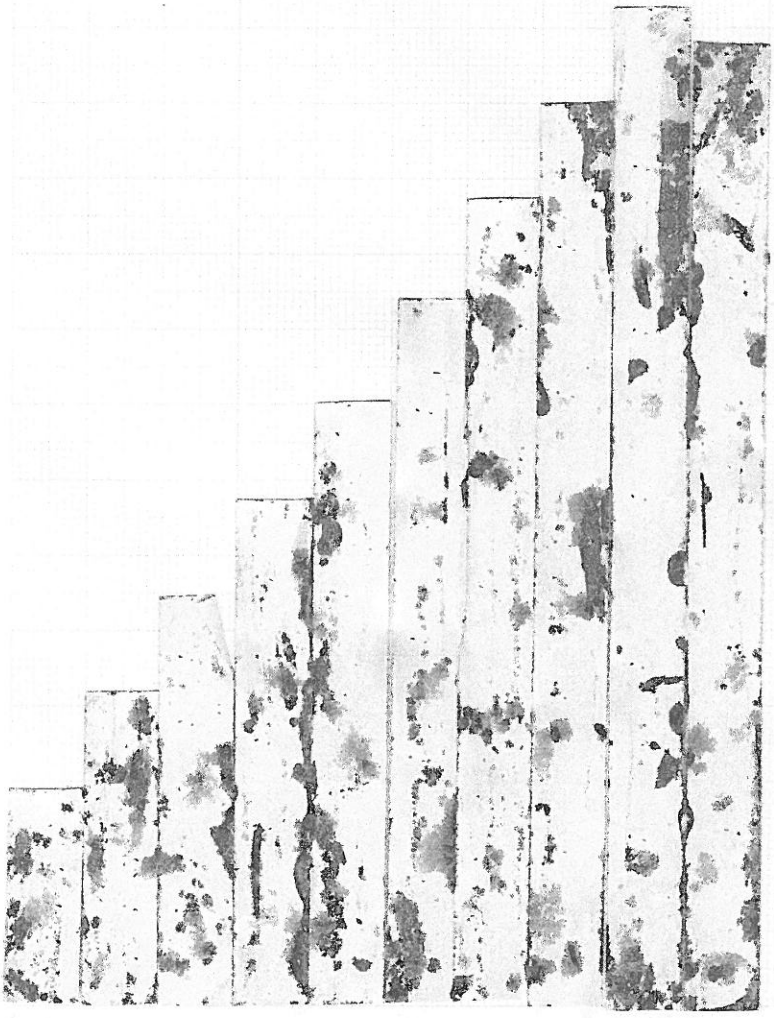
・Meet a deadline ・Write logically ・Write clearly ・Write with your own words

