POWER UNIT

اللجنة الأكاديمية

في قسمي هندسة الكهرباء والحاسوب

8.5

LAB REPORT FOR EXPERIMENT 1

Date: 7/10/2019

Name

Registration No:---------------

Registration No:--------------

Physics Section:----------------

Instructor's Name:-----------

PHYSICS LAB EXPERIMENT 1: ELECTRIC FIELD MAPPING

1. PURPOSE

To compute & find the electric field while plotting on couple of graphs between voltage & distance, and while finding the lines of the E.F using the pointer and two // plates.

II. DATA AND DATA ANALYSIS

A. Mapping The Equipotential Lines

1- Enter your data in Table 1.1 below:

Table (1.1 a)

For one type of electrodes:

Location of P (position of equipotential point)				
P_1	P_2	P_3	P_4	P_5

For another type of electrodes:

Table (1.1 b)

Location of P (position of equipotential point)				
P_1	P_2	P_3	P_4	P_5

2- Use your data of Table (1.1a)and Table (1.1 b) to plot the equipotential points on two sheets of graph paper.

3- Connect the **eight points** corresponding to each location $\mathbf{P_i}$ with a line which is an **equipotential line**.

4- On the same graph , draw the lines of force. These are everywhere **perpendicular** to the equipotential lines, explain **why**.

$W = q \cdot \Delta V = \text{zero}$

$W = F \cdot d = Fd\cos\theta = 0$

$= qEd\cos\theta = 0$

non-zero quantities (qEd); $\cos\theta$ → must equal zero

$\Rightarrow \theta = 90^\circ$

B. Measurement of The Electric Field

The data in Table (1.2) below are **V** in volts and **d** in centimeters.

Table 1.2

V(volt)	d(cm)
0	0
1	5
2	11
3	16
4	18
5	19
6	20

1. Plot **V** (as dependent variable) versus **d** .
   Find the slope of your graph.

Slope = $\frac{\Delta V}{d}$ = $\frac{5.4 - 4.5}{24 - 20}$ = 0.225 Volt/cm

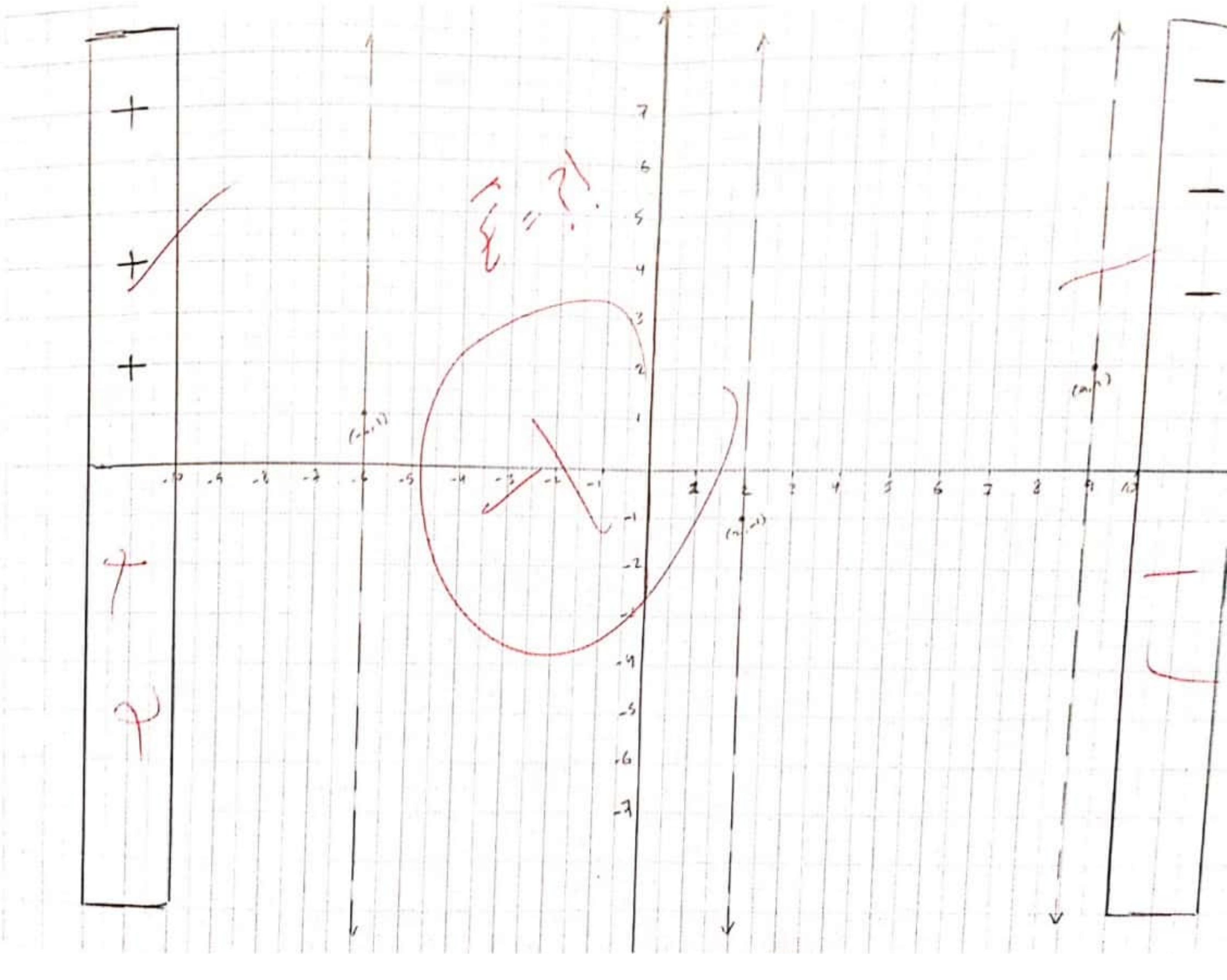
= 0.225 N/C

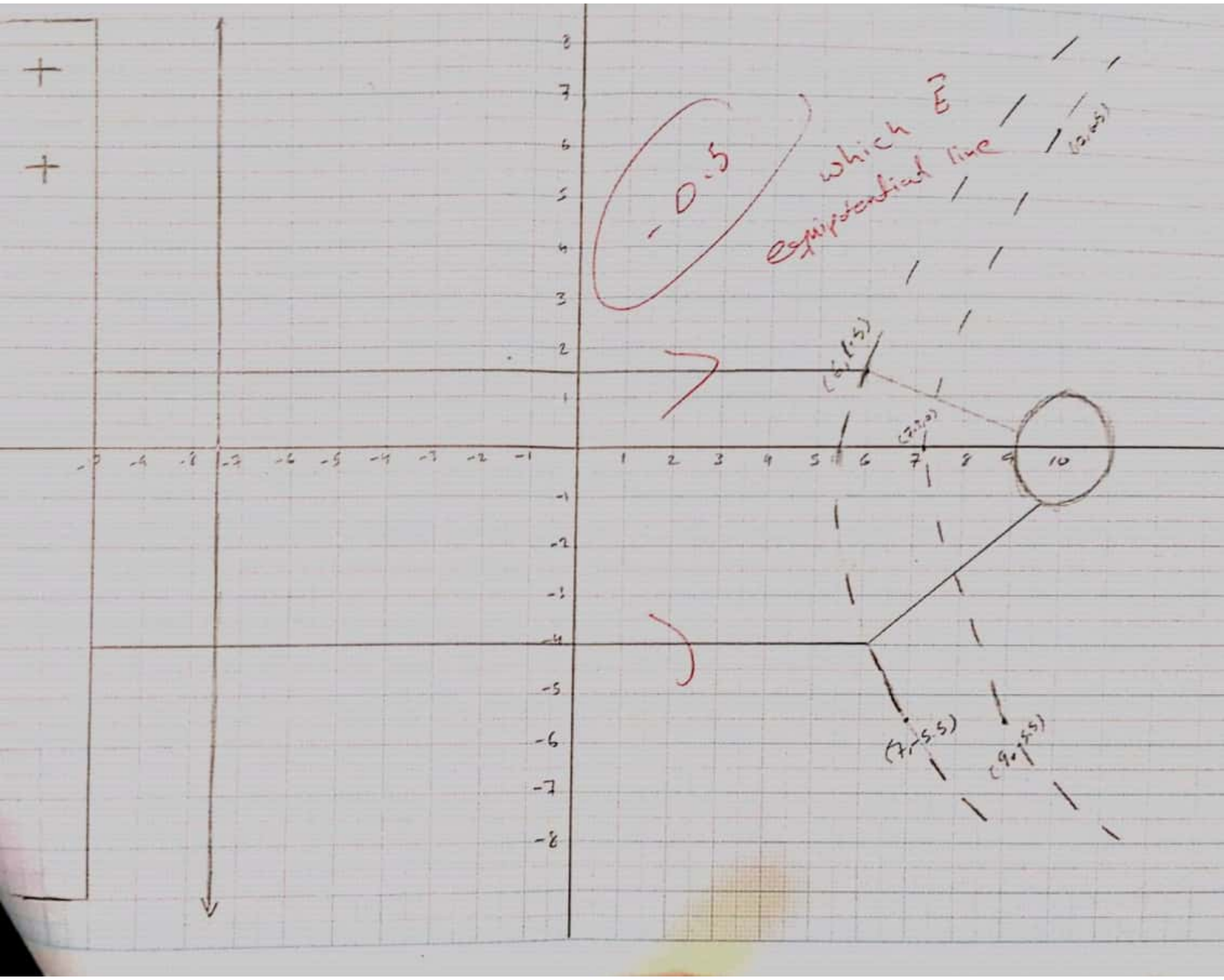
2. How is the slope related to the electric field ?

