Pre-Lab Report

Lab section:

Name & Surname:

Table # :

***Before the Lab* complete this page YOURSELF! Hand it in *in the first 5 min*. of the session PERSONALLY!**

You MUST justify your answers and show all steps. NO COPYCAT answers, or NO credits!

Please read the relevant presentation on PHYS LAB Website.

Q1. What does the Inertia of the system in this experiment depend on, in terms of the quantities you are going to measure? **Justify your answer or no credits!**

(2nd Question is on the next page!)

Q2. Show the dimension **analysis** for torque **explicitly! Show your formulae and derivation step by step or no credits**!

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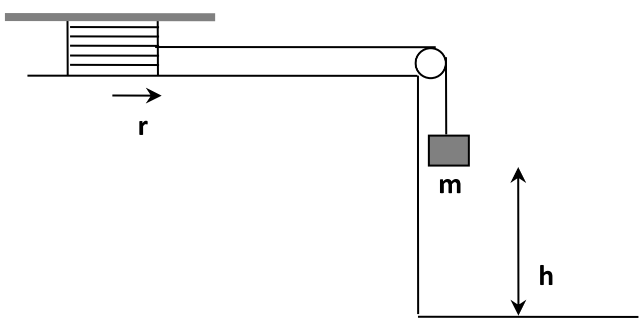
***Complete this report YOURSELF except DATA taking parts! Use a pencil for plots only and a pen for the rest!* Show your work clearly, NO COPYCAT analysis allowed, or NO credits!**

OBJECTIVE : To measure the effect of torque acting on a rotating mass.

THEORY :



A rotating object also obeys the Newton's Laws of motion. When we apply a torque on an object, we can express the Newton's Law in terms of the torque and the angular acceleration:

$$\tau = I\alpha$$

where torque is applied through a string wrapped around the drum with a radius r attached to a free falling object of mass *m*.

$\mathcal{T}$ is tension in the string:

$$\tau = \vec{F}x\vec{r} = mgr = \mathcal{T}\,\mathrm{r}$$

Then the torque and angular acceleration equation becomes

$$I\alpha = \mathcal{T}\,\mathrm{r}$$

Using the force equation

$$\mathcal{T} - \mathrm{mg} = -\mathrm{ma} \quad (\mathrm{a} = \alpha \mathrm{r})$$

we can determine the moment of inertia by measuring the angular acceleration.

$$I = \frac{mgr}{\alpha} - mr^2$$

We can also determine the moment of inertia from the free fall time:

$$I = mr^2\left[\frac{gT^2}{2h} - 1\right]$$

APPARATUS : Rotational inertia apparatus with rotational sensor, data logger, mass and hanger set.

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PROCEDURE :

1. Using a small mass (50 g) on the mass holder, observe the rotational motion of the disk on the rotational inertia apparatus. You should set the data logger to **2 samples/s**. When the free fall is completed, retrieve the rotation angles as a function of time from the data logger.
2. Calculate the average angular velocity for successive time intervals and plot the result as a function time. ($\omega_{average} = \Delta\theta / \Delta t$)
3. From your graph, obtain the angular acceleration of the disk assembly by determining the slope of the straight line fit to your data.
4. Determine the moment of inertia of the disk assembly using the angular acceleration.
5. Determine the free fall time and the height of the mass holder from the floor and calculate the moment of inertia using the equation given above.
6. Compare both results for the moment of inertia and calculate the percentage difference between them:

$$\%\text{diff} = \frac{|I_1 - I_2|}{(I_1 + I_2)/2} \times 100$$

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DATA:

Description / Symbol			Value & Unit
Diameter of the drum	d	=	. . . .
Radius of the drum	r	=	. . . .
Mass on the mass holder + mass of the holder	m	=	. . . .
Height of the mass holder from the floor	h	=	. . . .
Time for descent	T	=	. . . .

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Δt ( )	t ( )	Θ ( )	$\Delta\Theta$ ( )	$\omega_{average} = \Delta\Theta / \Delta t$ ( )

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From the line, choose two SLOPE POINTS other than data points,

SP_1 : (;)

SP_2 : (;)

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CALCULATIONS & RESULTS

By using SP_1 and SP_2, calculate:

Description / Symbol		**Calculations(show each step)**	**Result**	**Dimension**
SLOPE	=	....	....	....
		....		
Angular Acceleration α	=	....	....	....
Moment of Inertia $I = \frac{mgr}{\alpha} - mr^2 =$		....	....	....
$I = mr^2\left[\frac{gT^2}{2h} - 1\right]$	=	....	....	....
		....		

%difference for *I*:

Consult to the resources for this experiment from PHYS LAB Website:

PHYL101 Intro **Presentation #7** **PHYL101 Lab Book**