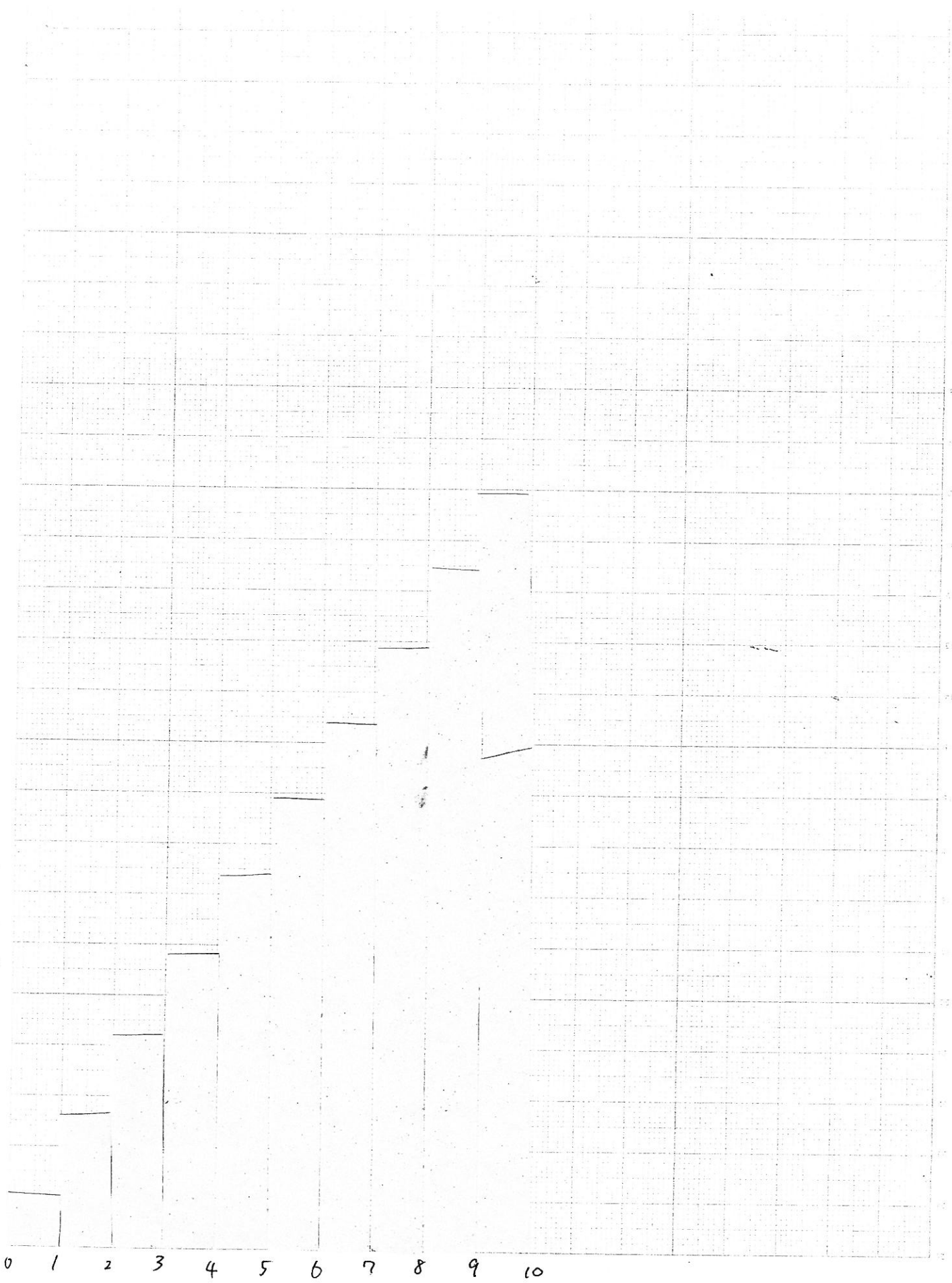
Teacher's Comments

Good data table, beautiful graphs and clear and reasonable discussion. No need to connect the data points with the origin in the v-t graph.

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

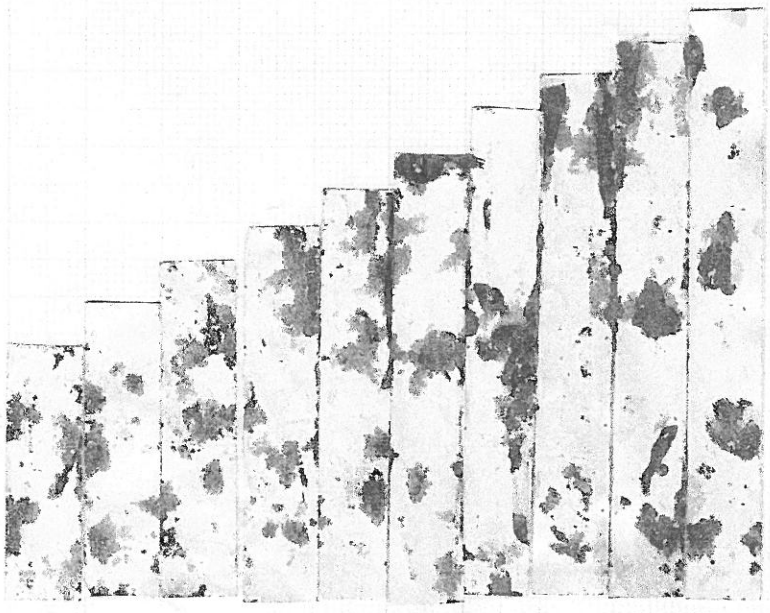
* Use this form as a cover sheet.
* Submit your reports by the seventh day after your lab.

