10

Date of Lab 9/26/18 Date of Submission 10/3/18

Laboratory Report

Title

Analyzing the Accelarating Motion with a Spark Timer

Homeroom	Section	Name	
11-0	2		Ryo Enomoto

Lab Partners Kaito Igarashi

What did you learn?

In this lab, our goal was to look at how the velocity and the accelaration (acceleration) of the dynamic cart change by changing the slope and weight of the cart. To record the velocity, we used spark timer and calculated the velocity from what was on the recording tape. What we observed from the table was that change in slope made a difference in acceleration. On the other hand, we observed that the change in mass of a cart doesn't make any difference in acceleration. From this lab, we fand out that slope of the angle changed the accelaration and that mass of a cart doesn't affect the accelaration.

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

Teacher Comments

Good data, beautiful Graphs and reasonable discussion. I made a small correction about a v-t graph. a v-t graph line does not nessarily comes on the origin.

1	2	3	4	5	6	7	8	9
Due 提出期限	Summary 要旨	Intro. 序	Method. 方法	Results 結果 Table	Table/Fig. 表/図	Discussion 考察	Clearness わかりやすさ	General 全般

* Write your report in English * Use this form as a cover sheet.
* Submit your reports by the due day on your lab.

Introduction:

1. Objective:
    a. Record the movement of a Dynamics Cart descending on a slope to obtain the acceleration
    b. To experiment the relationships between acceleration and mass
2. Theory and Past knowledge:
    a. Before doing this experiment, I knew from Galileo's experiment that mass of the object doesn't affect the velocity when they are dropped, only in a case where there are no air resistance.
3. Hypothesis:
    a. The movement of a cart is constant-acceleration motion.

Experimental:

1. Material Used:
    a. Spark Timer
    b. Dynamic Cart (540g)
    c. Weights (250g each)
    d. Track
    e. Scale
    f. Wood board
    g. Cramp
    h. Extension cord
    i. Scissors
    j. Glue
    k. Graph Paper
    l. Thermal Recording Tape
    m. Ruler
2. Procedure:
    a. Measure the Angle by calculating
    b. Set Dynamic Cart on the rail
    c. Put the Thermal Recording tape in the Spark Timer and attach them to the cart
    d. Turn the Spark Timer on
    e. Let Dynamic Cart go
    f. Measure the point on the Thermal Recording tape
    g. Record the data on the chart
    h. Repeat this step with putting three weights on Dynamic Cart, less steeper angle with no weights on Dynamic Cart, and less steeper angle with three weights on Dynamic Cart.

Experiment 1: θ=10° Acceleration = 1.58m/s² Mass: 540g

Time(s)	0	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900
Displacement (x)	0	0.45	3.44	7.54	13.5	20.24	24.04	34.33	51.20	64.65

Displacement / 0.001 s	0.95	2.44	4.1	5.56	7.14	8.8	10.24	11.87	13.45	
Average Velocity (10^{-2}m/s)	9.5	24.4	41.0	55.6	71.4	88.0	102.4	118.7	134.5	
Time at central point (s)	0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	

Experiment 2: θ=10° Acceleration = 1.74m/s² Mass: 790g

Time(s)	0	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900
Displacement (x)	0	1.91	4.43	9.65	16.08	24.25	34.1	46.08	59.29	74.11

Displacement / 0.001 s	1.91	3.02	4.72	6.43	8.17	9.85	11.48	13.21	14.82	
Average Velocity (10^{-2}m/s)	19.1	30.2	47.2	64.3	81.7	98.5	114.8	132.1	148.2	
Time at central point (s)	0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	

Experiment 3: θ=6.5° Acceleration = 0.745 m/s² Mass: 540g

Time(s)	0	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900
Displacement (x)	0	0.66	2.08	4.14	7.06	10.65	14.42	19.85	25.46	31.79

