The swinging rod*

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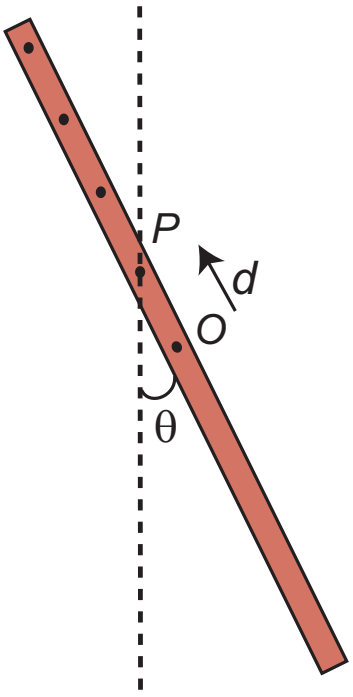
This experiment is yet another exercise in mathematical model building emerging from experimental observations. The object of interest is a rectangular cross section rod, essentially a meter rule of mass M and length L. There is a series of holes drilled through the midline of the rod. There is the provision of hanging the rod vertically with the help of a pin through any of the provided holes. See the accompanying figure. The position of the pin is P and the rod is made to swing in a vertical plane about this pivot. The centre of mass is of course the point O.



I require you to measure the time period T of the oscillation with the provided stop watch as the pivot P is varied. Plot a graph between T and d. Is there a minimum or maximum in your graph?

An important part of this experiment is to interpret the results. Use your knowledge of pendulums, simple harmonic motion, moments of inertia and the parallel axis theorem, to come up with a theoretical prediction. Any standard textbook [1] can provide you enough material to come up with a theoretical model. How do the experimental results compare with your predictions? I also like you to superpose the experimental data on top of the theoretical predictions. Why are there any discrepancies between observation and prediction? What are the additional variables that can be incorporated in order to improve the theoretical prediction?

References

[1] *Physics for Scientists and Engineers with Modern Physics*, J.W. Jewett and R.A. Serway, Cengage Learning, Delhi (2008).

[2] Many oscillations of a rigid rod, A. Cromer, Am. J. Phys. 63, 112 (1994).