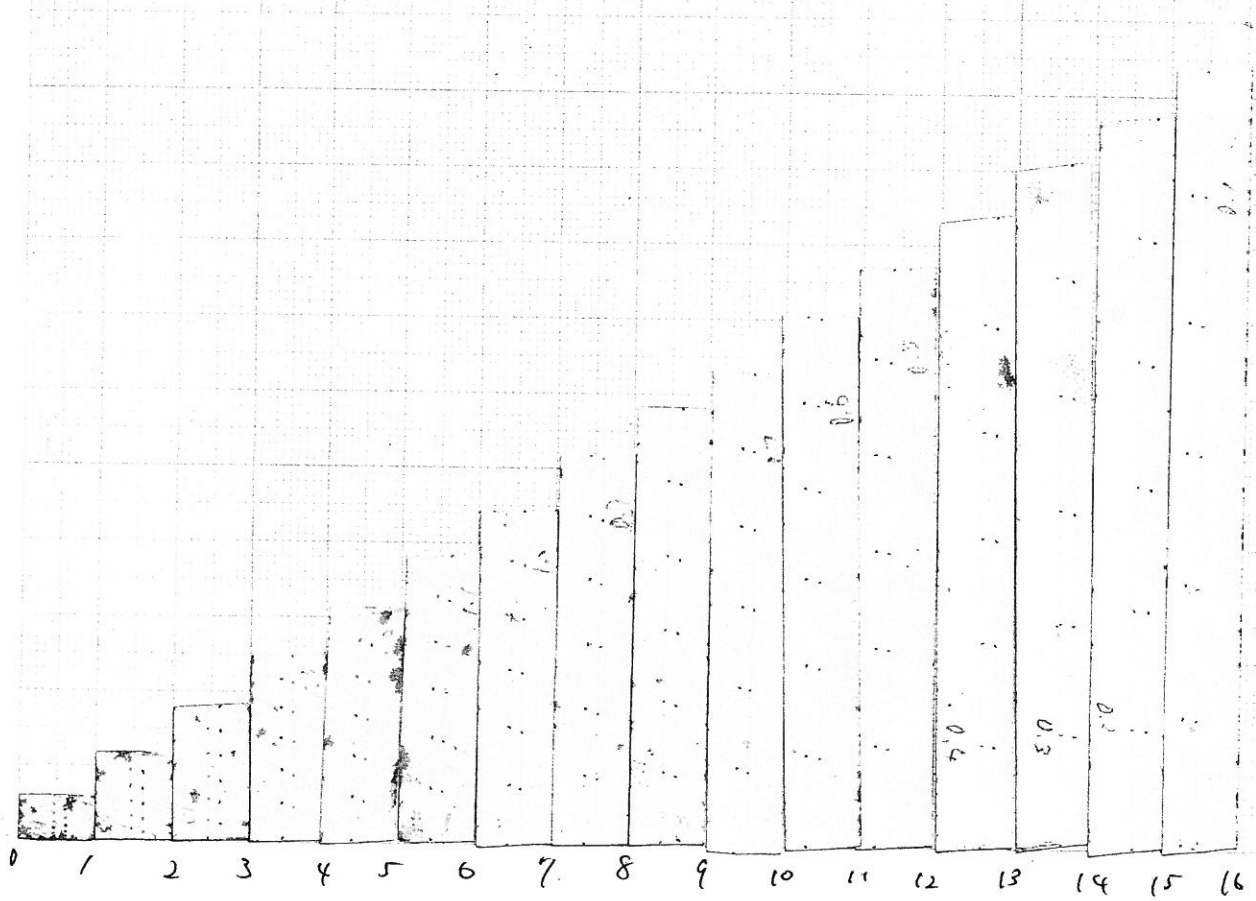




(a)