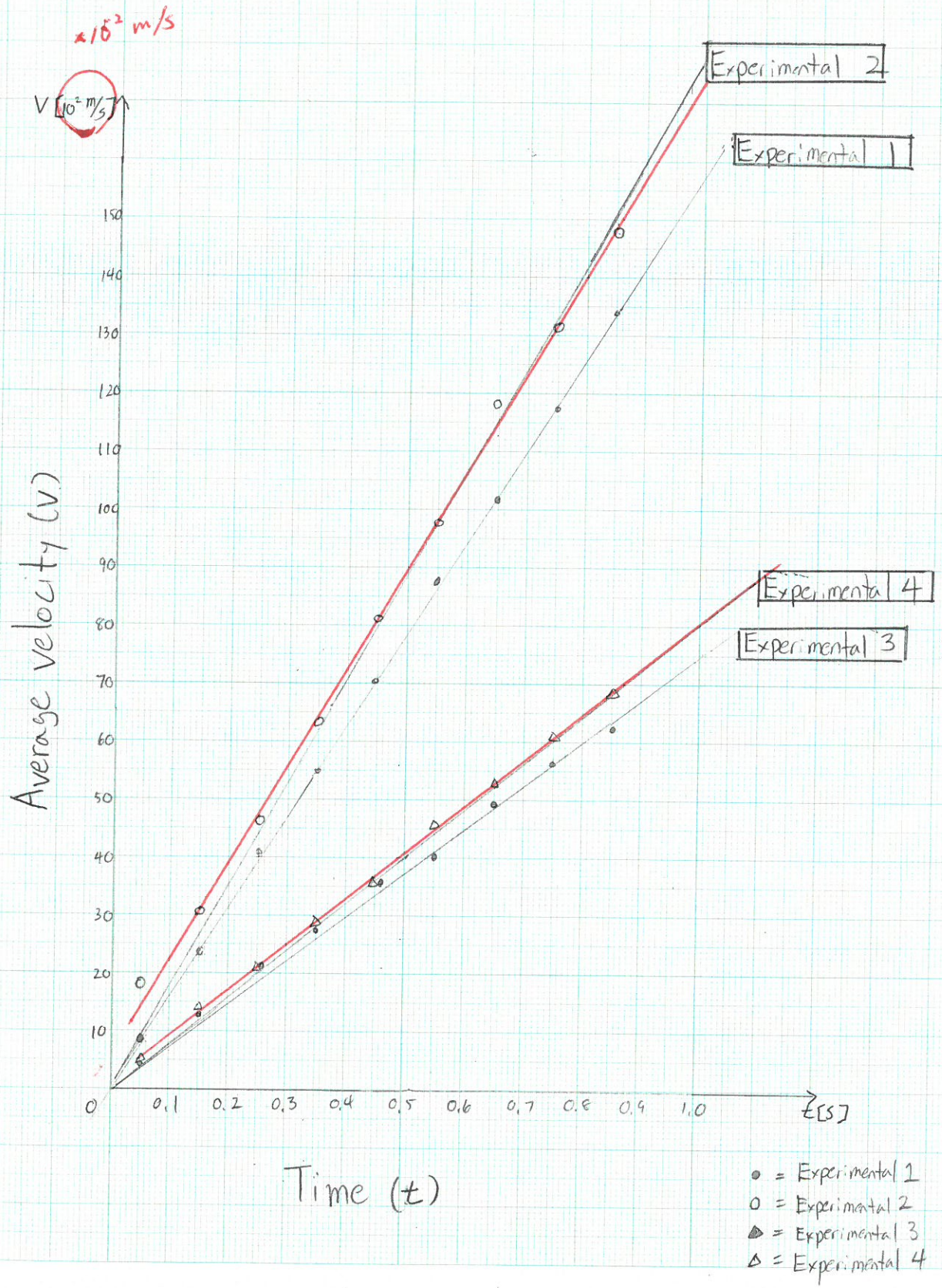
Displacement / 0.001 s	0.66	1.42	2.11	2.87	3.54	4.27	4.43	5.61	6.33	
Average Velocity (10^{-2}m/s)	6.60	14.2	21.1	28.7	35.4	42.7	44.3	56.1	63.3	
Time at central point (s)	0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	

Experiment 4: θ=6.5° Acceleration = 0.811 m/s² Mass: 790g

Time(s)	0	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900
Displacement (x)	0	0.61	1.41	4.09	7.00	10.65	13.32	20.55	26.56	33.45

