Date of Lab 2/26/19 Date of Submission 3/5/19

Laboratory Report

Title Parallel Plate Capacitor

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Summary

When the area of the plates is increased the capacitance is increased, the data shows that the area of plate is directly proportional to the value of the capacitance.
On the other hand, when the separation of plates increased, the value of capacitance decreased.
It shows that the separation of plates is inversely proportional to the value of the capacitance.

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

Teacher's Comments

I wonder why the capacitance at $d = 6$ mm is so large.
Valuable data and graphs.

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.

12K Anju Hayakawa

Physics Lab-035

Parallel Plate Capacitor

■ Introduction

Specification

Area of plate	25x25cm 0.0625 m^2
Separation	3mm Clearance 5 places
Capacity(Air)	Apporoximately 200pF
Dielectrics (Glass, PVC, Paper Board)	3mm(thickness)
Framing paltes	Acrylic resin
Capacity Meter	5~3000 pF

■ Experiment

1) 9V batteries for the capacitance meter
2) Calibration
3) The measurement of potential difference between the plates
4) Changing the overlapping area, Dependency between A and C, Stray Capacitance(浮遊容量)
5) Changing the separation of plates, Dependency between d and 1/
6) The effects of dielectrics
7) Stray Capacitance, Connect insulated wire to the terminals of the capacitance meter.
8) Hand-made capacitor (more than 1000pF)

Theory

$C=\varepsilon_0\varepsilon_r\frac{A}{d}$

$\varepsilon_0=8.85\times10^{-12}C^2 / (N\cdot m^2)$

$\varepsilon_r=\frac{C'}{C}$

■ Result

A) No Dielectrics

C [$\times 10^{-12}$ pF]		A [$\times 10^{-4}$ m^2]									
		125		250		375		500		625	
		実験値	理論値								
D [$\times 10^{-3}$ m]	6	55	18.4	91	36.9	130	55.3	160	73.7	195	92.1
	9	30	12.2	40	24.5	60	36.8	70	49.1	80	61.4
	15	20	7.37	30	14.7	40	22.1	48	29.5	50	36.8

$$C = \varepsilon_0 \varepsilon_r \frac{A}{d} \quad \left[\varepsilon_r = 1 \quad \varepsilon_0 = 8.85 \times 10^{-12}\ C^2/(N \cdot m) \right]$$

From the Graph 2, we could get the value of the stray capacitance. The value of the stray capacitance is about 19, so we could write the Graph 3.

→ Graph 1, 2, 3

V [v]		A [$\times 10^{-4}$ m^2]				
		125	250	375	500	625
D [$\times 10^{-3}$ m]	6	5.28	4.93	4.70	4.42	4.11
	9	5.46	5.32	5.25	5.12	5.09
	15	5.52	5.45	5.40	5.30	5.25

The voltage didn't change too much.

However, when the area of plate increased, the value of voltage decreased. On the other hand, the separation of plates increased, the value of voltage increased.

B) Glass $\varepsilon_0 = 5.6$

C [$\times 10^{-12}$ pF]		A [$\times 10^{-4}$ m^2]				
		125	250	375	500	625
D [$\times 10^{-3}$ m]	6	200	300	400	500	600
	15	20	30	40	50	60

C-A : directly proportional
C-D : inversely proportional → Graph 4

V [V]		A [$\times 10^{-4}$ m^2]				
		125	250	375	500	625
D [$\times 10^{-3}$ m]	6	6,05	5,90	5,80	5,70	5,55
	15	5,45	5,42	5,34	5,28	5,23

The voltage didn't change too much. However, when the are of the plate is increased, the voltage is decreased. It's a inversely proportional Also, when the separation of plate is increased, the voltage is decreased. It's different when there was no dielectrics between two plates.

C) PVC $\varepsilon_o = 5.8 - 6.4$

C $[\times 10^{-12}\,pF]$		A $[\times 10^{-4}\,m^2]$				
		125	250	375	500	625
D $[\times 10^{-3}\,m]$	6	130	220	250	300	400
	15	20	30	40	50	55

This data shows that the area of plates is directly proportional to the value of capacitance

Also the separation of the plates is inversely proportional to the value of capacitance

→ Graph 5

V $[V]$		A $[\times 10^{-4}\,m^2]$				
		125	250	375	500	625
D $[\times 10^{-3}\,m]$	6	6.10	6.02	5.90	5.85	5.80
	15	5.55	5.45	5.35	5.30	5.25

This data shows that the area of plate is inversely proportional to the value of the voltage.

