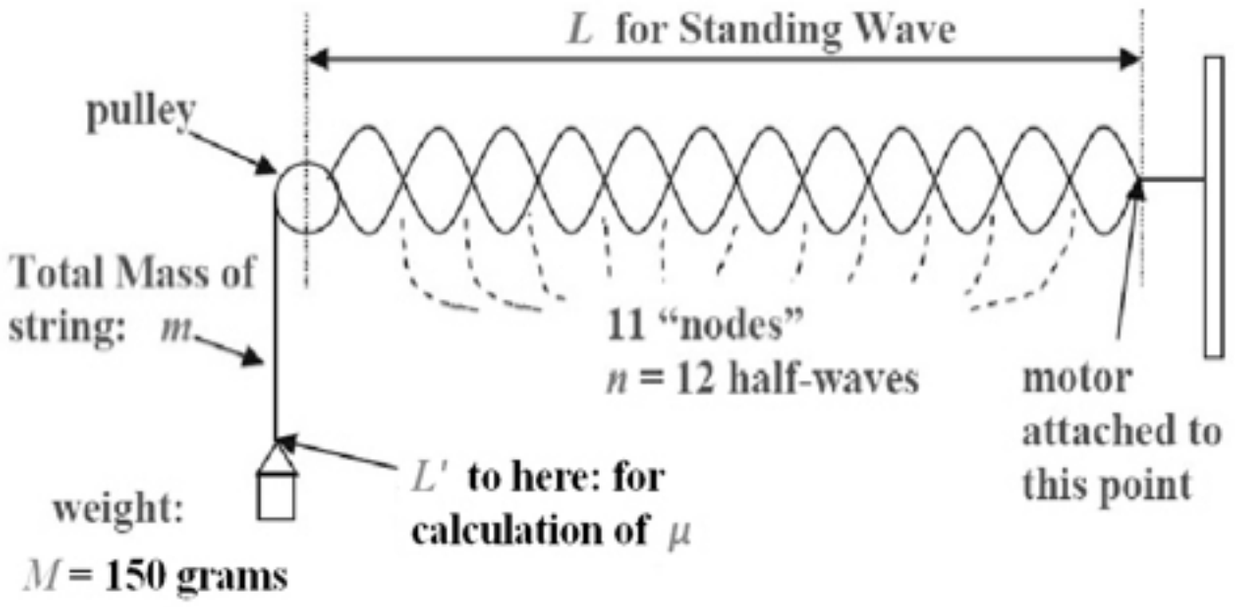
Standing Waves: Dependence of $(f_1)^2$ on the hanging mass M



If the mass density of the string was 0.0013 kg/m and measurement of the relevant length of the string gave 1.36 m, and the slope k of your graph was 1,000 $s^{-2}kg^{-1}$, then what would your measured value be for the acceleration due to gravity g ?

Answer: [Num] [Units]

Use the following equations to answer this question:

The tension T in the string is given by the gravitational force $$T = Mg$$

The equation for the velocity v of a traveling wave on a string is $$v = \sqrt{\frac{T}{\mu}}$$

The equation for the frequencies f_n of the standing waves on a string is

$$f_n = n\,\frac{v}{2L}$$

equation for the frequency f_1 as a function of the mass M that is hung from the string:

$$(f_1)^2 = \frac{(1)^2}{(2L)^2}\,\frac{g}{\mu}\,M$$

$$k = \frac{v}{2L}$$

Using the slope k from your (linear) plot of $(f_1)^2$ versus M, and using your measurements of the length of the string and the mass density of the string, you will be able to determine a value for the acceleration due to gravity.