Date of Lab 9/25/19 Date of Submission 10/2/19

Laboratory Report Cover for #12 Lab

Title Analyzing the Accelerating Motion with a Spark Timer

Homeroom	Section	Name	
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Summary
It was my first time to use a spark timer. A spark timer is used to make accurate time and distance measurements for a moving object. The timer will make a series of dots and also there are spaces between dots. I learned that these spacings are important for us to focus. The timer can be set at either 1/60 of a second or 1/10 of a second. This time we used 60 Hz. This means that there will be 6 dots in 0.10 second. As we see the tape, the dots get farther and farther apart in the beginning and we could know that the car is speeding up. We could do this lab fast & accurately but one thing we missed is when we cut the thermosentive tape for graph. We had to cut it for 6 points but we made one of them 7 so the graph went wrong. I want to improve this mistake by next lab.

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

Good summary

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

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PhysicsLab-001	Analyzing the Accelerating Motion with a Spark Timer

Example

Time t [s]	0	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900	
Displacement x [x 10^{-2} m]	0	2.35	6.25	11.65	18.60	27.15	37.24	48.85	61.95	76.65	
Displacement per 0.100 s Δx [x 10^{-2} m]	2.35	3.90	5.40	6.95	8.55	10.09	11.61	13.10	14.70		
Average velocity v [x 10^{-2} m/s]	23.5	39.0	54.0	69.5	85.5	100.9	116.1	131.0	147.0		
Time at central point t [s]	0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85		

① Condition: No weight.

Time t [s]	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Displacement x [x 10^{-2} m]	0	2.50	5.80	13.90	24.40	32.40	41.80	52.80	67.20	81.00	96.40
Displacement per 0.100 s Δx [x 10^{-2} m]	2.50	3.30	5.10	6.50	8.00	9.40	11.00	12.40	13.80	15.40	
Average velocity v [x 10^{-2} m/s]	25.0	33.0	51.0	65.0	80.0	94.0	110.0	124.0	138.0	154.0	
Time at central point t [s]	0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	0.95	

② Condition: 3 weight.

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	1.30	4.30	8.80	14.70	22.20	31.30	41.90	54.00	69.90
Displacement per 0.100 s Δx [x 10^{-2} m]	1.30	3.00	4.50	5.90	7.50	9.10	10.6	12.1	13.9	15.3
Average velocity v [x 10^{-2} m/s]	13.0	30.0	45.0	59.0	75.0	91.0	106.0	121.0	139.0	153.0
Time at central point t [s]	0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	0.95

③ Condition: lower angle / No weight.