Also the separation of plates is inversely proportional to the value of the voltage.

D) Paper Board $\varepsilon_o = 3.7$

$C_{[\times 10^{-12} pF]}$		$A\ [\times 10^{-4} m^2]$				
		125	250	375	500	625
D $[\times 10^{-3} m]$	6	75	130	175	210	250
	15	20	30	40	48	50

C-A : directly proportional

C-D : inversely proportional

→ Graph 6

$V_{[V]}$		$A\ [\times 10^{-4} m^2]$				
		125	250	375	500	625
D $[\times 10^{-3} m]$	6	5,20	4.60	4.25	3,95	3.60
	15	5,50	5,43	5,35	5,30	5,25

V-A : inversely proportional

V-D : directly proportional

■ Discussion

Through the results of the experiments that we carried out, the results were such that when the area of the plates was increased keeping in mind that the separation of the plates was kept constant, the capacitance increased.

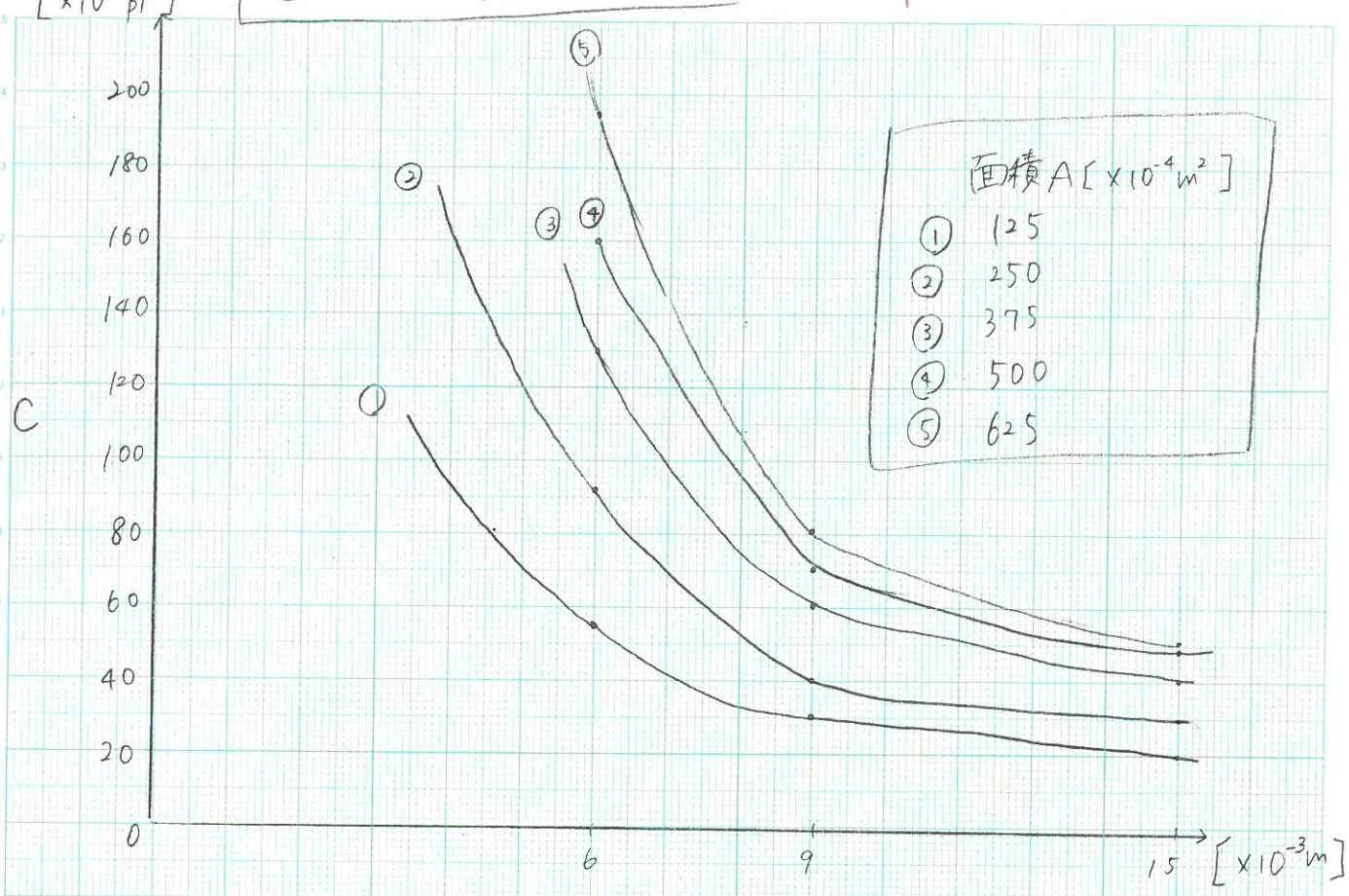
On the other hand, the experiment when the spacing between the plates was increased, capacitance decreased keeping the area of the plates constant.