The slope is equal to $\frac{\Delta V}{d}$ which is equal to E, ∴ slope = Electric field and it is constant between two plates.

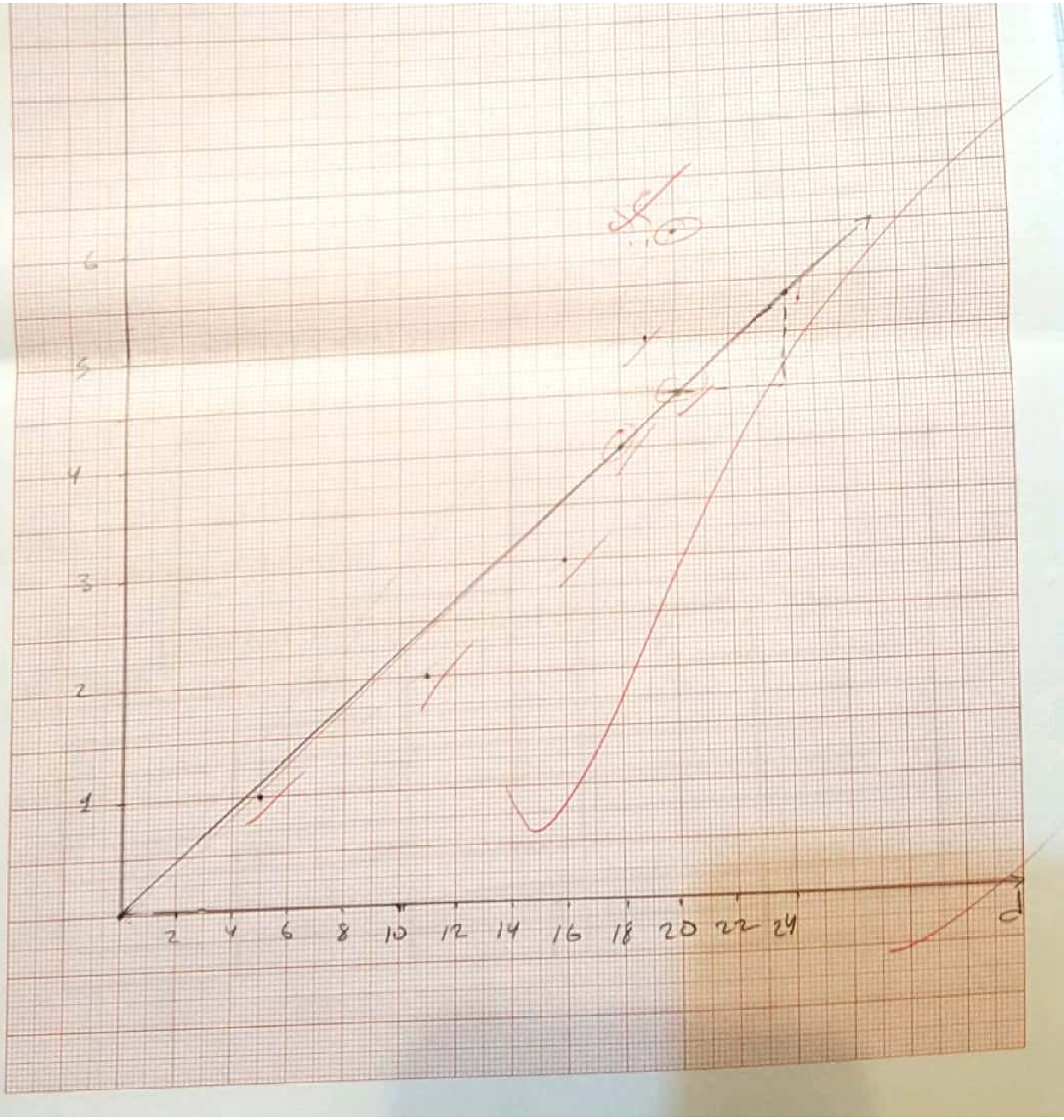
3. What conclusion can you draw about the electric field in the region between the electrodes near the center?

That it is uniform electric field.





-0.5
which E
equipotential line
(6,1.5)
(7.2,0)
(7,-5.5)
(9,-5.5)
(10,6.5)



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LAB REPORT FOR EXPERIMENT 2

Date: 30/9/2019

Name:- –

Partner's Na

Registration No:-----------------

Registration No:---------------

Physics Section:------------------

Instructor's Name:------------

PHYSICS LAB EXPERIMENT 2:
SPECIFIC CHARGE OF COPPER IONS

I. PURPOSE

To calculate the specific charge K, and to calculate the charge of an electron.

0.5

II. DATA AND DATA ANALYSIS

1. Enter your data of the masses, m_1 and m_2 in **kg** as related to the current, **I**, in **Ampere** and time, **t**, in **minutes** in Table 2.1 below:

Table(2.1)

Current(I) (A)	Time (t) (min)	Amount of charge (It) (Coulomb)	m_1 (Kg)	m_2 (Kg)	Deposited mass $M_{cu} = (m_2 - m_1)$ (Kg)
~~0.6A~~ 0.8	10 ~~20~~	480	28.14	28.35	0.21
~~0.3A~~ 0.4	10 ~~20~~	240	28.35	28.45	0.10
~~0.3A~~ 0.4	5 ~~10~~	120	28.45	28.49	0.04

2. Use the data in Table (2.1) to **plot** the amount of charge **(It)** versus **the mass of the deposited copper M_{cu}**.

3. What type of relationship do you see between M_{cu} and It?

Direct and linear relationship.

