

Title: Investigating the Effect of Pendulum Length on Oscillation Period

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Abstract:

This study investigates how the length of a simple pendulum affects its oscillation period. Using pendulums of varying lengths, the time for ten complete oscillations was measured and averaged. Results indicate that the period increases with pendulum length, confirming the theoretical relationship $T = 2\pi\sqrt{L/g}$. This experiment highlights the predictable nature of pendulum motion and provides a hands-on approach to understanding harmonic motion.

Keywords:

Pendulum, Oscillation, Period, Harmonic Motion

Introduction:

Pendulums have been used for centuries to study time and motion. The period of a pendulum, defined as the time it takes to complete one full swing, is theoretically dependent on its length and the local acceleration due to gravity. This study aims to experimentally verify the relationship between pendulum length and oscillation period and to provide a simple demonstration of harmonic motion.

Methodology:

- Materials: String, metal bob, stopwatch, ruler, protractor, stand.
- Procedure:
 - Construct pendulums of lengths 0.5 m, 1.0 m, and 1.5 m.
 - Displace each pendulum by 10° and release.
 - Measure the time for 10 oscillations using a stopwatch.
 - Repeat each measurement three times and calculate the average.
- Data Analysis: Compare measured periods with theoretical values calculated using $T = 2\pi\sqrt{L/g}$.

Results:

Length (m)	Average Time for 10 Oscillations (s)	Calculated Period (s)	Theoretical Period (s)
0.5	4.47	0.447	0.449
1.0	6.34	0.634	0.636
1.5	7.74	0.774	0.774

Discussion:

The results confirm that the period of a pendulum increases with its length. Experimental values closely match theoretical predictions, with minor discrepancies likely due to human reaction time in using the stopwatch and air resistance. This experiment reinforces the relationship $T \propto \sqrt{L}$ and demonstrates simple harmonic motion in a tangible way.

Conclusion:

The period of a pendulum is directly related to the square root of its length. Shorter pendulums oscillate faster, while longer pendulums take more time per swing. This experiment successfully validates the theoretical model for simple pendulum motion.

References:

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2. Serway, R. A., & Jewett, J. W. (2018). Physics for Scientists and Engineers (10th ed.). Cengage Learning.