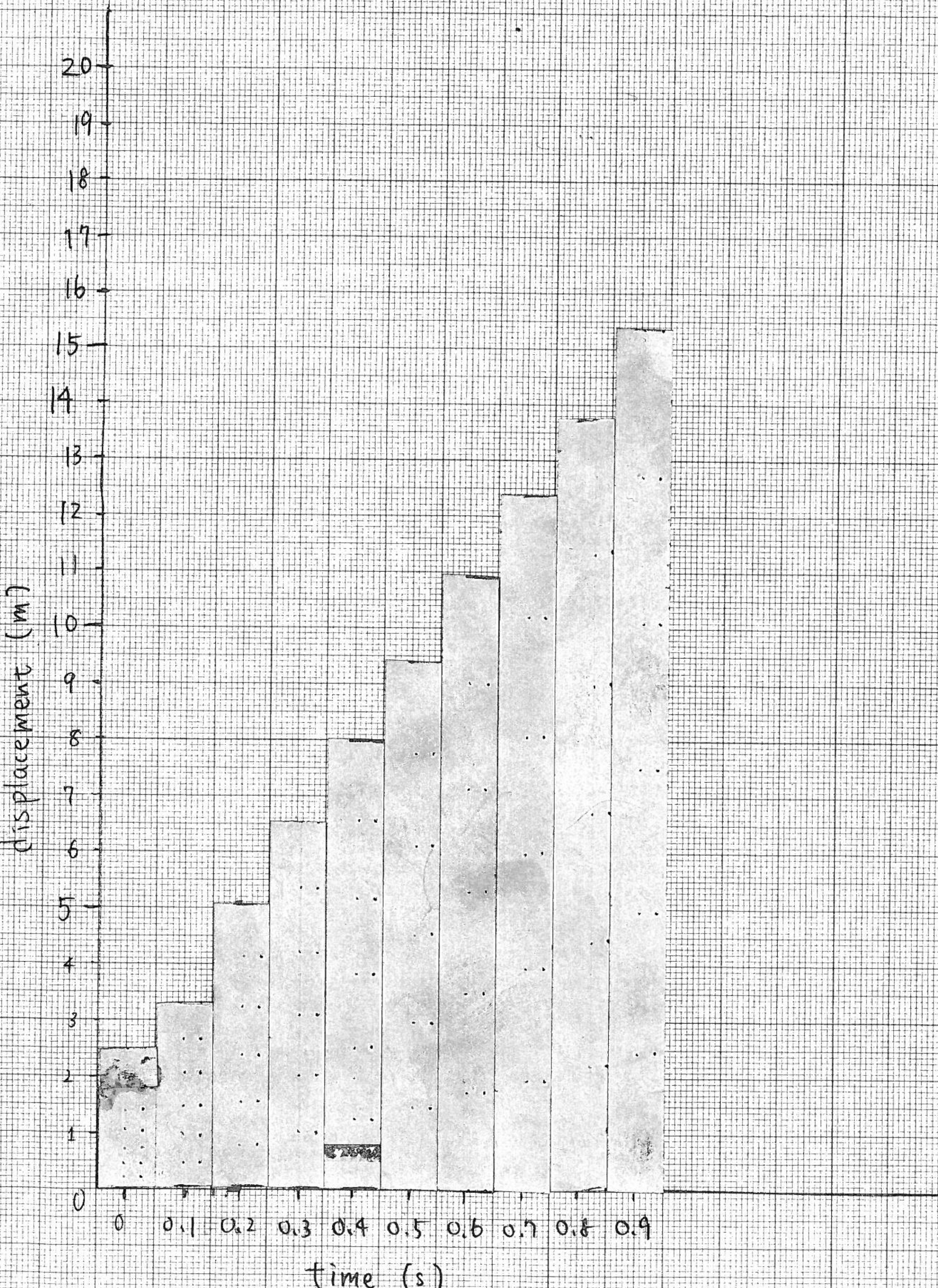
Time t [s]	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Displacement x [x 10^{-2} m]	0	1.40	3.90	7.40	12.00	17.60	24.30	32.10	41.00	51.00	61.90
Displacement per 0.100 s Δx [x 10^{-2} m]	1.40	2.50	3.50	4.60	5.60	6.70	7.80	8.90	10.00	10.90	
Average velocity v [x 10^{-2} m/s]	14.0	25.0	35.0	46.0	56.0	67.0	78.0	89.0	100.0	109.0	
Time at central point t [s]	0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	0.95	

④ Condition: lower angle / 3 Weight.

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	1.30	3.80	7.40	12.20	18.20	25.30	33.60	43.20	53.90
Displacement per 0.100 s Δx [x 10^{-2} m]	1.30	2.50	3.60	4.80	6.00	7.10	8.30	9.60	10.70	
Average velocity v [x 10^{-2} m/s]	13.0	25.0	36.0	48.0	60.0	71.0	83.0	96.0	107.0	
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:

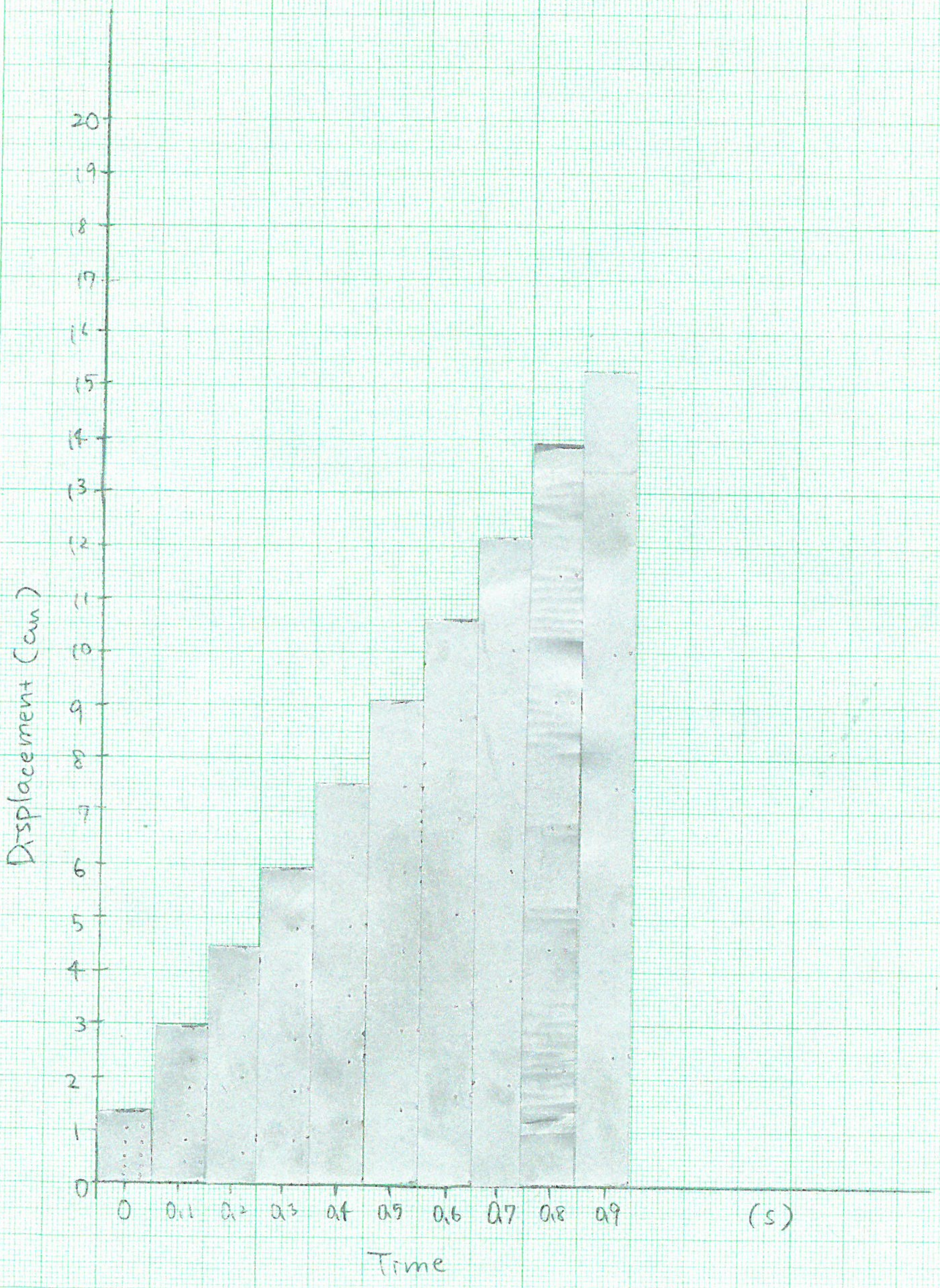
Time t [s]										
Displacement x [x 10^{-2} m]										
Displacement per 0.100 s Δx [x 10^{-2} m]										
Average velocity v [x 10^{-2} m/s]										
Time at central point t [s]										