Time ($\times 10^{-1}$ seconds)




0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Time (x 10^{-1} seconds.)
Displacement (x 10^{-2} m)

(A)

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Analyzing the Accelerating Motion with a Spark Timer

Results:

Condition: $\theta = 11.1°$, No weight

Time t [s²]	0	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900
Displacement χ [$\times 10^{-2}$m]	0	2.80	6.95	12.35	19.05	26.95	36.32	49.90	58.80	72.05
Displacement per 0.100s $\Delta\chi$ [$\times 10^{-2}$m]		2.80	4.15	5.40	6.70	7.90	9.37	10.58	11.90	13.25
Average Velocity v [$\times 10^{-2}$m/s]		28.0	41.5	54.0	67.0	79.0	93.7	105.8	119.0	132.5
Time at central point t [s]		0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85

Condition: $\theta = 11.1°$, With 750g weight

Time t [s²]	0	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900
Displacement χ [$\times 10^{-2}$m]	0	1.10	3.70	7.85	13.65	20.99	29.82	40.20	52.06	65.46
Displacement per 0.100s $\Delta\chi$ [$\times 10^{-2}$m]		1.10	2.60	4.15	5.80	7.34	8.83	10.38	11.86	13.40
Average Velocity v [$\times 10^{-2}$m/s]		11.0	26.0	41.5	58.0	73.4	88.3	103.8	118.6	134.0
Time at central point t [s]		0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85

