PHY 108: ELECTRICITY & MAGNETISM

EXPERIMENT 1 : OHM'S LAW

Lab Report:

Date: 27.10.21	
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#1: Record the data from Table 3-1.

	R_1			R_2			R_3		
	Nominal R: *2.2 kΩ*			Nominal R: *4.7 kΩ*			Nominal R: *10 kΩ*		
	Measured R: 2.16 KΩ			Measured R: 4.67 KΩ			Measured R:		
	Measured Values		$I_{Calculated}$	Measured Values		$I_{Calculated}$	Measured Values		$I_{Calculated}$
	$E_{Measured}$	$I_{Measured}$		$E_{Measured}$	$I_{Measured}$		$E_{Measured}$	$I_{Measured}$	
1 V	1.03V	0.47 mA	0.45 mA	1.00 V	0.21 mA	0.21 mA	1.00 V	0.10 mA	0.1 mA
2 V	2.04V	0.94 mA	0.91 mA	2.02 V	0.42 mA	0.43 mA	2.03 V	0.20 mA	0.2 mA
5 V	5.02V	2.31 mA	2.27 mA	5.00 V	1.01 mA	1.06 mA	4.96 V	0.51 mA	0.5 mA
10 V	10.02V	4.62 mA	4.55 mA	9.97 V	2.12 mA	2.13 mA	9.97 V	1.02 mA	1.0 mA
15 V	15.02V	6.96 mA	6.82 mA	15.02 V	3.21 mA	3.19 mA	15.04 V	1.53 mA	1.5 mA
20 V	20.08V	9.33 mA	9.09 mA	20.06V	4.27 mA	4.26 mA	20.04V	2.04 mA	2.0 mA
25V	25.09 V	11.75 mA	11.36 mA	25.06 V	5.36 mA	5.32 mA	25.01 V	2.55 mA	2.5 mA

For, R_1, $I_{calculated} = \frac{1V}{2.2K\Omega} = 0.45$

#2: Comment on the measured current compared to calculated currents.

For, R_1

$I_{measured} = 0.94\ mA$

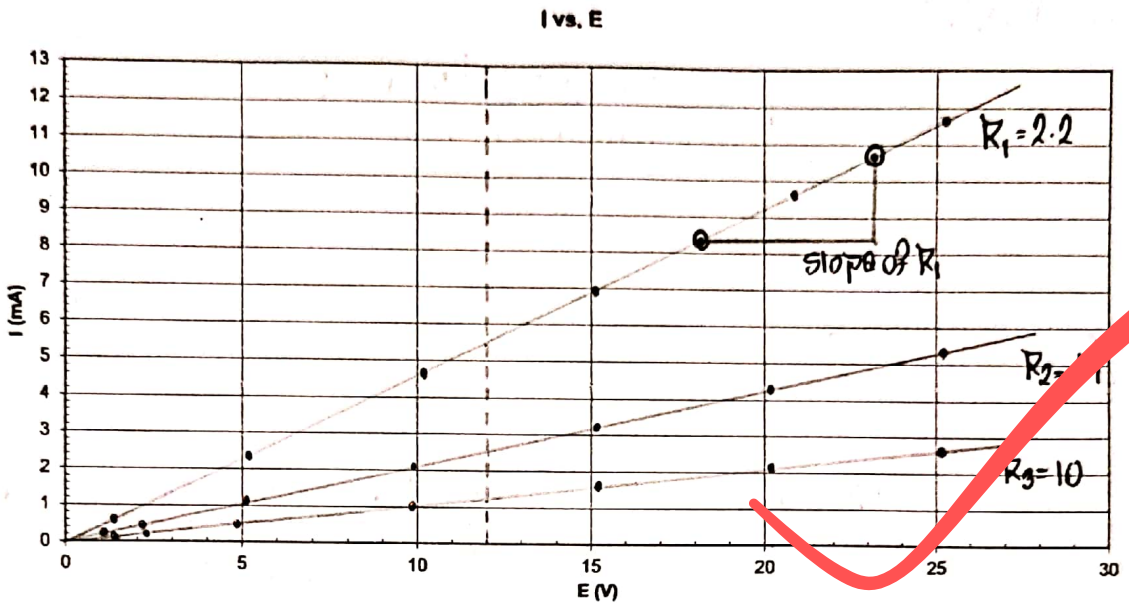
$I_{calculated} = 0.91\ mA$

$\therefore$ % of Error $= \left|\frac{I_{calculated} - I_{measured}}{I_{calculated}}\right| \times 100\% = \left|\frac{0.91 - 0.94}{0.91}\right| \times 100\%$

$= 3.3\%$

So, as calculated all other values of $I_{measured}$ and $I_{calculated}$ the % of error are minimal between measured current and calculated current the error is minimal.

#3: Use the data obtained in Table 3.1 to plot $I_{measured}$ vs. $E_{measured}$ graph.



#4: What does the inverse of the slope of your graphs represent? Illustrate using an example.

The inverse of the slope of my graphs represent the resistance of the resistor.

Inverse slope $= \frac{\Delta I}{\Delta E} = \frac{I_2 - I_1}{E_2 - E_1}$ $\frac{10.7 - 8.21}{23 - 18} = 0.498\ K\Omega^{-1}$ or $0.5\ K\Omega^{-1}$

The slope is same as the slope of the curve.

2KΩ

#5: Using your graph, estimate the current that would flow through each resister at *E* = 12 volts and compare it with the calculated value (12 V/ $R_{Measured}$). Calculate the error.

For *E* = 12 V

Measured Resistance	Estimated Current from Graph	Calculated Current (12 V/ $R_{Measured}$)	% of Error
R_1 = 2.16 KΩ	5.5 mA	5.56 mA	1.08%
R_2 = 4.67 KΩ	2.6 mA	2.57 mA	1.17%
R_3 = 9.82 KΩ	1.1 mA	1.22 mA	9.84%

$R_1 \Rightarrow$ % of error $= \left|\frac{5.56 - 5.5}{5.56}\right| \times 100\% = 1.08\%$

$R_2 \Rightarrow$ % " " $= \left|\frac{2.57 - 2.6}{2.57}\right| \times 100\% = 1.17\%$

$R_3 \Rightarrow$ % " " $= \left|\frac{1.22 - 1.1}{1.22}\right| \times 100\% = 9.84\%$