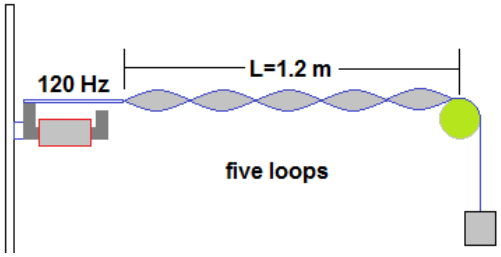
Physics I

Standing Waves

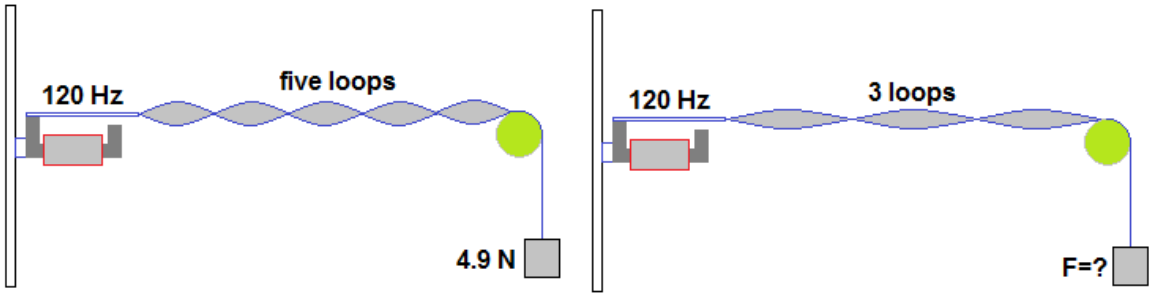
Speed of a standing wave $v = \sqrt{\frac{F_{tension}}{\rho_{linear}}}$

$f = \frac{n}{2L}\sqrt{\frac{F_T}{\rho_{linear}}}$ Standing waves on a string

Problem 1.- Suppose you have a standing wave forming five loops with a vibrating magnet of frequency 120 Hz. If the length of the string is 1.2 m, calculate the speed of the wave.



Problem 2.- Suppose you have a standing wave forming five loops. This is accomplished by putting a string under a tension F=4.9 N and a vibrating device with frequency 120Hz. How much tension do you need to get 3 loops?



Problem 3.- A guitar string produces a fundamental frequency of 293Hz. Another string in the same guitar is under the same tension, but it has three times the linear density (it is thicker). What is the fundamental frequency of the second string?

Problem 4.- A guitar string is tuned so its fundamental frequency is 440Hz, but then you tighten it, so the tension increases 2%. What is the new frequency?

Problem 5.- A violin string produces a sound whose fundamental frequency is 312 Hz when free to vibrate. You put your finger 1/3 of the way from the top, so only 2/3 of the length can vibrate. What is the new fundamental frequency?

Problem 6.- A guitar string has a linear density of 3.5 g/m. The distance from the bridge to the support post is L=0.65 m and the string is under a tension of 250N. What is the frequency of the fifth harmonic?

Problem 7.- A cord of mass 0.75kg is stretched between two supports 28m apart. If the tension in the cord is 250N, how long will it take a pulse to travel from one support to the other?

Problem 8.- A cable of mass 100 kg is stretched between two poles 115 m apart. Find the tension in the cable if it vibrates with a third harmonic of 1.35 Hz.