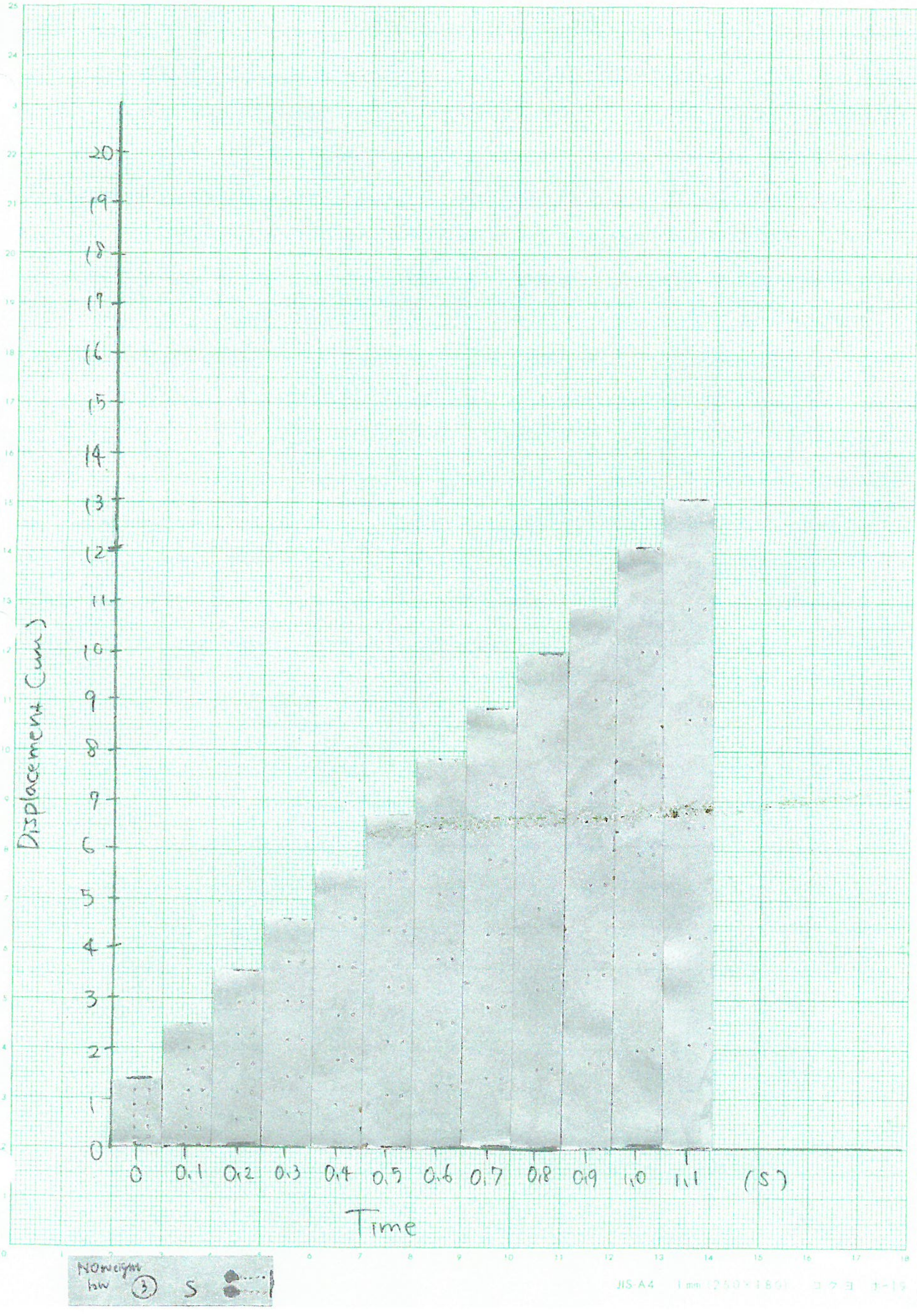
① s

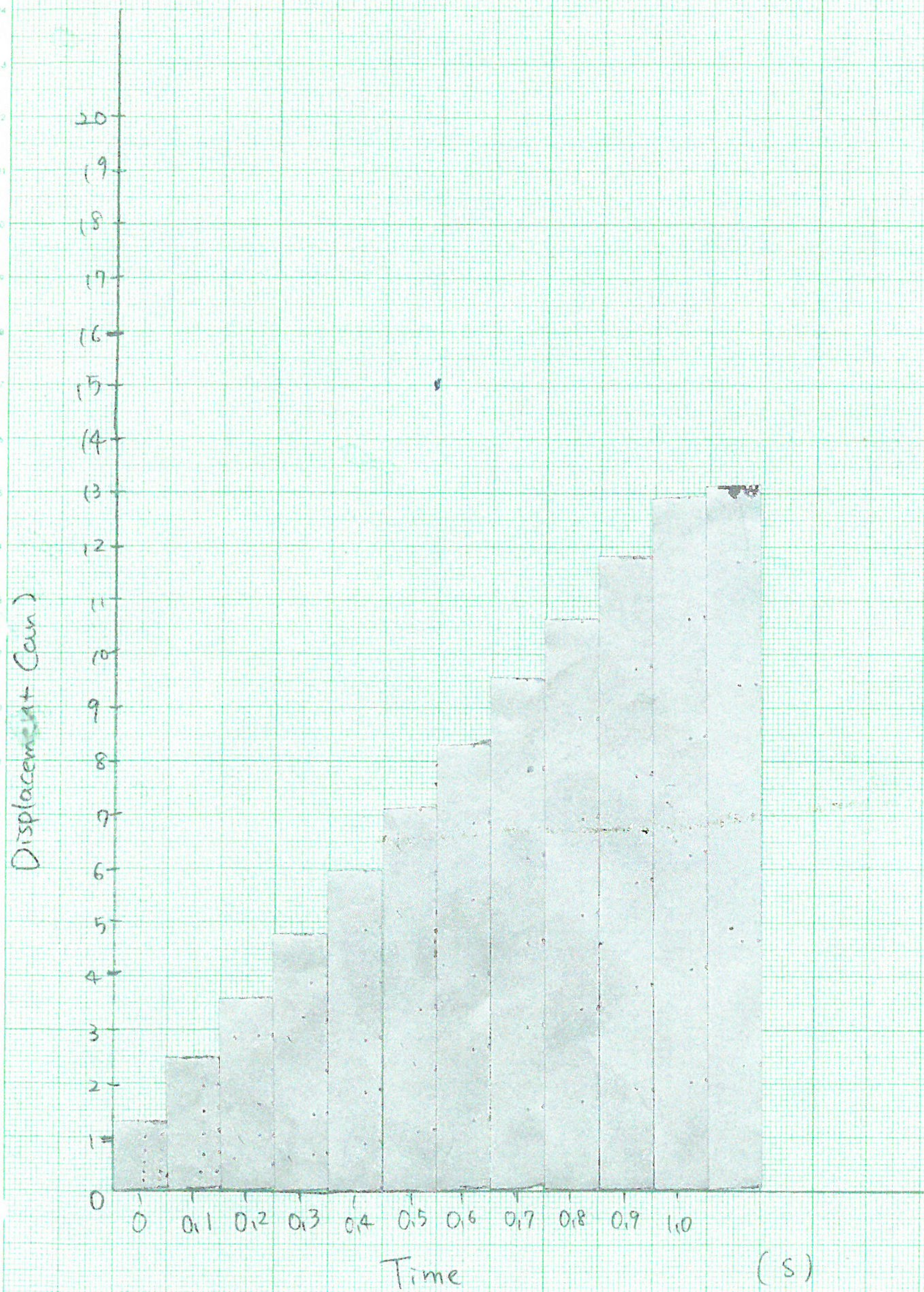
lab1 highest / No weight

JIS-A4 1mm 250×180 コクヨ ホ-19

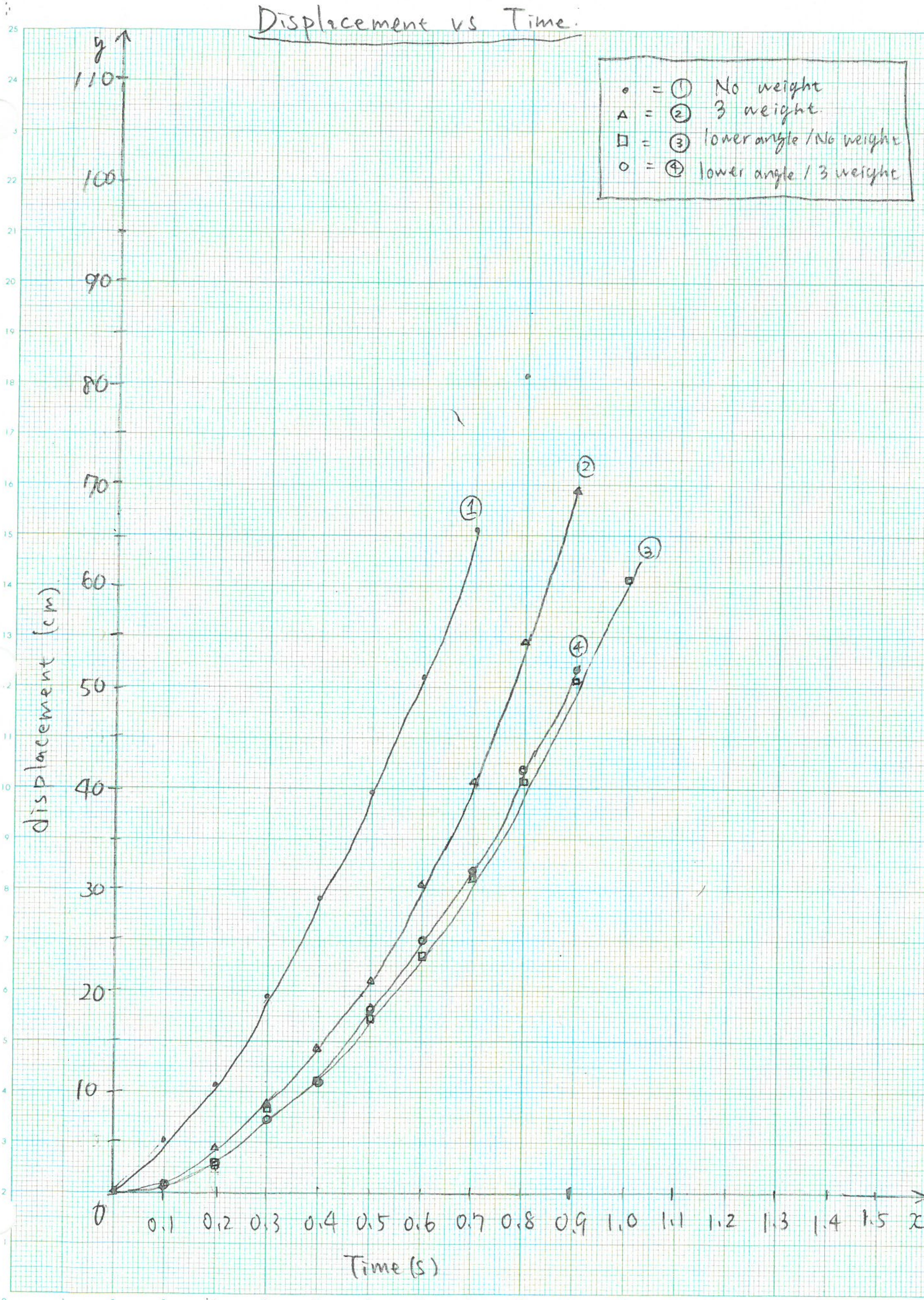


Displacement (cm)
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
(s)
Time

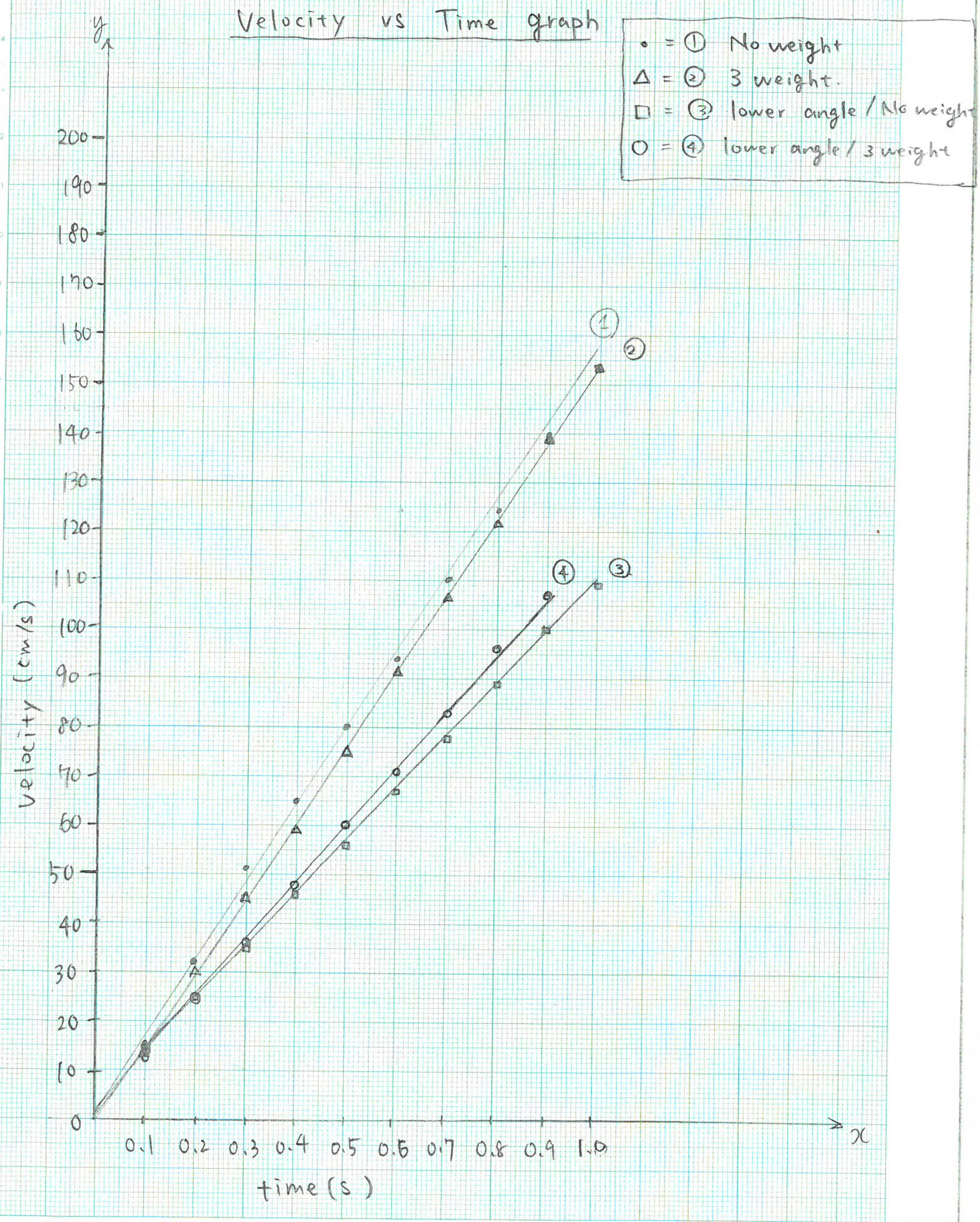

Displacement (cm)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
(S)
Time
No weight
hw ③ S



Displacement (cm)
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Time
(s)



Displacement vs Time.
• = ① No weight
Δ = ② 3 weight
□ = ③ lower angle / No weight