4. From your graph find the specific charge, **K**, of copper ions by calculating the slope.

$K = Slope = \frac{380-280}{0.16-0.12} \times 10^3 = 2500 \times 10^3$

$= 25 \times 10^5$ Coul/Kg

5. What are the units of K?

Coul / Kg

6. Estimate the error, ΔK, in your value and write the result as K ± ΔK.

7. Calculate the **charge** carried by each **copper ion** in the solution.

$Q = Km = K(\text{Atomic mass} * \text{Atomic mass unit})$

$= K(63.6 * 1.66 \times 10^{-27})$

$= K(105.576 \times 10^{-27})$

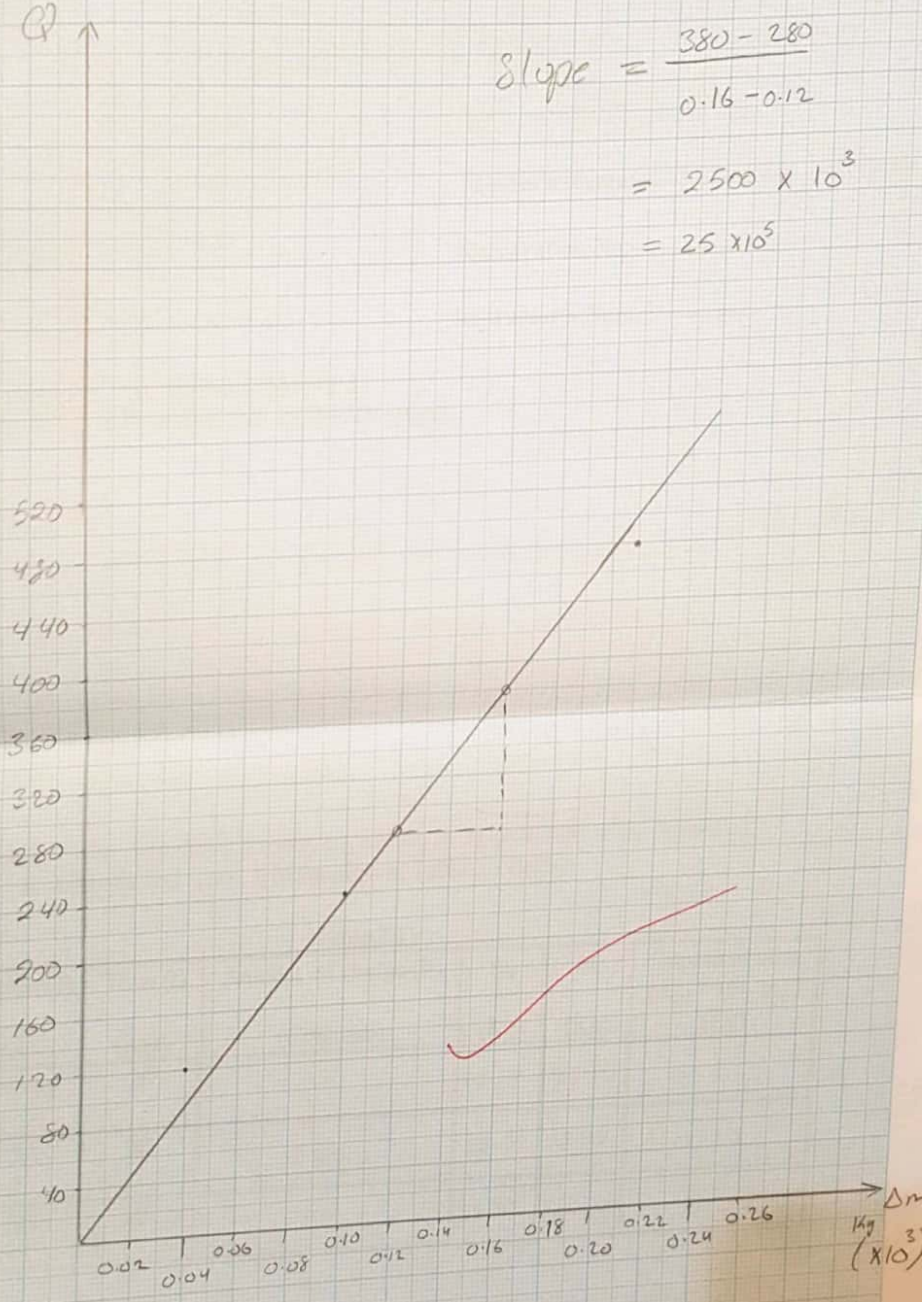
$= (25 \times 10^5)(105.576 \times 10^{-27})$

$= 2.6394 \times 10^{-19}$ Coul

8. Use the result above to calculate the **charge of the electron e**. How does it compare with the **standard value**?

$e = \frac{Q}{2} = \frac{2.6394 \times 10^{-19}}{2} = 1.3197 \times 10^{-19}$ Coul.

Q Vs Δm



Q
Slope = $\frac{380 - 280}{0.16 - 0.12}$
$= 2500 \times 10^3$
$= 25 \times 10^5$
520
480
440
400
360
320
280
240
200
160
120
80
40
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
0.20
0.22
0.24
0.26
Δm
Kg
(x10^3

LAB REPORT FOR EXPERIMENT 3

Date: ---------------------------

Name

Partner's Na

Registration No:---------------

Registration No:---------------

Physics Section:-----------------

Instructor's Name:------------

PHYSICS LAB EXPERIMENT 3: OHM'S LAW

1. PURPOSE

To improve ohm's law which states that if a conductor is kept in a constant temperature the current flowing through it would equal Potential difference / Resistance.

II. DATA AND DATA ANALYSIS

1- Enter your data in Table 3.1

Table 3.1

R_1 Wire resistance		R_2 Carbon resistance		R_1 and R_2 in Series		R_1 and R_2 in Parallel	
V(Volt)	I(Amp.)	V(Volt)	I(Amp.)	V(Volt)	I(Amp.)	V(Volt)	I(Amp.)
1.6	2.2	2.2	4	3	2.2	1	3.8
3.8	2.8	3	5.3	3.8	2.6	1.5	4.8
5.2	3.6	3.6	8.8	4.8	3.1	2	6.2
6.2	4.6	4.5	8.2	5.3	3.5	2.6	8.2
7	5	5	8.66	5.6	4.1	3	9.8

2- Plot graphs of voltage **V** as a dependent variable versus current **I** .

3- Determine the values of **R** for each **unknown resistance** as well as for the series and parallel combinations by calculating the **slopes** of your graphs.

$R_1 =$ Slope = 2 Ω

$R_2 =$ Slope = 0.667 Ω

R equivalent of R_1 and R_2 in series= 3 Ω

R equivalent of R_1 and R_2 in parallel= 0.4 Ω

4- From the graph of **V** versus **I** for R_1, estimate the error ΔR_1.

0.37 x10^{-3}

5- Using the value of $\mathbf{R_1}$ obtained in (3) and the **length** and **diameter** of the wire used for R_1, calculate the resistivity of the wire ρ.

$R = \frac{\rho L}{A} \Rightarrow \rho = \frac{RA}{L}$ $A = \pi\left(\frac{D}{2}\right)^2$

$= \frac{2 \times 1.07 \times 10^{-7}}{1}$ $= 3.14 \times \left(\frac{0.37}{2}\right)^2$

$= 2.14 \times 10^{-7}\ \Omega.m$ $= 1.07 \times 10^{-7}$

6- Compare the calculated values with the experimental values you obtained for:

Combination of resistances in series:

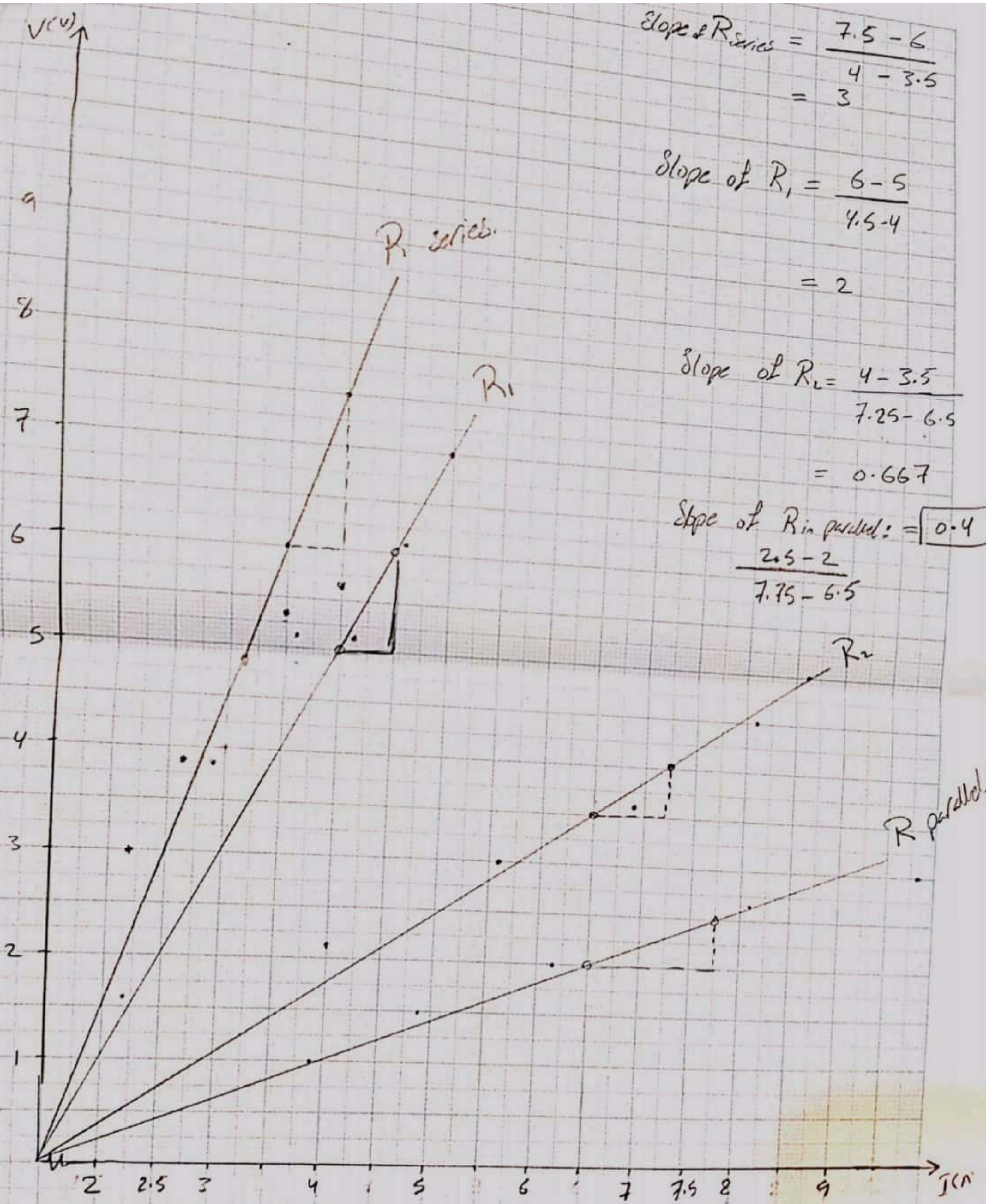
- experimental value: 3 Ω

- calculated value: $R_1 + R_2 = 2 + 0.667 = 2.667\ \Omega$

Combination of resistances in parallel:

- experimental value: 0.4 Ω

- calculated value: $\left(\frac{1}{2} + \frac{1}{0.667}\right)^{-1} = 0.5\ \Omega$



Slope of $R_{series} = \frac{7.5 - 6}{4 - 3.5}$

$= 3$

Slope of $R_1 = \frac{6 - 5}{4.5 - 4}$

$= 2$

Slope of $R_2 = \frac{4 - 3.5}{7.25 - 6.5}$

$= 0.667$

Slope of R in parallel: $= \boxed{0.4}$

$\frac{2.5 - 2}{7.75 - 6.5}$

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LAB REPORT FOR EXPERIMENT 4

Date: -----------------------------

Name:

Partner's Name

Registration No:----------------- Registration No:----------------

Physics Section:------------------ Instructor's Name:------------

PHYSICS LAB EXPERIMENT 4: POWER TRANSFER

I. PURPOSE

To calculate R_s and to compare it to R_L, and to find the relation between the power dissipated and the resistance.