■ Conclusion

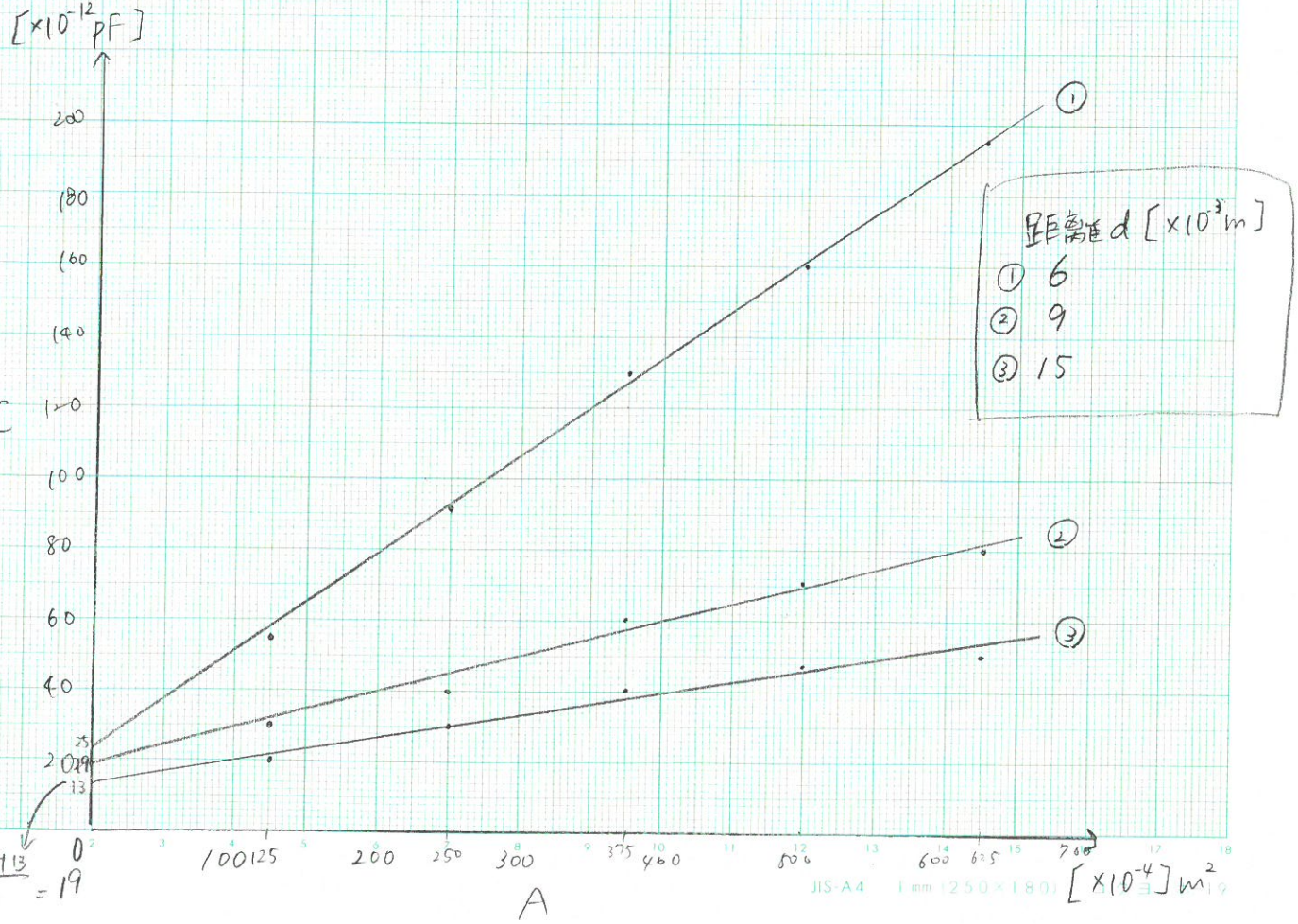
After conducting the experiment, the conclusion is such that the objective of the experiment is achieved and the results are also verifying the theory which states that when the area of the plate is increased the capacitance is increased, that shows the area of the plate is directly proportional to the value of the capacitance.