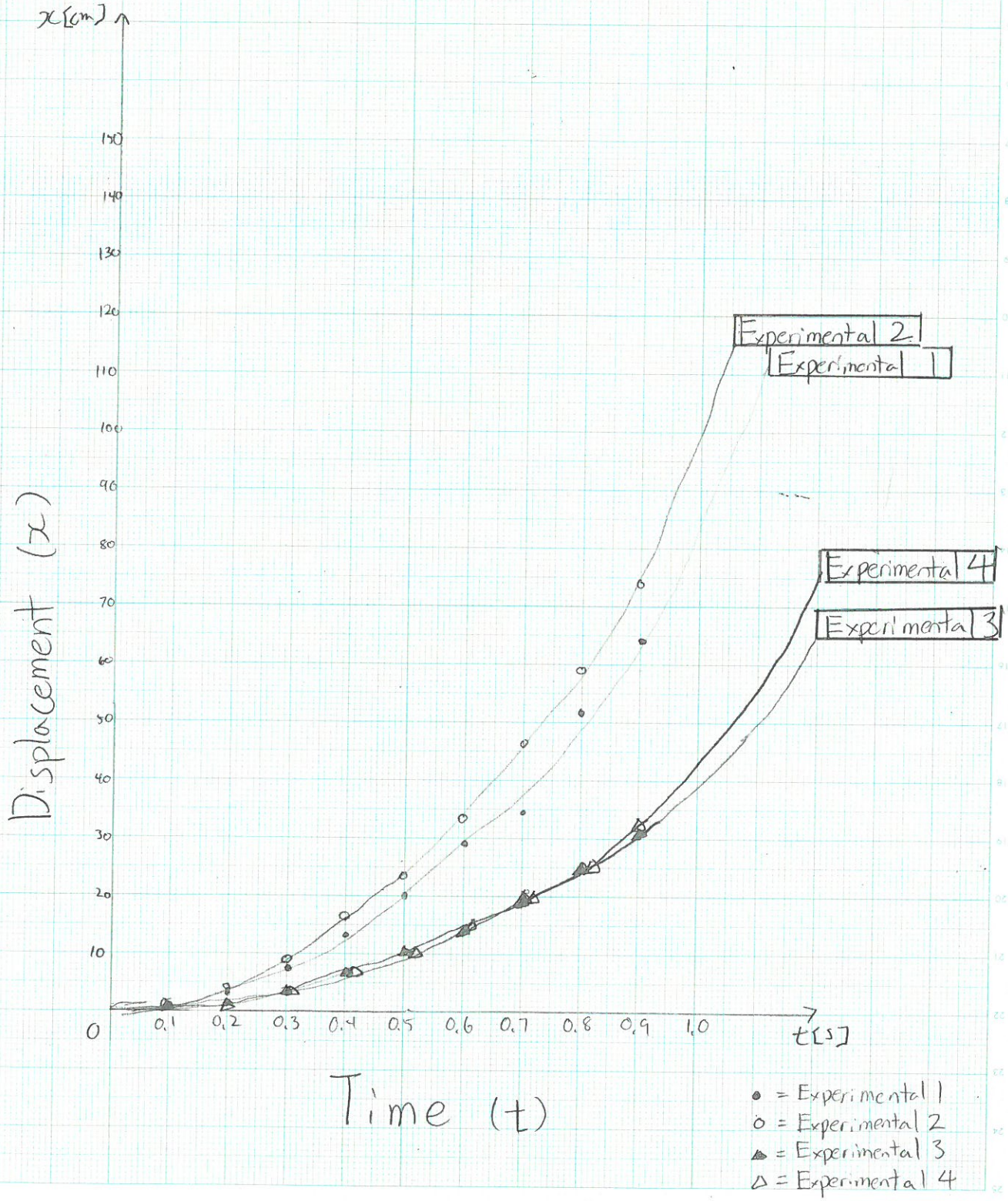
Displacement / 0.001 s	0.61	1.3	2.18	2.91	3.65	4.67	5.23	6.01	6.85	
Average Velocity (10^{-2}m/s)	6.1	13.0	21.8	29.1	36.5	46.7	52.3	60.1	68.5	
Time at central point (s)	0.05	0.15	0.25	0.35	0.45	0.55	0.65	0.75	0.85	

