

EXPERIMENT #12 - PHYSICS 30

Torsion Pendulum

OBJECT: To study the moment of inertia by using a torsion pendulum.

EQUIPMENT: rod and clamp
disk and ring
timer

THEORY: Refer to chapters 12 and 15 of Resnick and Halliday.

GENERAL DIRECTIONS:

1. A torsion pendulum may be constructed by suspending a disk or a disk and ring by a thin rod as indicated below:



By properly using a timer measure the period of oscillation for the torsion pendulum with the disk only. Approximately fifty oscillations should be used to determine the period.

2. Place the ring concentrically over the disk. Using the same method that was described in part 1 measure the period of oscillation of the disk and ring torsion pendulum.
3. Detach the ring and disk from the thin rod and measure the diameter of the disk, the outer and inner diameters of the ring, the mass of the disk, and the mass of the ring.
4. Using the values for the ring's mass, inner diameter, and outer diameter calculate the moment of inertia of the ring about the appropriate axis.
5. Starting with a basic equation for angular motion derive a differential equation that describes the motion of a torsion pendulum in terms of angular displacement (θ), time (t), moment of inertia (I), and a torsion constant (K). Write down the solution for this differential equation and the equation for the period of a torsion pendulum in terms of I and K .
6. Calculate the moment of inertia of the disk by using the values for the moment of inertia of the ring and the two periods of oscillation.
7. Calculate the moment of inertia of the disk by using the mass and diameter of the disk. Compare this value to the value calculated in part 6 by finding the per cent error. Explain why there may be an error.