On the other hand, when the separation of plates increased, the capacitance is decreased, that shows the separation of plates is inversely proportional to the value of the capacitance.

C vs d 誘電体なし Graph 1



C vs A 誘電体なし Graph 2

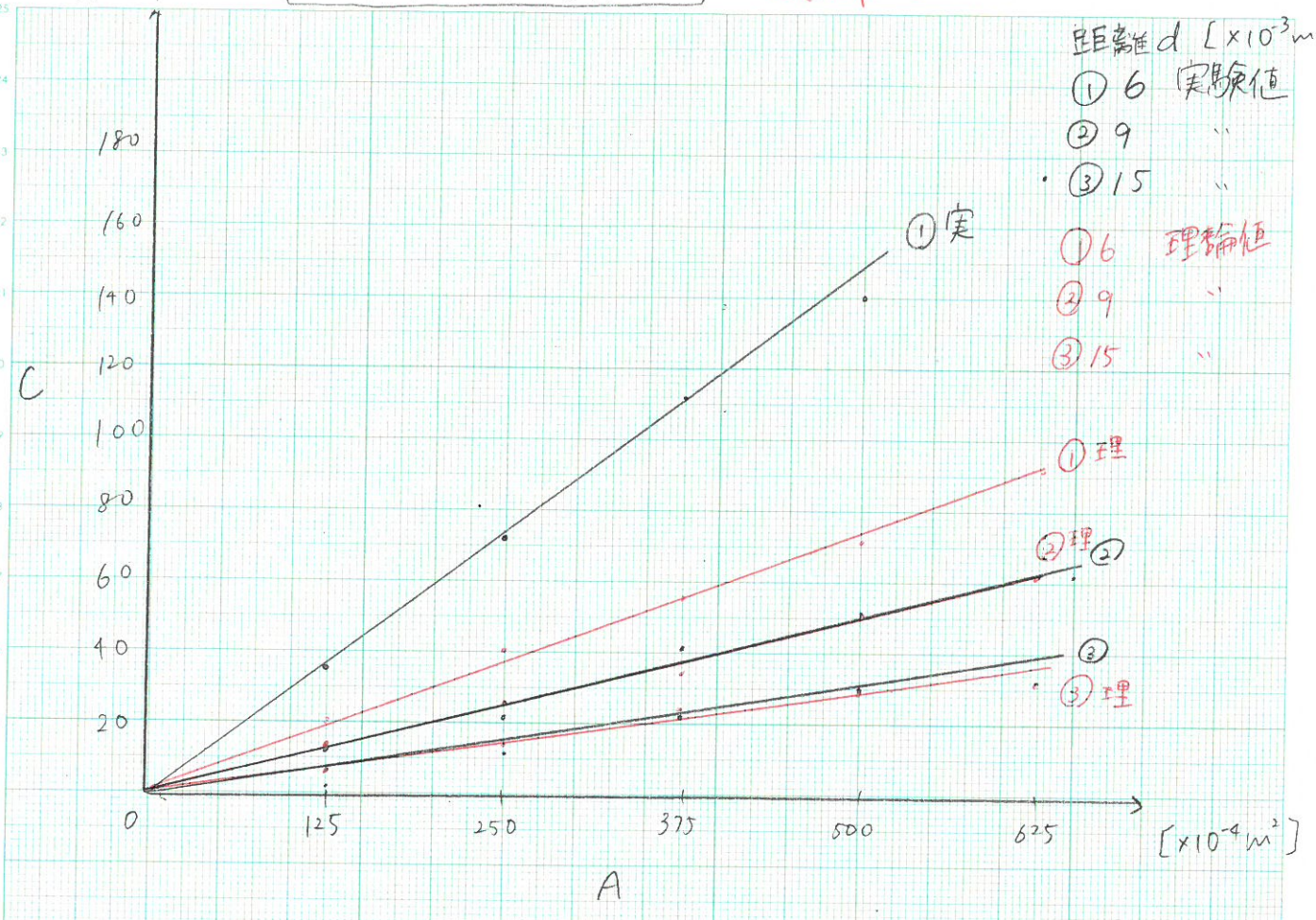


$\frac{25+19+13}{3} = 19$

[×10⁻¹² pF]

