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(24)

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Lab Report - 05

Name of the Experiment	: Period of Oscillation for a Pendulum and determination of volume of "g"
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Name of the Lab Partner	: Rahiqul Islam Alif
Date	: 28/10/25

Instructor's comments:

Data tables:

Table 1. Mass Dependence of the Period

Length, 40cm = 0.4m || Angle, θ = 5°

Length of Pendulum, L = 0.4 m

Mass (grams)	A Single Period (sec)			T_{avg} (sec)	$T_{avg}2$ (sec^2)
13.8	1.312	1.304	1.326	1.314	1.7266
21.6	1.294	1.296	1.34	1.31	1.7161
82	1.32	1.346	1.324	1.33	1.7689

Table 2. Angle Dependence of the Period

Mass of Pendulum = 82 grams ; l = 40cm = 0.4m

Angle (degrees)	A Single Period (sec)			T_{avg} (sec)	$T_{avg}2$ (sec^2)
5	1.32	1.346	1.324	1.33	1.7689
8	1.324	1.328	1.326	1.326	1.7583
10	1.306	1.302	1.334	1.314	1.7266
15	1.312	1.334	1.302	1.316	1.7318
20	1.308	1.328	1.322	1.319	1.7406
30	1.316	1.334	1.328	1.326	1.7583
40	1.328	1.334	1.354	1.338	1.792

For 5(degrees),

Average Time period, $T_{avg} = \dfrac{1.32+1.346+1.324}{3}$

$= 1.33\ s$

$\therefore T_{avg}^2 = (1.33)^2 = 1.7689\ s^2$

~~$= 1.66\ s^2$~~

m = Fixed 82gm
θ = Fixed 5°

Table 3. Length Dependence of the Period

Length l (m)	A Single Period (sec)			T_{avg} (sec)	$T_{avg}2$ (sec^2)
0.40	1.3	1.298	1.314	1.304	1.70
0.45	1.404	1.388	1.404	1.3986	1.956
0.50	1.458	1.466	1.464	1.4626	2.139
0.55	1.518	1.54	1.528	1.5287	2.337
0.60	1.59	1.582	1.584	1.585	2.5133

Slope of the best fit line = 3.9 s^2/m.

g_{exp} = 10.122 m/s^2.

Percent error = 3.18%

Results:

$$\text{Slope} = \frac{\Delta T^2}{\Delta l} = \frac{1.32-0.93}{0.3-0.2} \quad \frac{1.35-0.96}{0.3-0.2}$$

$$= 3.9 \ s^2/m$$

Now,

$$g_{exp} = \frac{4\pi^2}{\text{slope}} = \frac{4\pi^2}{3.9} = 10.122 \ ms^{-2}$$

$$\text{Percentage error} = \left| \frac{9.81 - g_{exp}}{9.81} \right| \times 100\%$$

$$= \left| \frac{9.81 - 10.122}{9.81} \right| \times 100\%$$

$$= 3.18\%$$

Questions:

1. Does the period of a simple pendulum depend on the mass?

No, ~~No~~, The period of a simple pendulum doesn't depend on the mass. We know, $T=2\pi\sqrt{l/g}$; here the formula is independent of mass.

2. Is the period constant over small angles? Does it vary when one reaches larger angles?

We observe that, small angle like $\theta \leq 15°$, the period remain almost constant. But after the angle getting larger the period increase with respect to angle increase.

3. Does the period depend on the length of the pendulum?

Yes, the period significantly depend on the length of the pendulum. We know, $T=2\pi\sqrt{l/g}$, $T \propto \sqrt{l}$. So, the period, with respect to l change in square root term.

4. Of the three parameters explored in this experiment, which has the strongest influence?

Of the three parameters, we explored; Length, (l) has the strongest influence on change in period cause every small change in l, increase T in a bigger pattern. We know, $T \propto \sqrt{l}$. But the other two, mass is independent and θ cause very small change.

5. Is your best-fit line in form Table-3 goes through the origin? Explain why or explain not?

No, in this experiment we didn't consider the effective length of the string, $L = l+R$, rather we use only the string length (l) was considered, the main equation, $T^2 = 4\pi^2 \frac{L}{g}$

$$= 4\pi^2 \frac{l}{g} + 4\pi^2 \frac{R}{g}$$

Here, we exclude the second part (R) when experimenting. So our graph didnot go through the origin, rather it pass through the y-axis.