II. DATA AND DATA ANALYSIS:

1. Use the equation **P = VI to calculate P_L** the power dissipated by the load resistor R_L and enter the calculated values in Table (4.1) below:

Table 4.1

$R_s = 100\ \Omega$				
Reading	R_L (Ω)	I_L (mA)	V_L (V)	P_L (mW)
1	20	48 mA	1	48
2	40	40	1.8	72
3	60	35	2.2	77
4	80	32	2.6	83.2
5	100	29	3	87
6	200	19	4	76
7	400	12	4.8	57.6
8	600	8	5.2	41.6
9	800	6	5.4	31.8

$$I = \frac{V_s}{R_s + R_L}$$

2. **Plot** on a graph paper the power $\mathbf{P_L}$ as dependent variable **versus** the load resistor $\mathbf{R_L}$. Find the value of the load resistor for which the power dissipated is **maximum**. How is this value related to the series resistance $\mathbf{R_s}$.

The maximum power dissipated happens when the value of the resistance equals R_s.

$P_{max} = 87$ mWatt , $R_L = 100\ \Omega$

3. For what value of the load resistance $\mathbf{R_L}$ was:

1) The load current a maximum? $20\ \Omega$, $I = 48$ mA

2) The load voltage a maximum ? $800\ \Omega$, $V = 5.4$ V

4. Using the expression for $\mathbf{P_L}$ **power dissipated in the load resistance** as a function of the load resistance $\mathbf{R_L}$, determine the condition for the **maximum** power (differentiate P_L with respect to R_L and set $\frac{dp_L}{dR_L} = 0$)

$P = IV$

$P_{R_L} = I^2 R_L$

$P_{R_L} = \frac{V_s^2}{(R_s + R_L)^2} \cdot R_L$

$P = \frac{V_s^2 R_L}{R_s^2 + 2R_sR_L + R_L^2}$

$\frac{dP}{dR_L} = \frac{(R_s^2 + 2R_sR_L + R_L^2) V_s^2 - V_s^2 R_L (2R_s + 2R_L)}{(R_s^2 + 2R_sR_L + R_L^2)^2}$

$\frac{dP}{dR_L} = 0 \Rightarrow 0 = (R_s + R_L)^2 V_s^2 - V_s^2 R_L (2R_s + 2R_L)$

$(R_s + R_L)^2 - 2R_L(R_s + R_L) = 0$

$R_s + R_L - 2R_L = 0$

$R_s - R_L = 0 \Rightarrow \boxed{R_s = R_L}$

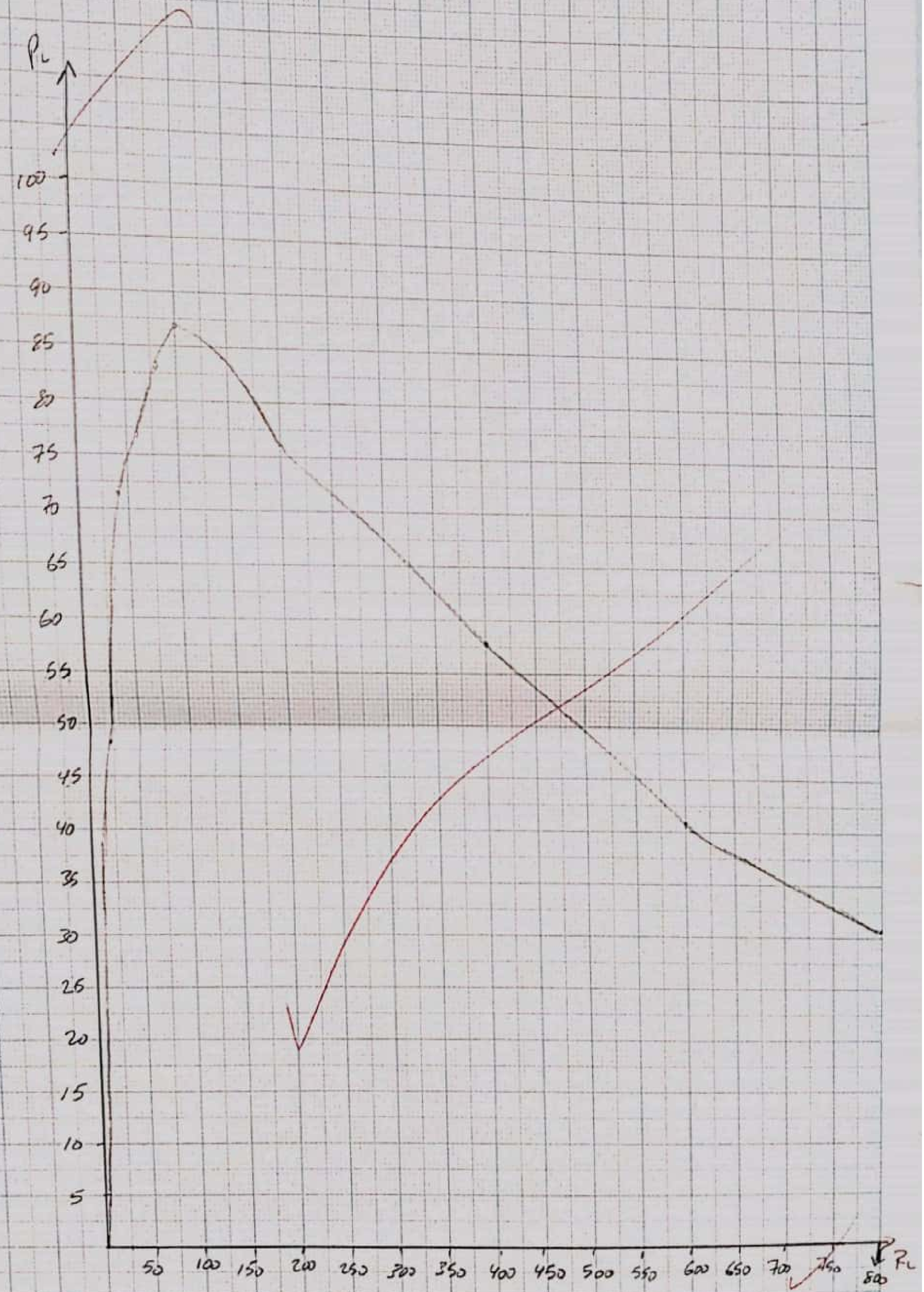
5- Compare the value of R_L at maximum power found in (2) with that found in (4) above.

$R_s = R_L \Rightarrow R_{L(P_{max})} = 100\ \Omega$, $R_s = 100\ \Omega \Rightarrow 100 = 100 \therefore R_s = R_L$

6- If the internal resistance, $\mathbf{R_s}$, is larger than the load resistance R_L, which resistance will dissipate more power?

R_s because $P = I^2 R$ and the current is equal therefore $P \propto R$

$P = I^2 R$



P_L
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
P_L

/

LAB REPORT FOR EXPERIMENT 5

Date: ---28/10/2019----

Name:– **Partner's Nan.**

Registration No:----------------- **Registration No:**--------------

Physics Section:------------------ **Instructor's Name:**-----------

PHYSICS LAB EXPERIMENT 5: THE WHEATSTONE BRIDGE

I. PURPOSE

Determining an unknown resistance by using wheastone bridge.

