

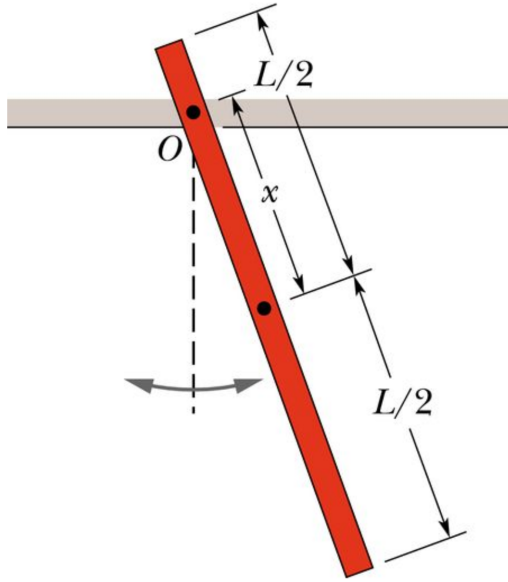
General Physics B1 - Homework Set 4

Due 12/02/2022, 5:00PM sharp. Please hand in your homework via eLearn.

1 points for each problem. Total:5 points

1. Physical Pendulum

A stick of length $L = 1.85$ m oscillates as a physical pendulum. (a) What value of distance x between the stick's center of mass and its pivot point O gives the least period? (0.5point) (b) What is that least period? (0.5point)



2. Wave speed of a hanging rope

A uniform rope of mass m and length L hangs from a ceiling. (a) Show that the speed of a transverse wave on the rope is a function of y , the distance from the lower end, and is given by $v = \sqrt{gy}$. (0.5point) (b) Show that the time a transverse wave takes to travel the length of the rope is given by $t = 2\sqrt{L/g}$. (0.5point)

3. Standing wave

A string oscillates according to the equation $y'(x,t) = (0.5\text{cm})\sin[(\frac{\pi}{3}\text{cm}^{-1})x]\cos[(40\pi\text{s}^{-1})t]$. What are the (a) What is the distance between nodes? (0.5point)(b) What is the transverse speed of a particle of the string at the position $x = 1.5$ cm when $t = \frac{9}{8}$? (0.5point)

4. Doppler effect

A woman is riding a bicycle at 18.0 m/s along a straight road that runs parallel to and right next to some railroad tracks. She hears the whistle of a train that is behind. The frequency emitted by the train is 840 Hz, but the frequency the woman hears is 778 Hz. Take the speed of sound to be 340 m/s. (a) What is the speed of the train, and is the train traveling away from or toward the bicycle? (0.5point) (b) What frequency is heard by a stationary observer located between the train and the bicycle? (0.5point)

5. Torque on dam due to water

In the following figure, water stands at depth $D = 35.0$ m behind the vertical upstream face of a dam of width $W = 314$ m. Find (a) the net horizontal force on the dam from the gauge pressure of the water (0.5point) and (b) the net torque due to that force about a horizontal line through O parallel to the (long) width of the dam. (0.5point) This torque tends to rotate the dam around that line, which would cause the dam to fail.

