Moment of inertia of a table tennis ball*

Azeem Iqbal, Muhammad Sabieh Anwar
Centre for Experimental Physics Education
LUMS School of Science and Engineering

December 1, 2015
Version 2015-1

This task is an interesting extension to the experiment (1.2A) where we determined the moment of inertia of a tennis ball using the geometrical expression for a hollow sphere. Here, you are required to experimentally determine the moment of inertia of a ping-pong (table tennis) ball using its intrinsic properties.

The moment of inertia of a hollow-sphere with a sufficiently thin spherical shell of radius R and mass M can be predicted using,

$$I = \frac{2}{3}MR^2, \tag{1}$$

Now, observe in your apparatus that the ping pong ball is suspended at the end of a very thin wire and is allowed to oscillate as a torsional pendulum. Here, the period of simple harmonic motions depends on the moment of inertia of the ball and the torsional constant κ of the wire($\tau = -\kappa\theta$). For the provided string, κ has been found to be (21.5 ± 0.1) gcm^{2}s^{-2}. The expression for the oscillation period T of a torsional pendulum is,

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

Use this information to calculate the moment of inertia of the table tennis ball. You will receive credit for (a) tabulating data, (b) calculating the values and (c) calculating the uncertainties. How does your measured I compare with the value determined from the geometry in (Eq.1)?

References

[1] X-S. Cao, "*Moment of inertia of a Ping-Pong ball*", Phys. Teach, Vol. 50, 292 (2012).