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II. DATA AND DATA ANALYSIS :

1. Show that $\frac{R_s}{R_x} = \frac{L_1}{L_2}$

$V_{ab} = V_{ac}$ $V_{bd} = V_{cd}$

$I_1 R_s = I_2 R_1$ $I_1 R_x = I_2 R_2$

$\frac{I_1}{I_2} = \frac{R_1}{R_s}$ $\frac{I_1}{I_2} = \frac{R_2}{R_x}$

$\Rightarrow \frac{R_1}{R_s} = \frac{R_2}{R_x}$

$$\frac{\frac{\rho L_1}{A}}{R_s} = \frac{\frac{\rho L_2}{A}}{R_x} \Rightarrow \frac{L_1}{R_s} = \frac{L_2}{R_x} \Rightarrow R_x = \frac{L_2}{L_1} R_s.$$

2. Record your data in Table (5.1) below:

Table 5.1

Reading	R_S (Ω)	L_1 (cm)	L_2 (cm)	R_x (Ω)	$\Delta R_x / R_x$ "Error"
1	1	11.5	88.5	7.696	4.38×10^{-3}
2	2	23.5	76.5	6.5	2.22×10^{-3}
3	3	32.1	67.9	6.345	1.72×10^{-3}
4	4	39.7	60.3	6.076	1.51×10^{-3}
5	5	45	55	6.111	1.44×10^{-3}
6	6	49.8	50.2	6.048	1.41×10^{-3}
7	7	54	46	5.963	1.43×10^{-3}
8	8	57.3	42.7	5.962	1.46×10^{-3}
9	9	60.2	39.8	5.950	1.5×10^{-3}
10	10	62.8	37.2	5.924	1.56×10^{-3}
$\overline{R}_x = 6.2568$ Ω					

3. Using the equation derived in (1), calculate the value of the unknown resistance R_x. Repeat for the different values of R_1 and enter your calculation in table 5.1 above .

Example for one calculation:

$R_x = \frac{L_2}{L_1} R_s = \frac{88.5}{11.5}(1) = 7.696\ \Omega$

4. Calculate the relative error $\Delta R_x / R_x$ for the different values of R_1 using the equation:

$$\frac{\Delta R_x}{R_x} = \left[\left(\frac{\Delta L_1}{L_1}\right)^2 + \left(\frac{\Delta L_2}{L_2}\right)^2\right]^{\frac{1}{2}}$$

(ΔL_1 = 0.05)

Example for one calculation:

$\frac{\Delta R_x}{R_x} = \left[\left(\frac{0.05}{23.5}\right)^2 + \left(\frac{0.05}{76.5}\right)^2\right]^{\frac{1}{2}} = 2.22 \times 10^{-3}$

5. Is it essential that the battery supplies a constant current to the wire? Explain your answer.

No, because the resistance depends on the length "L_2 & L_1" and on the resistance source.

6. From the table, determine the values of L_1 and L_2 for which the error $\Delta R_x / R_x$ is a **minimum.**

L_1 = 49.8 cm

L_2 = 50.2 cm.

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LAB REPORT FOR EXPERIMENT 6

Date: 21 /10/2019

Name:--

Partner's Nam

Registration No:---------------

Registration No:---------------

Physics Section:-----------------

Instructor's Name:------------

PHYSICS LAB EXPERIMENT 6: THE POTENTIOMETER

I. PURPOSE:

To learn how to calculate the electromotive force and to fin the relationship between V_x and Lx.

II. DATA AND DATA ANALYSIS :

A. Calibration of the Potentiometer

1- Record your measurements of the reading V_x of the voltmeter at any point on the wire and the corresponding distance L_x in Table (6.1)below:

Table (6.1)

Reading	V_x (V)	L_x (cm)
1	0.5	20
2	1	40
3	1.4	60
4	2	80
5	2.4	90
6	2.7	100

2- Plot a graph of V_x versus L_x. State your conclusion.

The relation between V_x and L_x is a direct linear relationship.

3- If the wire is uniform derive a simple relation between the voltmeter reading V_x at any point on the wire and the corresponding distance L_x.

$V = IR$

$= \frac{I \rho L}{A}$

$V = \left(\frac{I\rho}{A}\right) . L$

slope, $L \rightarrow L_x$

B. Measurement of an Unknown EMF

1- Calculate and record $\overline{L}_x$, the average value of L_x.

Trial	L_x(cm)
1	55
2	54.5
3	55.1
$\overline{L}_x$ = 54.87 cm	

2- Use your graph of part A to find the value of E_x corresponding to $\overline{L}_x$.

$E_x = Slope . \overline{L}_x = 0.025 \times 54.87$

$= 1.37 \approx 1.4$ V

3- What is the current flowing through E_x when pointer touches the potentiometer wire at the balance point?

The current at the balance point = zero.

4- What happens to the balance point when a small resistor is connected in series between E_x and the **galvanometer**? Explain the result you observe.

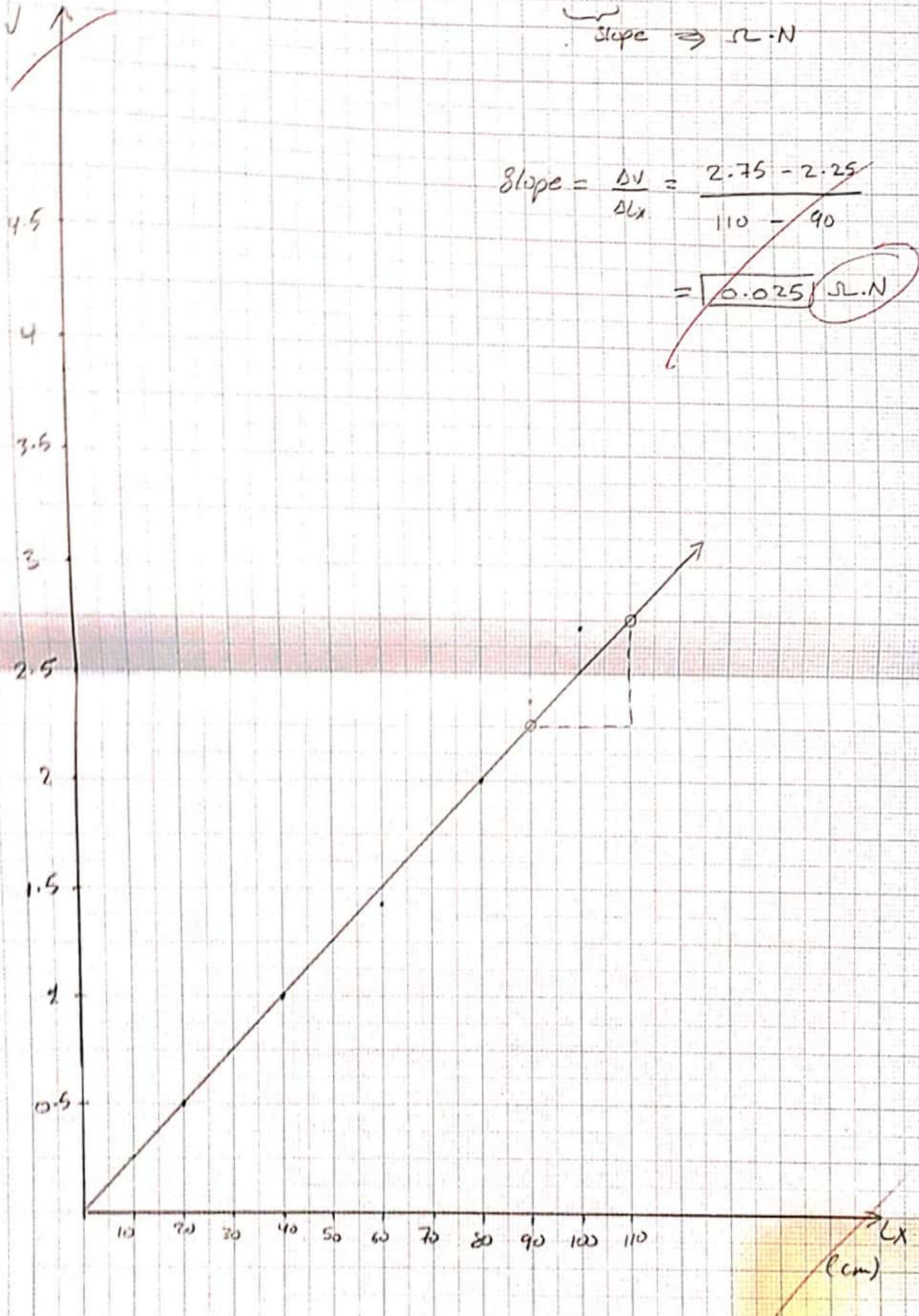
The balance point will not change because the current that passes through the wire is zero "No current is passing".

$$V = \underbrace{\frac{I\rho}{A}}_{\text{slope}} \cdot l$$

slope ⇒ Ω·N

$$\text{Slope} = \frac{\Delta V}{\Delta l_x} = \frac{2.75 - 2.25}{110 - 90}$$

$$= \boxed{0.025}\ \Omega \cdot N$$



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LAB REPORT FOR EXPERIMENT 7

Date: ---18/11/2019---------

Name

Partner's

Registration No:-----------------

Registration No:---------------

Physics Section:------------------

Instructor's Name:------------

PHYSICS LAB EXPERIMENT 7 : THE RC TIME CONSTANT

1. PURPOSE

To learn how to calculate the RC time constant.

