Physics III Fall 2010

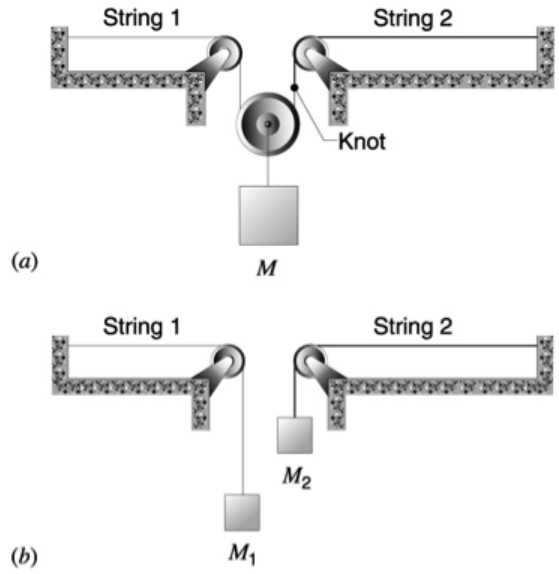
Homework Set 1

Chapter 18, Halliday, Resnick and Krane

Due Date: Monday, September 13 in lecture

E18.12

In the figure below, string 1 has a linear mass density of 3.31 g/m, and string 2 has a linear mass density of 4.87 g/m. They are under tension due to the hanging block of mass M = 511 g. (a) Calculate the wave speed in each string. (b) The block is now divided into two blocks (with $M_1 + M_2 = M$) and the apparatus is rearranged as shown in the figure. Find M_1 and M_2 such that the wave speeds in the two strings are equal.



P18.4

A continuous sinusoidal wave is traveling on a string with speed 82.6 cm/s. The displacement of the particles of the string at x = 9.60 cm is found to vary with time according to the equation y = (5.12 mm) sin [(1.16 rad) - (4.08 rad/s) t]. The linear mass density of the string is 3.86 g/cm. (a) Find the frequency of the wave. (b) Find the wavelength of the wave. (c) Write the general equation giving the transverse displacement of the particles of the string as a function of position and time. (d) Calculate the tension in the string.

P18.8

A uniform rope of mass *m* and length *L* hangs from a ceiling. (*a*) Show that the speed of a transverse wave in the rope is a function of *y*, the distance from the lower end, and is given by $v = \sqrt{g\,y}$. (*b*) Show that the tie it takes a transverse wave to travel the length of the rope is given by $t = 2\sqrt{L/g}$. (*c*) Does the actual mass of the rope affect the results of (*a*) and (*b*)?