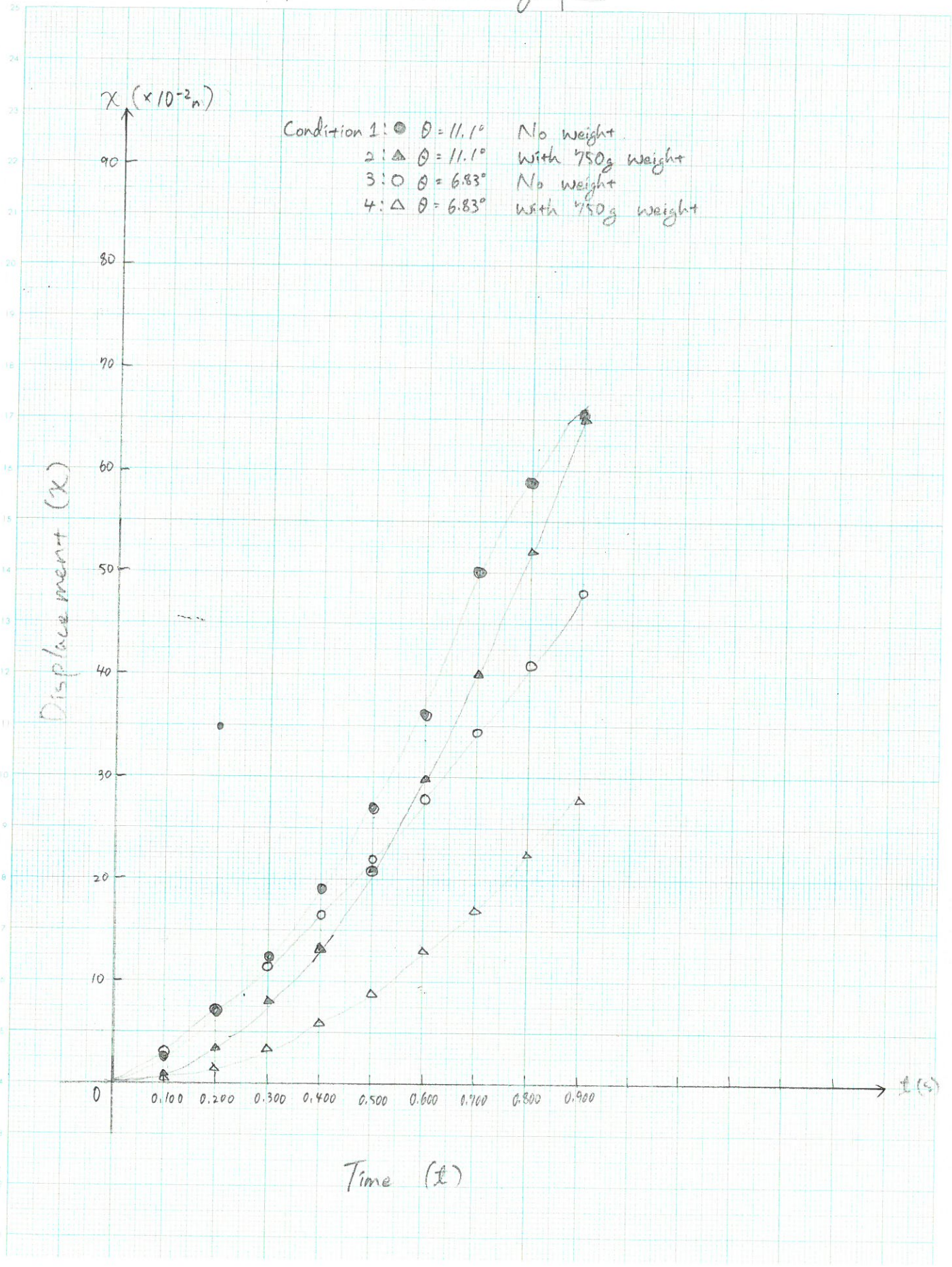
Condition: $\theta = 6.8°$, No weight

Time t [s²]	0	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900
Displacement χ [$\times 10^{-2}$m]	0	3.40	7.30	11.75	16.70	22.15	28.13	34.53	41.39	48.71
Displacement per 0.100s $\Delta\chi$ [$\times 10^{-2}$m]		3.40	3.90	4.45	4.95	5.45	5.98	6.40	6.86	7.32
Average Velocity v [$\times 10^{-2}$m/s]		34.0	39.0	44.5	49.5	54.5	59.8	64.0	68.6	73.2
Time at central point t [s]		0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85