IV. DATA AND DATA ANALYSIS:

1- Enter your data of the **charging current** , the corresponding **time** and the measured voltage source $\mathbf{V_0}$ in Table 7.1 below:

Table 7.1

Case 1				Case 2			
$C_1 = 200\ \mu F$, $R = 60 K\Omega$				$C_2 = 500\ \mu F$, $R = 60 K\Omega$			
V_o = 6 Volts, I_o = 100 (μA)				V_o = 6 Volts, I_o = 86 (μA)			
Current (μA)	Time (s)	I / I_o	$Ln (I / I_o)$	Current (μA)	Time (s)	I / I_o	$Ln (I / I_o)$
100	0	1	0	86	0	1	0
48	5	0.48	-0.734	72	5	0.837	-0.178
36	10	0.36	-1.022	52	10	0.605	-0.503
22	15	0 22	-1.514	38	15	0.442	-0.816
14	20	0.14	-1.966	30	20	0.349	-1.053
8	25	0.08	-2.526	24	25	0.279	-1.277
8	30	0.8	-2.526	20	30	0.233	-1.457
6	35	0.6	-2.813	18	35	0.209	-1.565
6	40	0.6	-2.813	12	40	0.139	-1.973
6	45	0.6	-2.813	12	45	0.139	-1.973
				8	50	0.093	-2.375
				8	55	0.093	-2.375
Slope = -0.09 , τ_1 = 11.11				Slope = 0.05 , τ_2 = 20			

Plot the **charging current** as dependent variable versus **time** as independent variable **for case 1**. Is the plot linear? What can you say about the shape of your graph?

No, The shape of the graph is exponential.

3- From the data of charging current versus time, determine the value of the initial charging current I_o. This is the value of the current at $t = 0$. Record the value in table 7.1 .

4- Plot $\ln(I/I_o)$ as the dependent variable versus time. Here, I is the charging current and I_o, the initial current determined in step (3) above. Is the plot linear?

Yes

5- Draw the straight line that best fits the data and determine the slope of the line. Record the value of the slope in table 7.1 .

6- Repeat steps 3,4 and 5 above for the second case.

7- Determine the time constant for each case from the equation:

$$\tau = \frac{-1}{\text{slope}}$$

and record it in table 7.1.

τ_1 (experimentally) = 11.11 s

τ_2 (experimentally) = 20 s

From the known values of C and R for each case, calculate $\tau_1 = RC_1$ and $\tau_2 = RC_2$ and compare these values with those obtained in step (6).

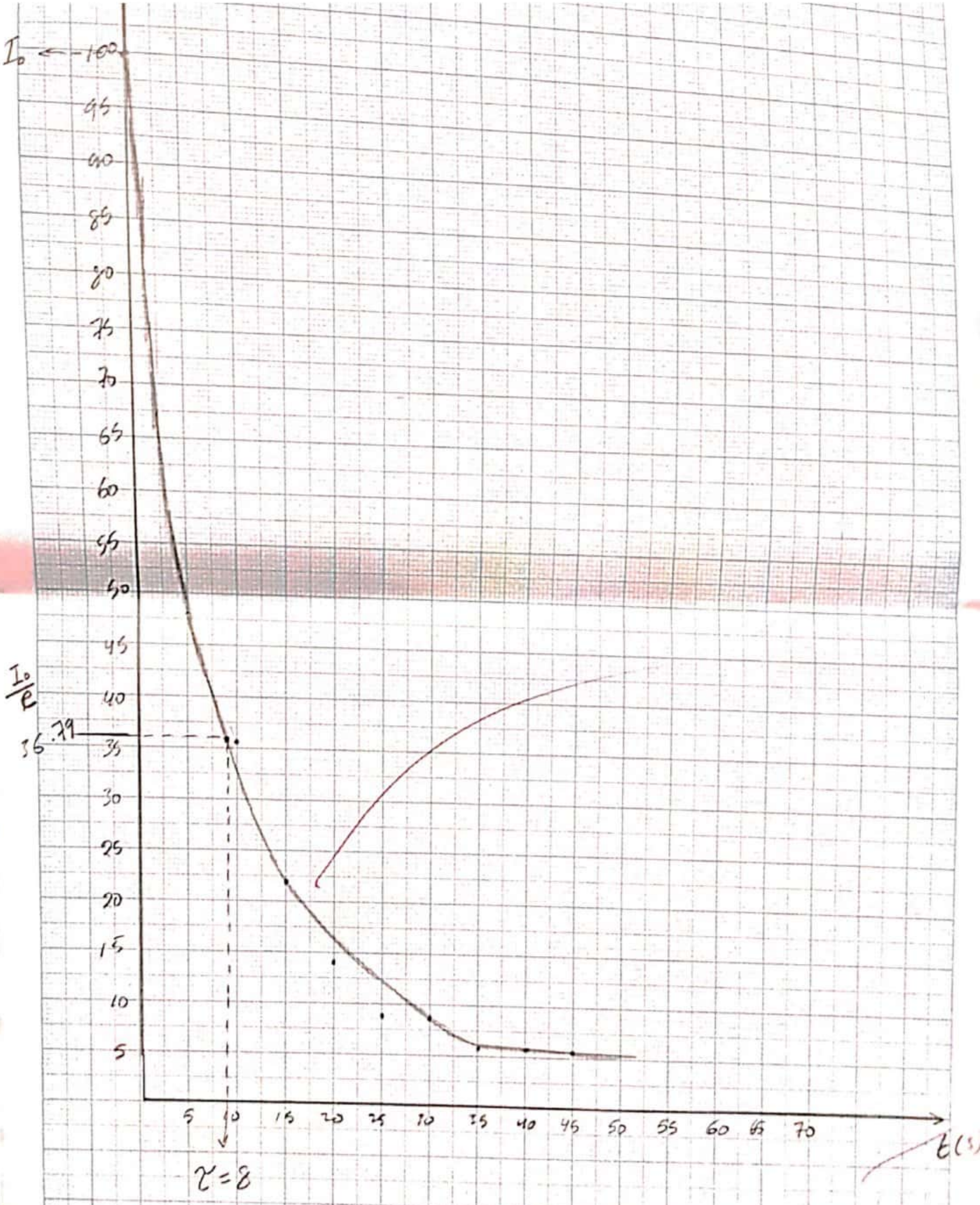
τ_1 (Calculated) = $200 \times 10^{-6} \times 60 \times 10^{3} = \boxed{12}$ s

