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Hooke's Law: Spring Constants

Two experiments were performed to determine the force constant of a steel spring. First, a mass was attached to the free end of an unstretched, vertical spring and allowed to fall freely. The maximum amplitude of the resulting oscillation was recorded for several different masses. The initial potential energy was plotted versus the square of the oscillation's amplitude. The resulting plot appeared linear, and the slope was determined using the method of least squares. By doubling the slope, a spring constant of 10.27 ± 0.44 N/m was obtained. The main source of uncertainty was the accuracy of the maximum amplitude. In the second method, a mass was hung from the vertical spring so that it did not oscillate. The change in length of the spring was recorded for several different masses. Weight was plotted versus this displacement. The resulting plot appeared linear, and the slope was determined using the method of least squares. From this slope, the force constant was determined to be 9.92 ± 0.23 N/m. The main source of uncertainty was the accuracy of the measured displacement. This value is consistent with the result obtained using the first method.

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