Discussion:

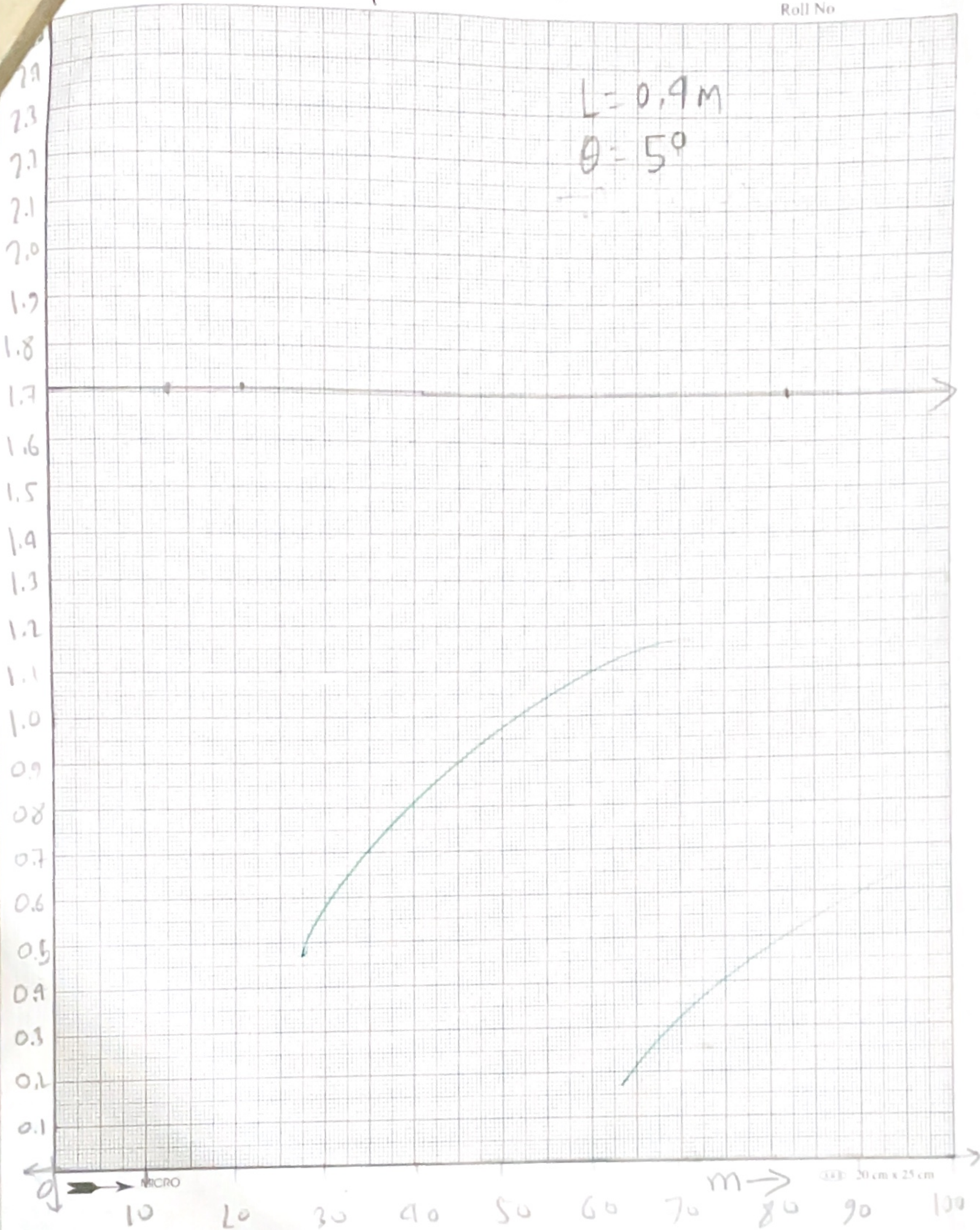
Today our main goal of the experiment was to determine whether the period of oscillation is dependent on mass, the angle of displacement and the length of pendulum. And also to measure the acceleration due to gravity. To experiment this, we use three different masses, bob and string. We saw that, the whole experiment was independent of mass, but the actual result slightly vary for instrumental error, and also for human error as we observe the time period by our own eye and using stop watch. But for the other inputs like angle, upto 15° it was almost same but then it increases the time period as for the greater angle, sinθ got deviated from normal θ. But the most influence on changing period was the length of string. But we observe that the practical g, calculated from the graph, is slightly vary from the theoritical g, cause of instrumental error, and some human error caused by us.