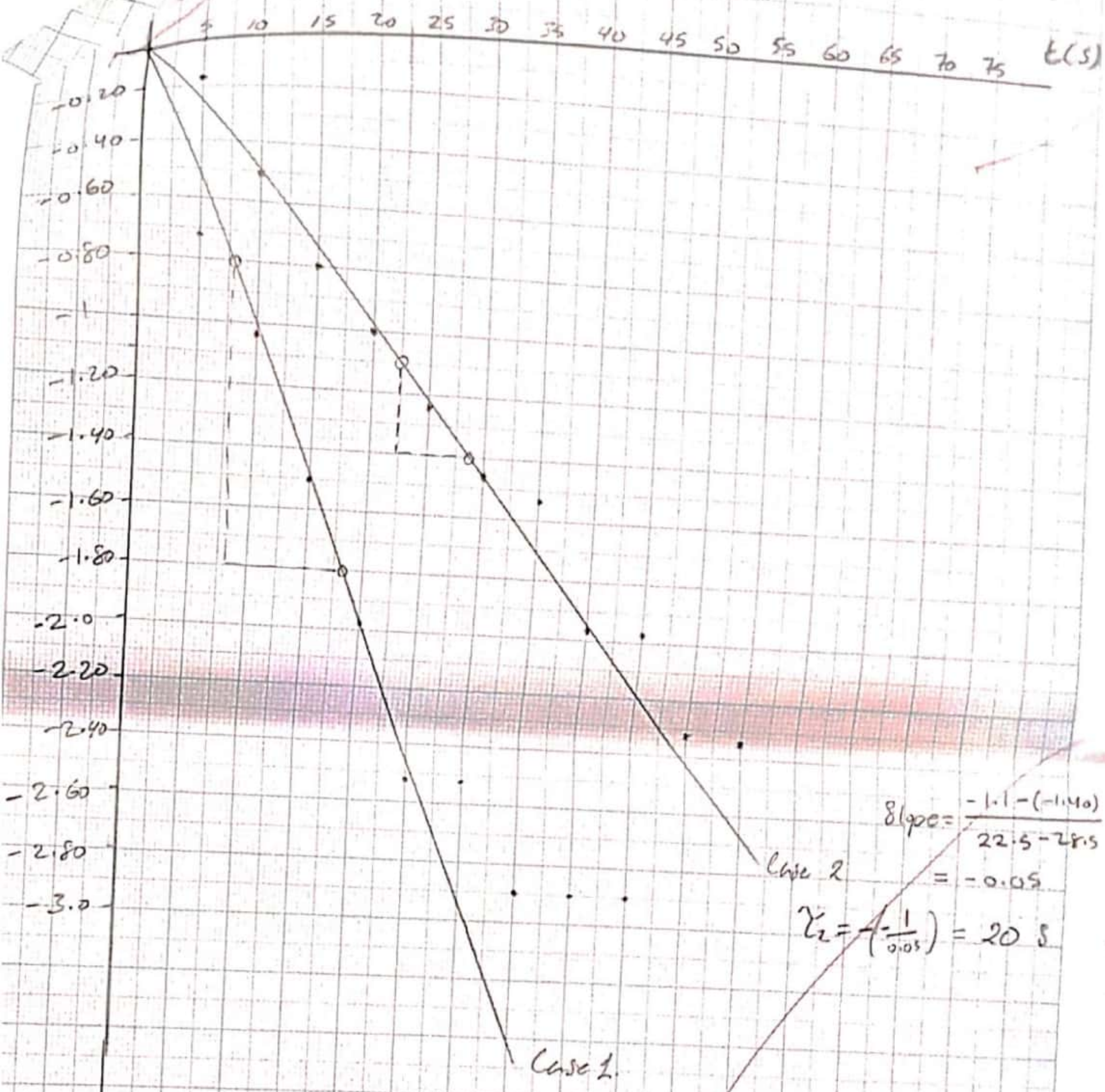
τ_2 (Calculated) = $\boxed{30}$ s

9- From the known values of V_o and R, , calculate $I_o = \frac{V_o}{R}$ which is the same for both cases. Compare this value with the one obtained in step (3) above.

I_o(calculated) = 0.0001 A

$$I_o = \frac{6}{60 \times 10^{3}} = \boxed{0.0001\ A}$$


I0
100
95
90
85
80
75
70
65
60
55
50
45
I0/e
40
36.79
35
30
25
20
15
10
5
5 10 15 20 25 30 35 40 45 50 55 60 65 70
τ = 8
t



$$Slope = \frac{-1.1-(-1.40)}{22.5-28.5} = -0.05$$

$$\tau_2 = -\left(-\frac{1}{0.05}\right) = 20\ s$$

$$Slope\ 1 = \frac{-0.80-(-1.80)}{6-17} = -0.09$$

$$\tau_1 = -\frac{1}{slope} = -\frac{1}{-0.09} = 11.11\ s$$

LAB REPORT FOR EXPERIMENT 8

Date: ---------------------------

Name.

Partner's Nan.

Registration No:----------------

Registration No:--------------

Physics Section:-----------------

Instructor's Name:-----------

PHYSICS LAB EXPERIMENT 8: THE MAGNETIC FIELD OF A CURRENT

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I. PURPOSE

To find the magnetic field of a current reduction factor manually using the tangent galvanometer.

II.DATA AND DATA ANALYSIS:

1. Enter your data in Table 8.1 below:

Table 8.1

Reading	I(mA)	θ_1	θ_2	θ_3	θ_4	$\bar{\theta}$	$\tan\bar{\theta}$
1	30	26	26	35	37	31	0.6
2	40	34	34°	35	33	34	0.67
3	50	37°	37°	37	41	38.5	0.79
4	60	42	43	44	40	42.25	0.91
5	70	45	46	57	54	50.5	1.21
6							
7							
8							
radius of the coil = 7.25 cm → a				N=50 turns			

2- Using Table 8.1 plot a graph between the values of **I** as a dependent variable against the corresponding values of **tan** $\bar{\theta}$ as the independent variable.

3- Use your graph to find the value of the reduction factor **K** and the error **ΔK**.

$K = \text{Slope} = \dfrac{(60-55)\times10^{-3}}{1.04-0.95} = \boxed{0.056}$

K ± ΔK. =

Using the above value of $K \pm \Delta K$, find the value of $H_E \pm \Delta H_E$.

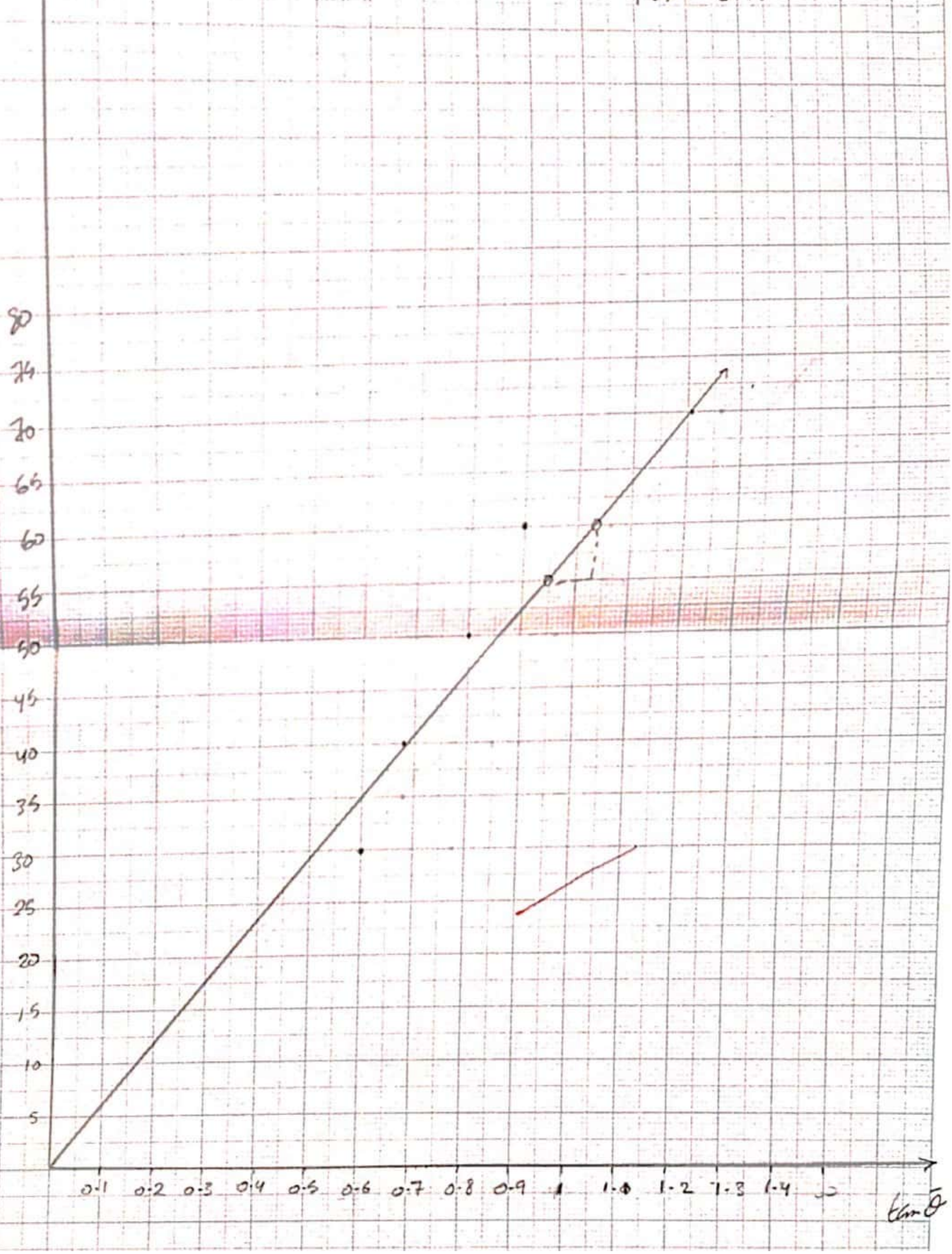
$\tan\theta \; H_E = \frac{2\pi NI}{10a}$ $H_C = \frac{2\pi NI}{10a}$

$K = \frac{10 H_E a}{2\pi N}$

$0.056 = \frac{10 H_E (7.25)}{2\pi * 50}$ $\Rightarrow$ $H_E = 0.24$ Gauss

$H_E \pm \Delta H_E$ = **Gauss**

$$K = \text{Slope} = \frac{(60-55)\times 10^{-3}}{1.04 - 0.95} = 0.056$$



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LAB REPORT FOR EXPERIMENT 9
KIRCHHOFF'S LAWS

Date: --11/11/2019----------

Name:-- -----

Partner's Name:

Registration No:----------------

Registration No:---------------

Physics Section:-----------------

Instructor's Name:------------

PHYSICS LAB EXPERIMENT 9 : KIRCHHOFF'S LAWS

1. PURPOSE :

To apply KVL & KCL effectively.

