**PHYSICS 1D03 Lab 3 WRITE-UP**

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Lab Section:\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Student No:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Partner:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Lab Section:\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Student No:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**FINDING RADIUS, PART 1 RESULTS**

Part 1. Finding the radius of the shaft

 Radius \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_±\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ( )

**FINDING** $I\_{o}$**, PART 2 RESULTS**

Part 2. Measuring I0

Driving mass M = 15 g

Radius of shaft $r=$

Table 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *t* ± ( ) | *h* ± ( ) | *v* ± ( ) | *w* ± ( ) | *I0* (method 1) | *I0* (method 2) |
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Report $I\_{o}(t)$ as the average value plus or minus the standard deviation

Method 1. I0 = \_\_\_\_\_\_\_\_\_\_\_\_\_±\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ( )

Method 2. I0 = \_\_\_\_\_\_\_\_\_\_\_\_\_±\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ( )

**FINDING** $I\_{m}$**, PART 3 RESULTS**

Method 2 I0 = \_\_\_\_\_\_\_\_\_\_\_\_\_±\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ( )

Part 3. $I\_{m}$ versus R

Table 2

Do not calculate errors for these quantities

|  |  |  |  |
| --- | --- | --- | --- |
|  *R* ( ) |  *t* ( ) | *I* ( ) | $$I\_{m}$$( ) |
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**PART 4: ANALYSIS**

Part 4: Graphical Analysis

Table 3

Do not calculate errors for these quantities

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| --- | --- | --- | --- | --- |
| *R* ( ) | *R2* ( ) | log *R* |  *Im* ( ) | log *Im* |
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Place your log-log plot from the procedure for PART 4 on this page

Place your $I\_{m}$ versus $R^{2}$ plot from the procedure for PART 4 here.

**DISCUSSION AND CONCLUSIONS**

***Question 1:*** How will the thickness of the string affect your measurements and subsequent calculations?

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***Question 2:*** Identify the point on each curve at which the driving mass is at its lowest position. Make sure to explain your reasoning. It may be helpful to describe the location of the point on both axes relative to the position of the extrema in position, linear velocity or angular velocity.

Think carefully about this question, keeping in mind that the rotary motion sensor determines position, linear velocity and angular velocity from the speed of rotation of the rotating shaft.

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***Question 3:*** How did you determine the starting time for each measurement from the software? With that in mind, what would the uncertainty in time be based on the software?

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***Question 4:*** Compare the results obtained between Method 1 and Method 2. Which method is more precise, and why (explain)?

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Question 5:For the log $I\_{m}$ versus log *R* plot, do the slope and y-intercept agree with the theoretical predictions of the moment of inertia of a point mass *m* situated at a distance *R* from the axis of rotation? Explain why or why not using the values of the slope and the y-intercept.

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Question 6: For the $I\_{m}$ versus $R^{2}$ plot, do the slope and intercept agree with the theoretical predictions? Explain why or why not using the values of the slope and the y-intercept, and provide possible causes of error if the values do not agree.

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Question 7: Based on your plot of *I*m versus *R*2, how well do our masses approximate point masses? Explain. Recall the general theoretical expression for moment of inertia.

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***Question 8:*** Explain why there may be any discrepancies between your results from the two plots you made. Describe any sources of error that may have arisen in the procedure for determining *I0* and *I*.

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Question 9: What simple observation could be made from the experiment which would indicate that there is a loss of mechanical energy due to friction and air resistance?

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