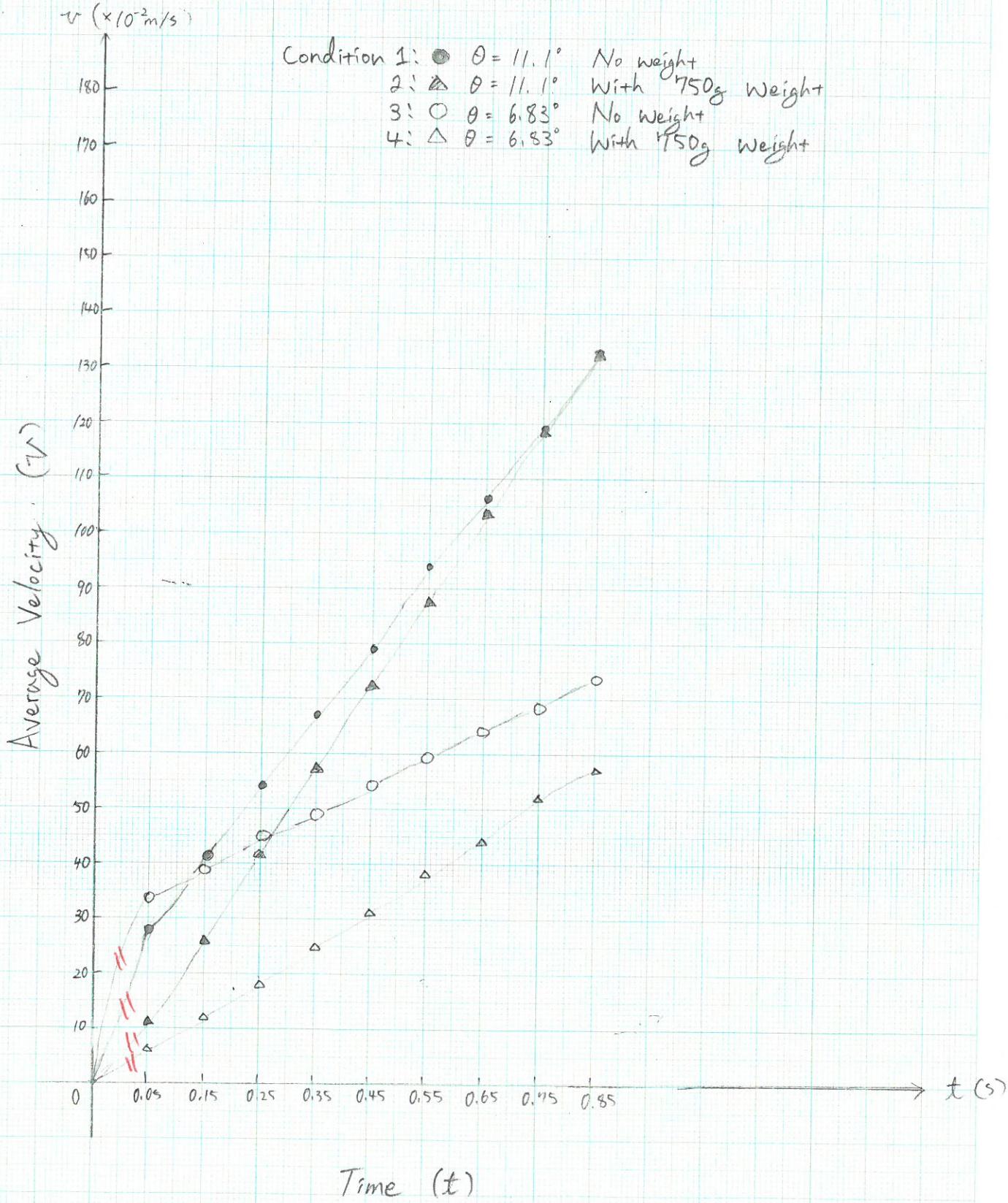
Condition: $\theta = 6.8°$, With 750g weight

Time t [s²]	0	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900
Displacement χ [$\times 10^{-2}$m]	0	0.60	1.78	3.58	6.06	9.18	12.96	17.36	22.52	28.25
Displacement per 0.100s $\Delta\chi$ [$\times 10^{-2}$m]		0.60	1.18	1.80	2.48	3.12	3.78	4.40	5.16	5.73
Average Velocity v [$\times 10^{-2}$m/s]		6.00	11.8	18.0	24.8	31.2	37.8	44.0	51.6	57.3
Time at central point t [s]		0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85

Graph - 1 [X - t graph]



Graph - 2 **V-t graph**



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Summary of Results

Condition:	Angle (°)	Weight on the cart (g)	Acceleration rate (m/s²)
1.	11.1°	0g	1.30 m/s²
2.	11.1°	750g	1.54 m/s²
3.	6.83°	0g	0.49 m/s²
4.	6.83°	750g	0.64 m/s²

Discussion:

My initial hypothesis:

- The lesser the angle, the lower acceleration rate
- The heavier the object, the higher acceleration rate

From the "Summary of Results", I was able to accept both hypotheses. I noticed that the difference of acceleration rates between condition 1 and 2, 3 and 4 were quite close. Meaning that even if one changes the weight of the object, the acceleration rate won't change significantly. On the other hand, the difference of acceleration rates between condition 1 and 3, 2 and 4 differed quite a lot. Meaning that if one changes the angle of the slope, the acceleration rate of the object will change a lot. As Dr. Moritani taught us, in Galileo's experiment, objects of different weight (mass) in free fall reach the ground at the same time. However, this result seems to differ when an object is on a slope. My guess is that it is the friction that causes the change. The heavier the object, the more resistance it can cancel out, leading to a higher acceleration rate.

Opinion:

Personally, I regret that I made a mistake in determining the start point for the thermostat papers. Luckily, the results didn't really change that much, except for the beginning. The graph looks a little awkward in the beginning at 0 to 0.05 interval, but the acceleration rate was fine.

Tatsuki