C vs. A 誘電体なし

Graph3



距離 d [×10⁻³ m]

① 6 実験値

② 9 〃

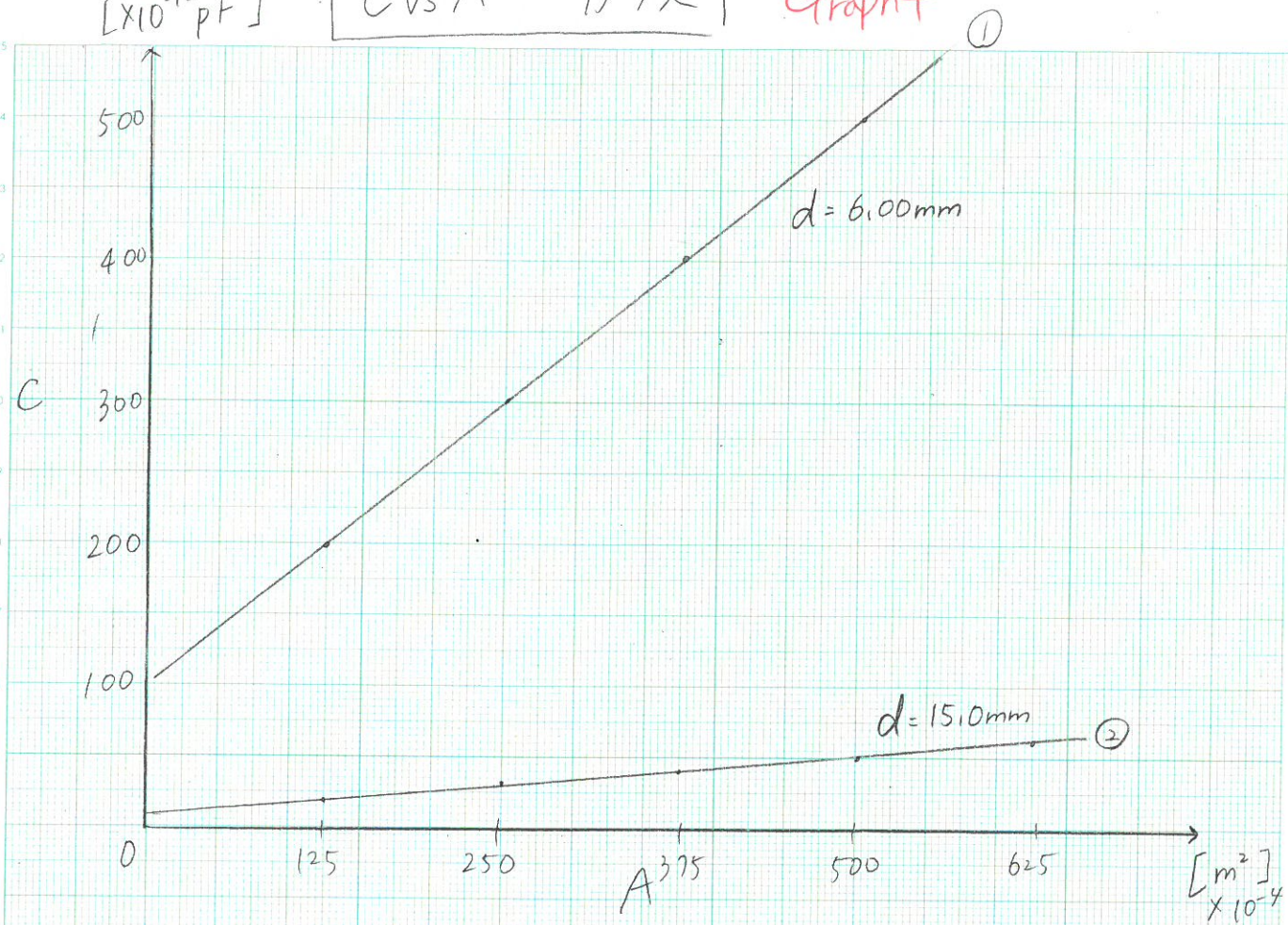
③ 15 〃

① 6 理論値