○ = ④ lower angle / 3 weight
y
110
100
90
80
70
60
50
40
30
20
10
0
displacement (cm)
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
x
Time (s)
①
②
③
④


Velocity vs Time graph
• = ① No weight
△ = ② 3 weight.
□ = ③ lower angle / No weight
○ = ④ lower angle / 3 weight
Velocity (cm/s)
time (s)
y
x
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
①
②
③
④

Result Table

	weight	angleθ	acceleration
experiment1	no	28°	(154.0-0)/(0.95-0)=162~~m~~cm/s^2
experiment2	3 weight	28°	(153.0-0)/(0.95-0)=161~~m~~cm/s^2
experiment3	no	23°	(109.0-0)/(0.95-0)=115~~m~~cm/s^2
experiment4	3 weight	23°	(107.0-0)/(0.85-0)=125~~m~~cm/s^2

Summary of Results

The acceleration of the carriage does not correlate with mass, but the slope correlates. The v-t graph is also a straight line, and it can be said that the car motion was a linear motion with constant acceleration. Although there were errors in theoretical value, the conclusion was almost as hypothesized.

Discussion

I experimented with the change in acceleration when measured with a car with and without added weights, and changed the rail slope. From the graph, it is considered that the more the angle of the slope becomes steeper, the higher the acceleration. The results were similar with and without a weight, therefore mass was not related to the acceleration.

Opinion

Since it was the first experiment in 11th grade, accurate data measurement and effective figures were still unfamiliar and difficult. It was a good opportunity to review what I learned in class in front of the actual examples. I thought that physics would not only solve the problem, but deepen understanding by actually experimenting. I was surprised that the mass is not related to acceleration.