Graph 1 Velocity vs Time



Graph 2

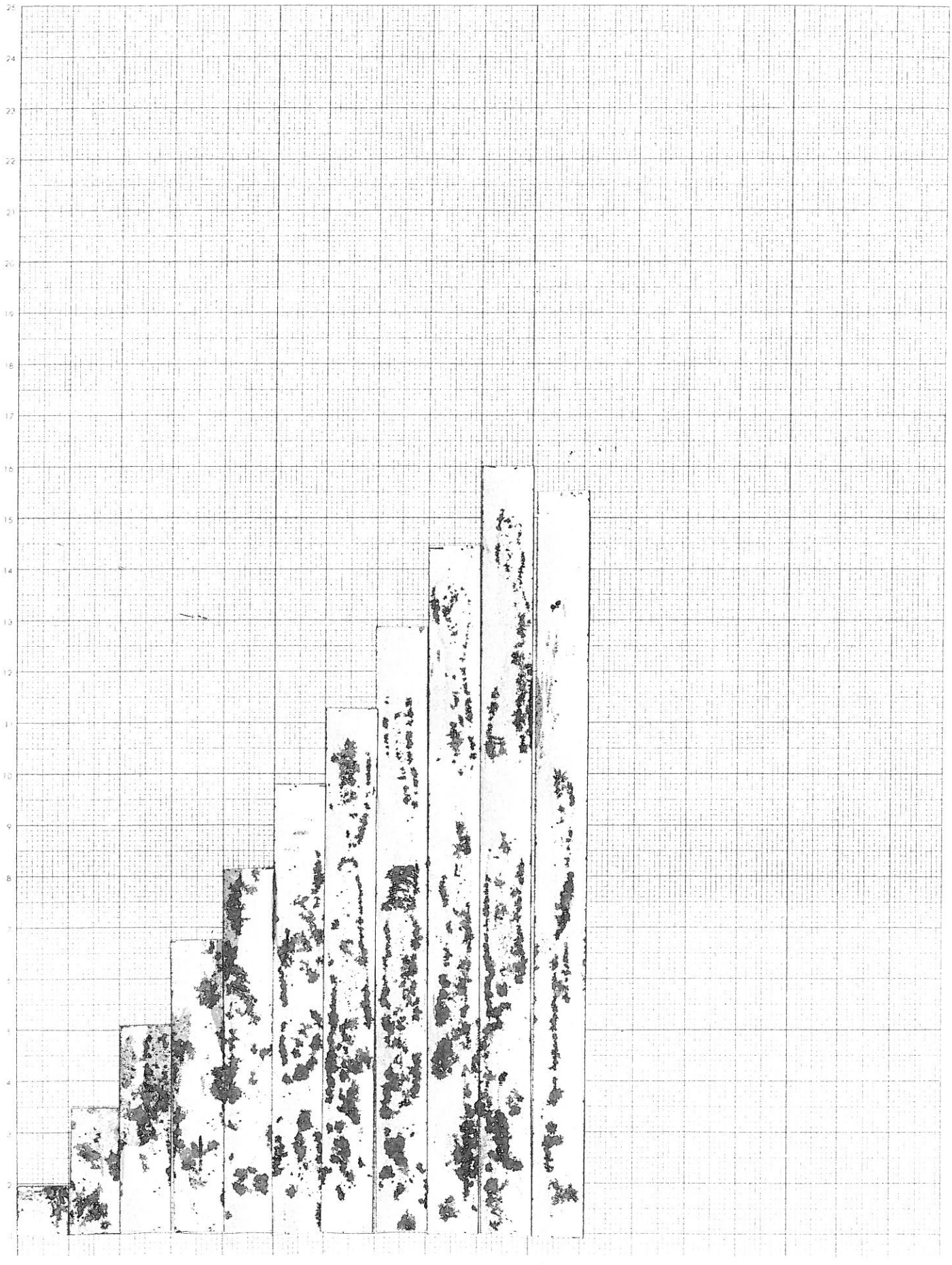
Displacement vs Time



Experiment 1

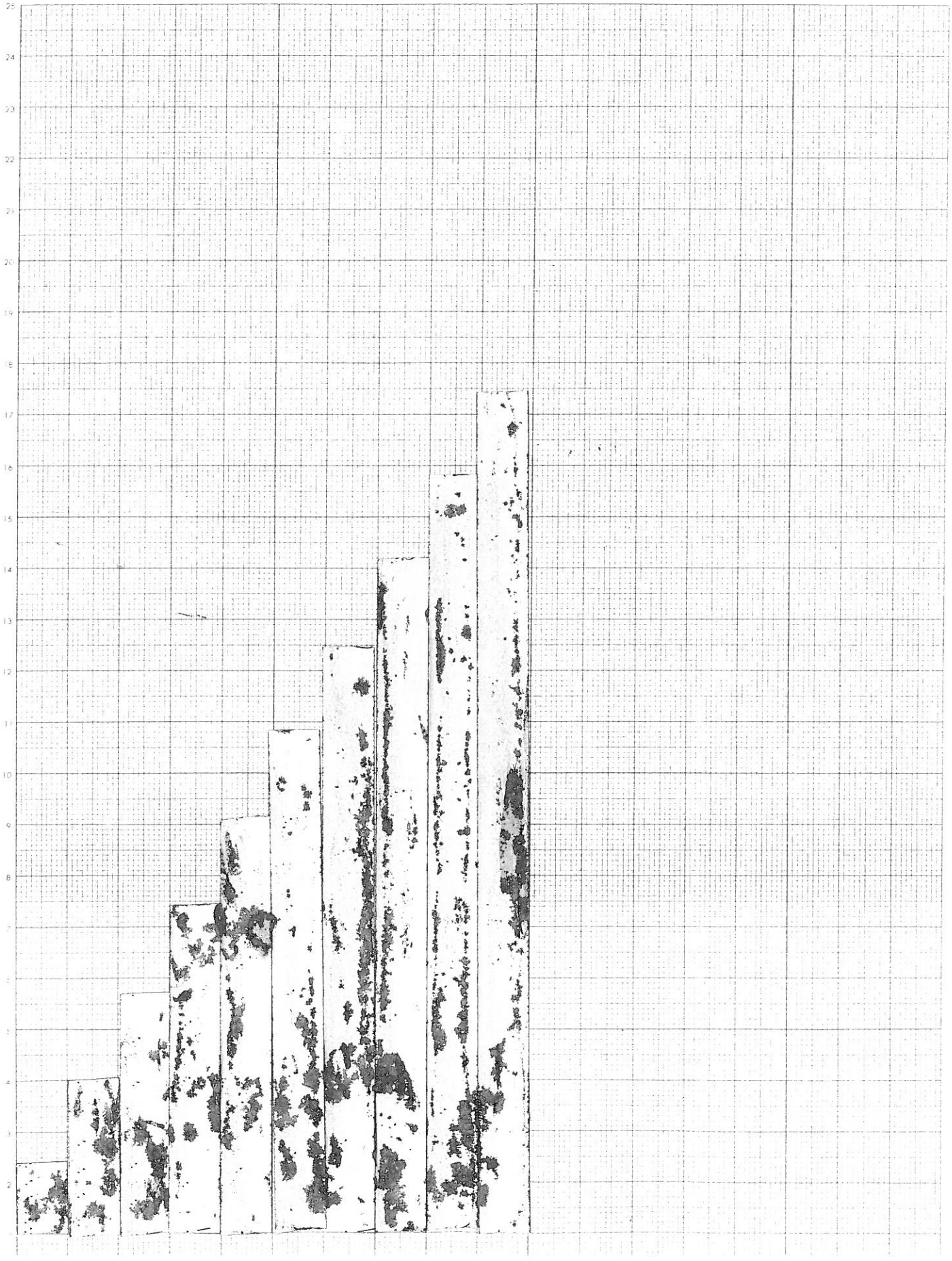
K.Z

R.E



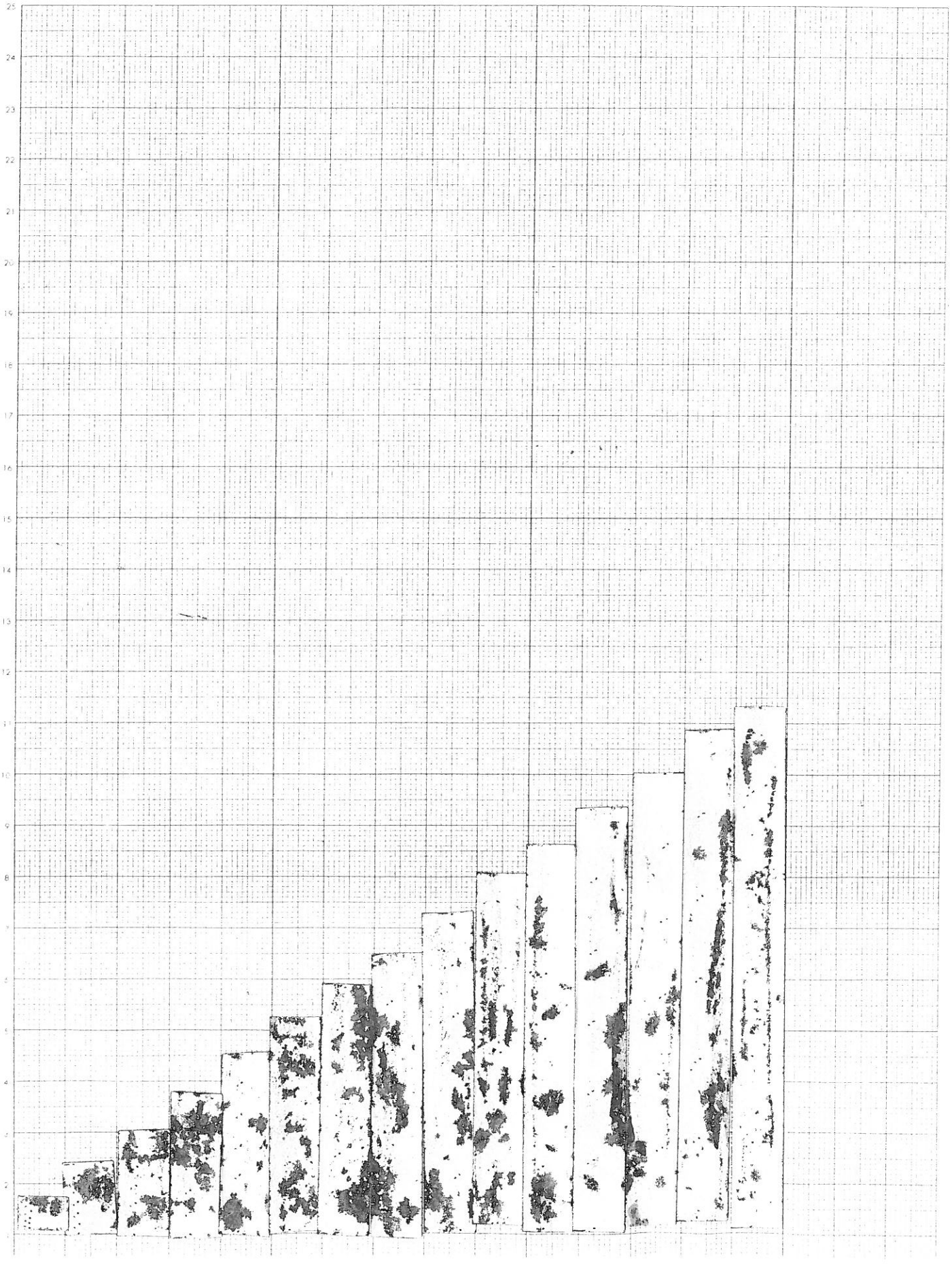
Experiment 2

K.I
R.E



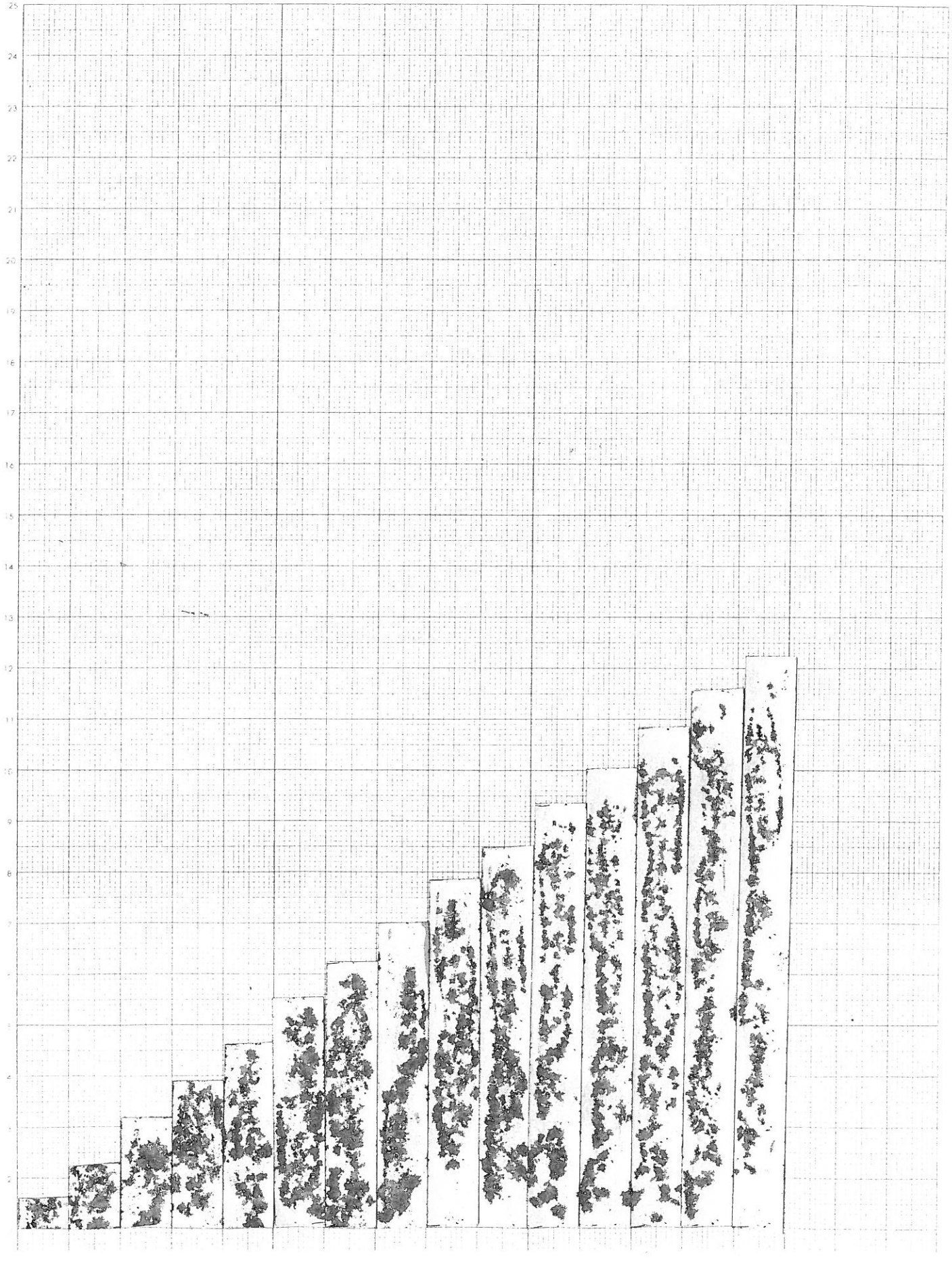
K.1

Experiment 3 R.E



K.I

Experiment 4 R.E



Results:

Experiment 1 and 2: Height (h)=18 Length (L)=102
Experiment 3 and 4: Height (h)=11.4 Length (L)=104

Experiment	Angle (°)	Weight (g)	Acceleration Rate (m/s^2)
Experiment 1	10.00	540	1.58
Experiment 2	10.00	790	1.74
Experiment 3	6.473	540	0.745
Experiment 4	6.473	790	0.811

Discussion:

As we graph our result for the four experimentals, we could see that there are 2 sets of graph that are similar. They are experimental 1 and 2, and experimental 3 and 4. What we did differently in the sets of the two line is that they had different weight but same angle. From this data, we can tell that the mass of an object doesn't effect the constant acceleration. On the other hand, slope made a difference between the two pairs. Cart on the steeper slope displaced much faster than it on the more gradual slope.

Moreover, in all of the experimentals, they are constantly accelerated. We can say this because as we look at the graph, velocity versus time graph showed a straight line. However, there was some point on the graph that didn't go on the straight lines. I think this is caused from how we did the experiment. If we had more accurate measurement, it might have fit the straight line. Also it is possible that some air resistance or humidity (causing the cart to descend slower with a friction between the air and the cart) affected our result.

From our result on the velocity versus time graph, we can say that our hypothesis was correct. To improve our experimental design, we should create vacuum to have no air resistance in this lab which would be impossible for us to create.

Conclusion:

The weight of the object does not affect its acceleration rate and the movement of a cart is in constant acceleration motion. Also change in the acceleration is caused by a change in the angles.

Opinion:

From this lab, I can make a connections to what I know about Galileo's experiment. He dropped the ball with different mass but landed at the same time. On this lab, we had different mass of cart and they descended from the slope at the same time. Overall, my hypothesis was correct. I wonder if we could get the same graph with perfect experimental conditions such as having a vacuum to get no air resistance.

Reference:

1. Lab Report of Sena Inoue (2017 E)
2. Lab Report of Sota Watabe (2017 E)
3. Lab Report of Kakeru Ito (2017 E)
4. Lab Report of Ryo Sakai (2017 E)
5. Lab Report of Nagisa Shionoya (2017 E)