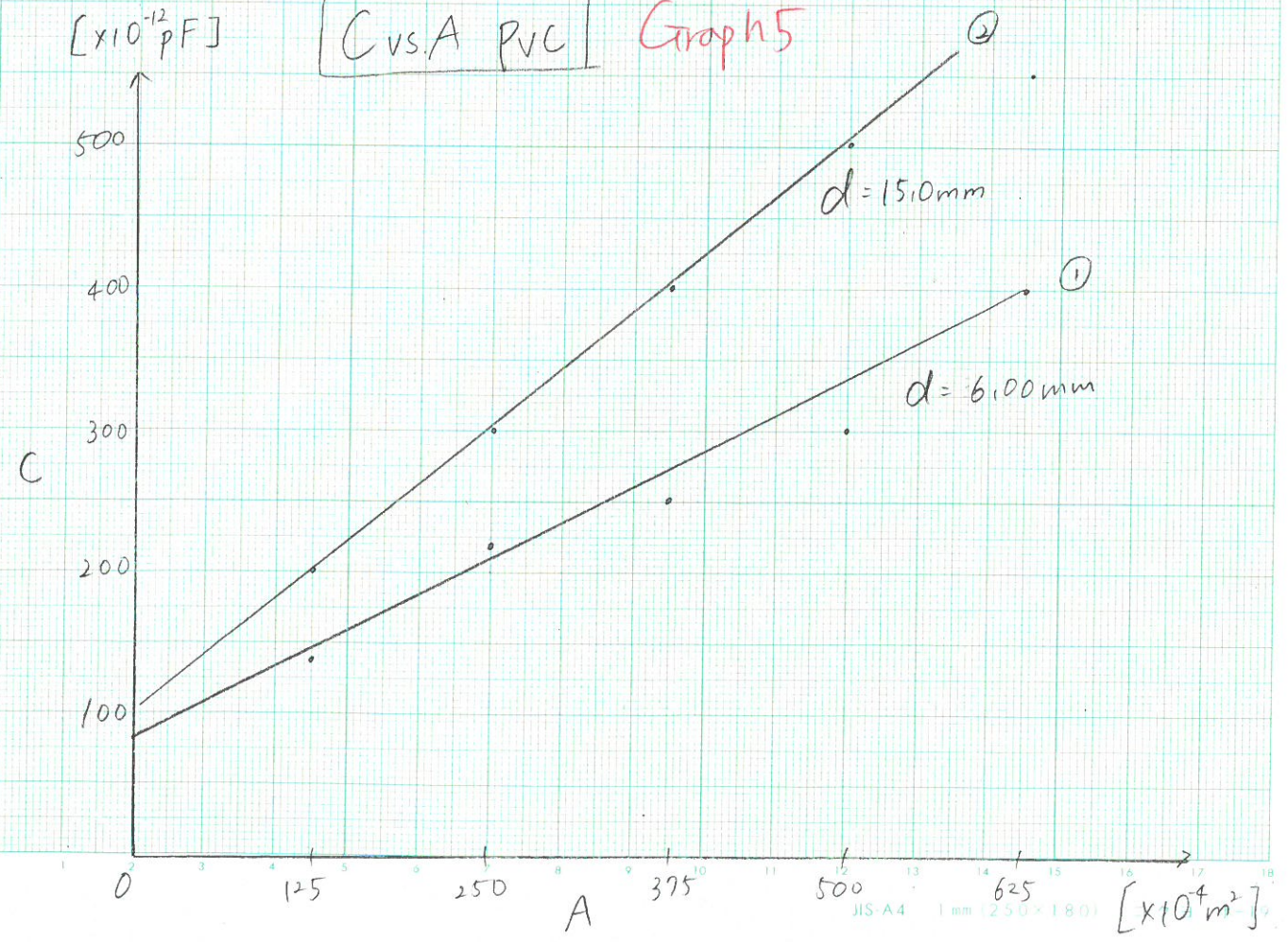
② 9 〃

③ 15 〃

C vs A ガラス　Graph4



C vs A PVC　Graph5



C vs. A 紙

Graph6