0.5

II. DATA AND DATA ANALYSIS:

A. DATA:

1. Record the **measured values** of V_1, V_2, V_{R_1}, V_{R_2} and V_{R_3} and their **polarities** on digram 1 shown bellow.

2. Record the measured values of I_1, I_2, and I_3 and and their **direction** of flow on **diagram 1.**

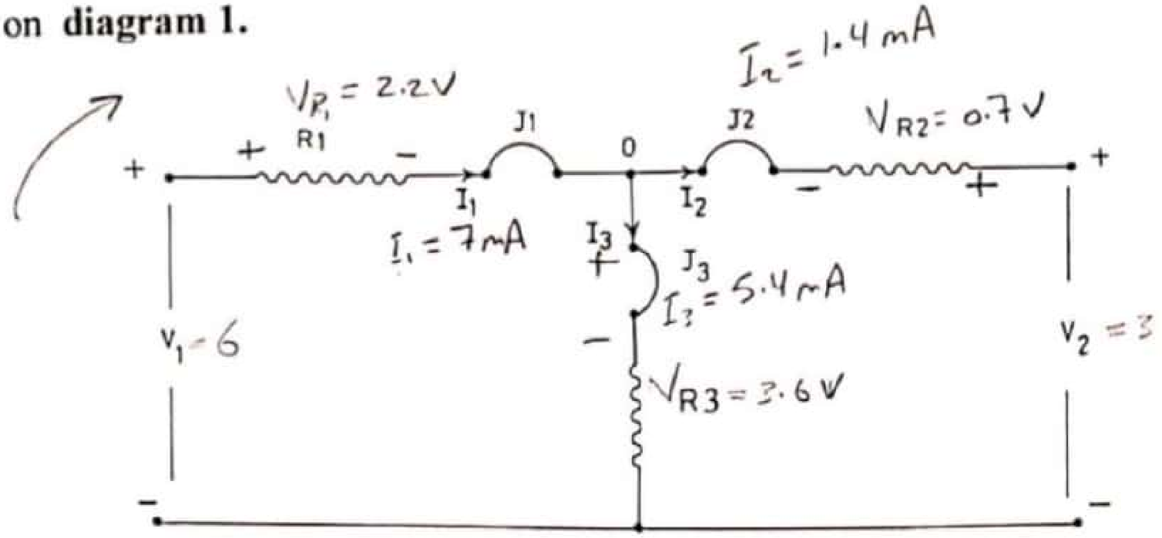
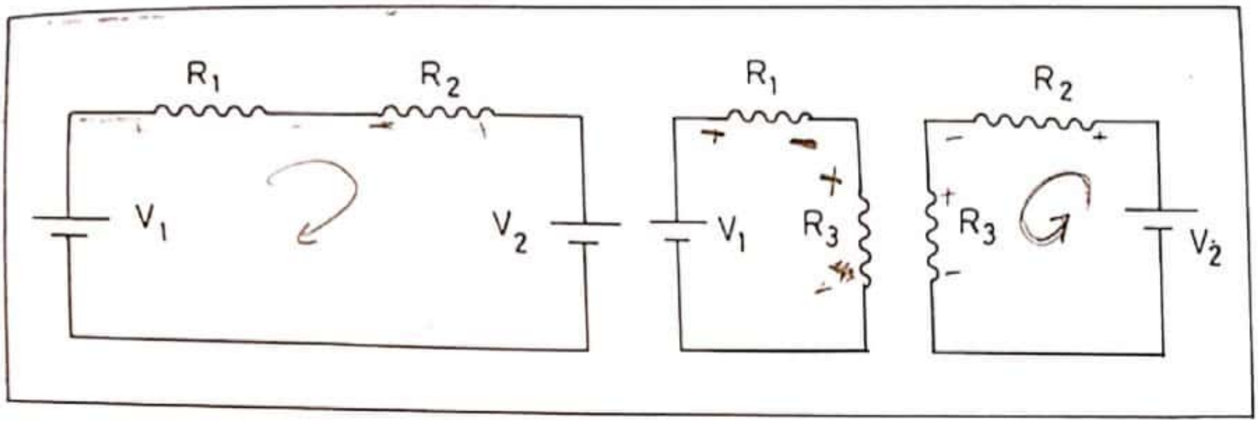


diagram 1

B. Using the values obtained in part A, calculate the sum of voltage drops around the three loops shown below:



$V_1 + V_{R_1} + V_{R_3}$ = -6 + 2.2 + 3.6 = 0.2 volt

$V_2 + V_{R_2} + V_{R_3}$ = -3 + 0.7 + 3.6 = 1.3 volt

$V_1 + V_{R_1} + V_{R_2} - V_2$ = -6 + 2.2 - 0.7 + 3 = -1.5 volt

Are the sums shown above equal to zero?

Yes they are close to zero.

C. Using the values of currents obtained in part A, calculate the total sum of currents at the junction O

$I_1 + I_2 + I_3 =$ +7mA - 5.4 mA - 1.4 mA = 0.2

Is the sum equal to zero?

Yes, 0.2 ≈ 0

D. Using the values of V_1 and V_2 and the values of R_1, R_2, and R_3, set up the **loop** and **branch** equations, and solve them to determine the values of I_1, I_2 and I_3 and **compare** with the values obtained **experimentally** in part A.

Loop equations:

Outer Loop: $-V_1 + I_1R_1 - I_2R_2 + V_2 = 0$

$-6 + 330I_1 - 470I_2 + 3 = 0$

$330I_1 - 470I_2 = 3V$ — (2)

Branch equations:

$-V_1 + I_1R_1 + I_3R_3 = 0$

$330I_1 + 0I_2 + 680I_3 = 6V$ — (1)

$I_2R_2 + V_2 - I_3R_3 = 0$

$680I_3 - 470I_2 + 0I_1 = 3V$ — (4)

$$\begin{bmatrix} 330 & 0 & 680 \\ 0 & -470 & 680 \\ 1 & -1 & -1 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} 6 \\ 3 \\ 3 \end{bmatrix}$$

$I_1 = I_2 + I_3$

$I_1 - I_2 - I_3 = 0$

$1 - (1 -) = 0 \rightarrow$ (5)

Calculated values:

I_1 = 6.95×10^{-3} Ampere

I_2 = 1.5×10^{-3} Ampere

I_3 = 5.45×10^{-3} Ampere

Experimental values:

I_1 = 7×10^{-3} Ampere

I_2 = 1.4×10^{-3} Ampere

I_3 = 5.4×10^{-3} Ampere

$R_1 = 33 \times 10^1$

$R_2 = 47 \times 10^1$

$R_3 = 68 \times 10^1$

LAB REPORT FOR EXPERIMENT 10

Date: 3/12/2019

Name ----------

Partner's Name:-

Registration No:-----------------

Registration No:---------------

Physics Section:------------------

Instructor's Name:------------

PHYSICS LAB EXPERIMENT 10: ELECTROMAGNETIC INDUCTION

I. PURPOSE:

To investigate the conditions required to produce an induced current.

II. DATA AND DATA ANALYSIS:

Enter, in Table 10.1 below your observations and deductions on the investigated cases of induced current production.

Table 10.1

Action	Direction of Current Primary	Direction of Current Secondary	Size of deflection and comments	
(a)	clockwise	Counterclockwise	Small deflection	
(b)	Clockwise	Clockwise	Small deflection	
(c)	Clockwise	Counter clockwise	Small deflection	
(d)	Clockwise	Clockwise	Small deflection	
(e)	Clockwise	Clockwise	Small deflection	
(f)	Clockwise	Counter clockwise	Small deflection	
(g)	clockwise	Counter clockwise	Small deflection but greater than the past ones.	→ greater
(h)	Clockwise	counter clockwise	Small deflection	
(i)		Counter clockwise	moderate deflection	Small but
(j)		Clockwise	moderate deflection	still greater than the
(k)		Clockwise	moderate deflection	deflection in the
(L)		Counter clockwise	moderate deflection	past trials

1- From the directions of the secondary current in case a and b determine whether **Lenz's law** is obeyed. Explain.

Case a:

Lenz's law is obeyed, because the secondary current direction flows in the other direction (Counter clockwise), to oppose the change that produce it.

primary current is on "Clockwise" ⟹ Secondry current is produced in the opposite direction

Case b:

Linz's law is obeyed, since:
Primary current is off ⇒ Secondry current is produced clockwise to opposite the change in the current.
"Clockwise"

2- Explain the reason for the **difference in deflection** of the galvanometer in case **g** when a soft iron rod is inserted in the winding .

The difference in deflection is larger in case g because the iron is a high magnetic material so the current is larger.

3- Explain what happens to the **size of deflection** of the galvanometer when a brass rod is inserted in the windings.

The size of deflection stays small (does not change) because the brass rod is less of a magnetic material than the iron so the current is small.