

Prelab: Experiment #6 – Moment of Inertia

Read the lab and find the equations necessary to answer the following questions. Neatly derive the uncertainty formulas for those equations. There are a lot of calculations to be done for this lab. If you have used MS Excel before, you should prepare a spreadsheet to help you do the calculations in the lab with your experimental data.

1. A student measures the angular acceleration of a pulley system with no load. He finds $\alpha_{\text{No Load}} = 5.10 \text{ rad/s}^2 \pm 2\%$. The hanger tied to the pulley has a mass of $100 \pm 1 \text{ g}$. The radius of the pulley where the string is attached is $75.0 \pm 0.1 \text{ mm}$. The acceleration due to gravity is $9.81 \pm 0.01 \text{ m/s}^2$. Find the experimental moment of inertia for the pulley with no load. The answer must be in SI units.
(0.01386 ± 0.00047)
2. A symmetrically-shaped object, the load, is placed on the pulley. With the load in place, the student finds $\alpha_{\text{Load}} = 4.23 \text{ rad/s}^2 \pm 2\%$. What is the experimental total moment of inertia for the pulley and load? The answer must be in SI units.
(0.01683 ± 0.00057)
3. Using the results of Questions 1 and 3 above, what is the experimental value of the moment of inertia of the load (i.e. the shape) all by itself?
(0.0030 ± 0.0010)
4. A solid disk has a mass of $500 \pm 1 \text{ g}$ and a diameter of $20.0 \pm 0.2 \text{ cm}$. What is the theoretical moment of inertia of this disk about the vertical axis through its centre of mass? The answer must be in SI units.
(0.002500 ± 0.000055)
5. A rectangular plate has a mass of $200 \pm 1 \text{ g}$, small side length of $5.0 \pm 0.1 \text{ cm}$, and long side length of $10.0 \pm 0.2 \text{ cm}$. What is the theoretical moment of inertia of this plate about the vertical axis through its centre of mass? The answer must be in SI units.
(0.0002083 ± 0.0000094)
6. A thick ring has a mass of $300 \pm 1 \text{ g}$, an inner diameter of $30.0 \pm 0.2 \text{ cm}$, and an outer diameter of $32.0 \pm 0.2 \text{ cm}$. What is the theoretical moment of inertia of this ring about the vertical axis through its centre of mass? The answer must be in SI units.
(0.007215 ± 0.000117)

Note, you will not be allowed into the lab until you show that you have done the pre-lab and have properly prepared the introductory portion (Title, Goal, Theory Summary, and Uncertainty Derivations) of the lab in your notebook.

No extra lab time will be allowed for the time you miss because you are unprepared.