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. Show the dimensional analysis for the Torsion Constant, κ. **Show your formulae / derivation below explicitly or no credits!**

Q2. How would the period of the oscillations be affected if you place another object on the disc while it is oscillating? Would the answer be different if you place the object before starting to oscillate? **Justify your answers, show calculations if needed or no credits!**

(3rd Question is on the next page!)

Q3. What would the uncertainty in determining the torsion constant k be if the period and the radius of the ring are determined with 1% uncertainties? Consult to the introduction part of your Lab Book or you may search for “Error propagation”. **Show your calculations below <u>explicitly or no credits</u>!**

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Lab Report

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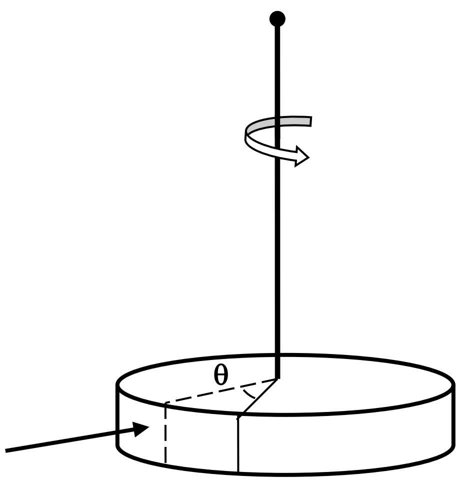
Complete this report YOURSELF except DATA taking parts! Use a pencil for plots only and a pen for the rest! **Show your work clearly, NO COPYCAT analysis allowed, or NO credits!**

OBJECTIVE : To study angular oscillatory motion and the dependence of the period of oscillation on the moment of inertia of the system.

THEORY :



We can study the angular harmonic motion in a torsional system where an object is attached to a straight rod and rotated to some angle initially. This initial rotation causes some torsion in the wire thereby producing a restoring torque. Resulting torque equation is similar to the force equations that we obtained for the simple harmonic oscillation; hence it has the same type of solution for the period:

$$T = 2\pi\sqrt{\frac{I}{\kappa}}$$

Below are the formulas to calculate the moment of inertia of uniform disk and ring masses:

$$I_{disk} = \frac{MR^2}{2}$$

$$I_{ring} = \frac{1}{2}M\left[\left(\overline{R}_{inner}\right)^2 + \left(\overline{R}_{outer}\right)^2\right]$$

APPARATUS: Torsion pendulum, disk and ring masses, meter stick, stopwatch.

PROCEDURE :

Part 1:

1. Measure the time, t, for the disc to complete 50 oscillations, and determine the mean period of oscillation T.
2. Measure the diameter of the disk, compute the radius R for the disc.
3. By using this radius, compute the moment of inertia of the disc and the torsion constant of the rod.

Part 2:

1. Place the body whose moment of inertia is unknown, on the disc, measure the time to complete 50 oscillations, and determine the mean period of oscillation T.
2. Compute the sum of the moment of inertias of the disc and the body.
3. Evaluate the moment of inertia of the body.
4. Compute the theoretical value of moment of inertia and determine the percentage error.

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Part 1: Moment of Inertia of the Disk

Description / Symbol			Value & Unit
Time for 50 oscillations	t	=	. . . .
Time for one oscillation	T	=	. . . .
Diameter of the disc	D_{disc}	=	. . . .
Radius of the disc	R_{disc}	=	. . . .
Mass of the disc	M_{disc}	=	. . . .

Part 2: Moment of Inertia of the Object & the Disc

Description / Symbol			Value & Unit
Time for 50 oscillations	t^*	=	. . . .
Time for one oscillation	T^*	=	. . . .
Outer diameter of the ring	D_{outer}	=	. . . .

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Description / Symbol			Value & Unit
Outer Radius of the ring	R_{outer}	=	....
Inner diameter of the ring	D_{inner}	=	....
Inner Radius of the ring	R_{inner}	=	....
Mass of the ring	M_{ring}	=	....

CALCULATIONS:

Description			Calculations (show each step)	Result
Moment of Inertia of the disk (theoretical)	I_{disc}	=	....	....
			....	
Torsion constant of the rod (emprical)	κ	=	....	....
			....	

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CALCULATIONS:

Description			Calculations (show each step)	Result
Total Moment of Inertia of the disk and the ring (emprical)	I_{total}	=	. . . .	. . . .
			. . . .	
Moment of Inertia of the Ring (emprical)	$I_{ring\text{-}EV}$	=	. . . .	. . . .
			. . . .	
Theoretical value of the Moment of Inertia of the ring	$I_{ring\text{-}TV}$	=	. . . .	. . . .
			. . . .	

% Error for the Moment of Inertia of the object: . . . .

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

PHYL102 Intro | **Presentation #5** | **PHYL102 Lab Book**