Finally, we are able to observe how there three factor influence on 'g'.

We calculated the value of g and it varied due to human error. Our error find by g is 3.18% and $g = 10.122\ ms^{-2}$.
The error is less than 5%.

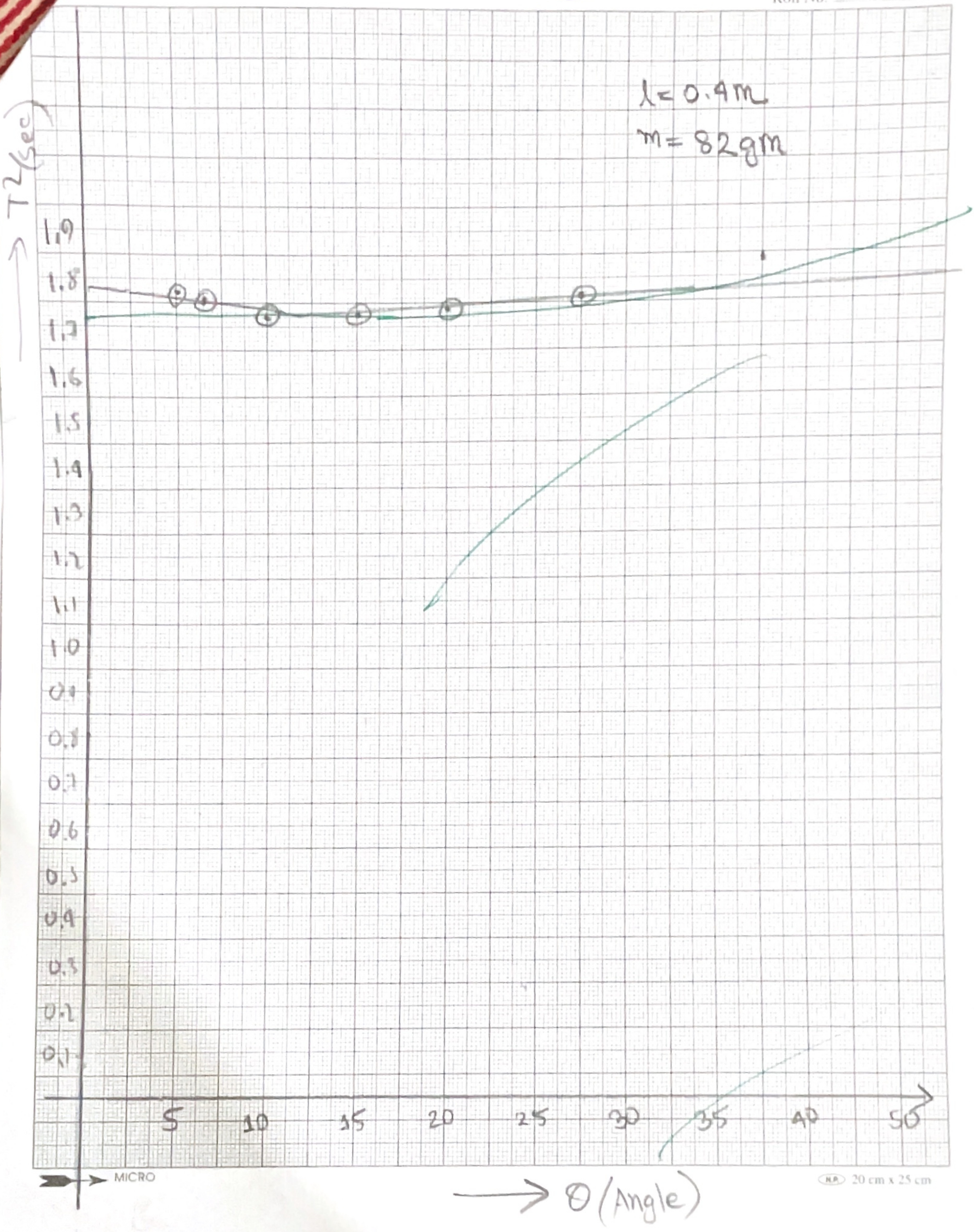
Rahiqul Islam Alif (22) Graph-01

Roll No



Tasvirul Hasan Riyad (24) Graph-02

Roll No.



Tasvirul Hasan Riyad (24) Graph-03