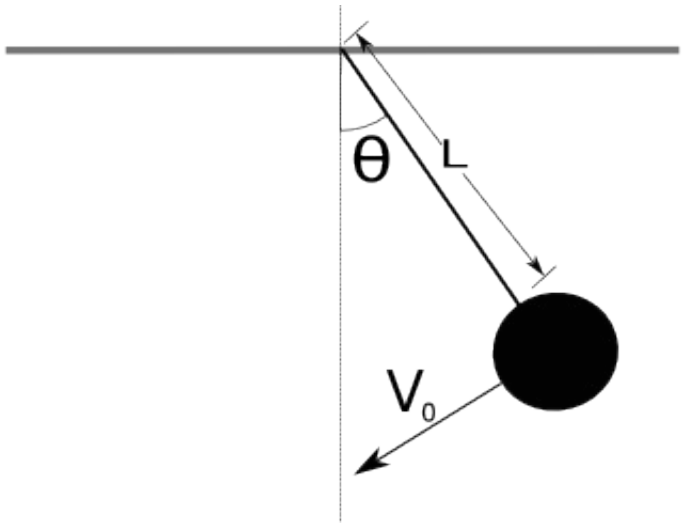
Oscillation – Set 3

Name _____ Pages ___/6

Below is a simple pendulum consisting of a massless rod of length L with a point mass if mass m attached to the end.

a) Find the frequency of small oscillations of the pendulum.
b) At t=0, the pendulum makes an angle θ_0 with the vertical and the point mass has a velocity V_0. What is the phase angle of the oscillator?



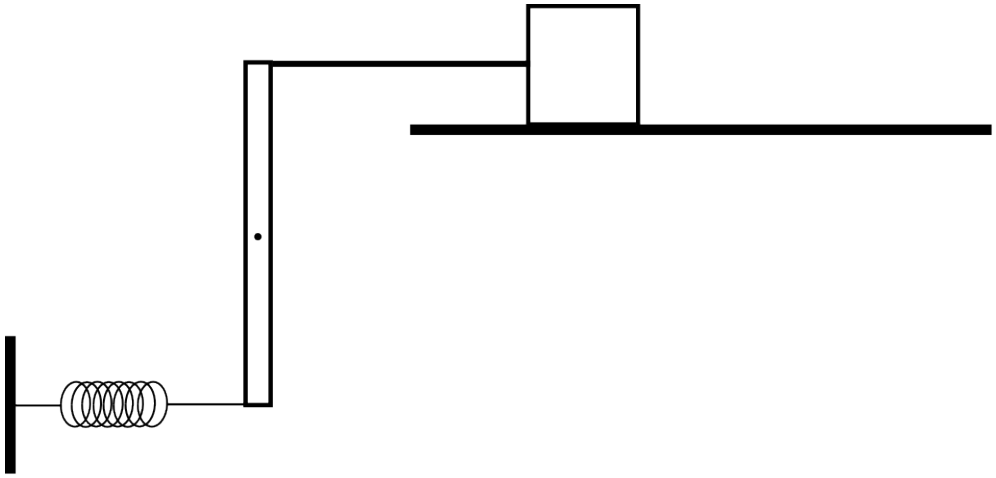
Oscillation – Set 3 2

A meter stick with a mass M is suspended from one end and allowed to swing like a pendulum.

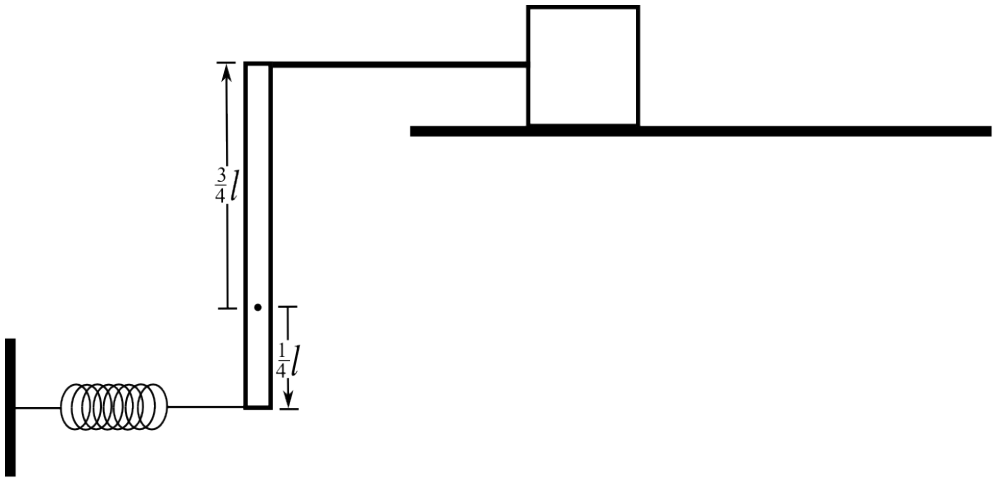
a) What is its **period** of small oscillations?
b) What length L does a simple pendulum (a point mass attached to a massless rod) need in order to have the same period?

Oscillation – Set 3 3

A block of mass *M* resting on a frictionless surface is attached to a stiff rod of negligible mass. The other end of the rod is attached to the top of a thin bar of length *l* mass *M* that is allowed to rotate about its center. The bottom of a bar is attached to a light spring of spring constant k. The spring is relaxed when the bar is vertical. Find the frequency of small oscillations.



3) (36 points) A block of mass *M* resting on a frictionless surface is attached to a stiff rod of negligible mass. The other end of the rod is attached to the top of a thin bar of length *l* and mass *M* that is allowed to rotate about the point shown in the figure below. The bottom of the bar is attached to a light spring with spring constant k. The spring is relaxed when the bar is vertical.

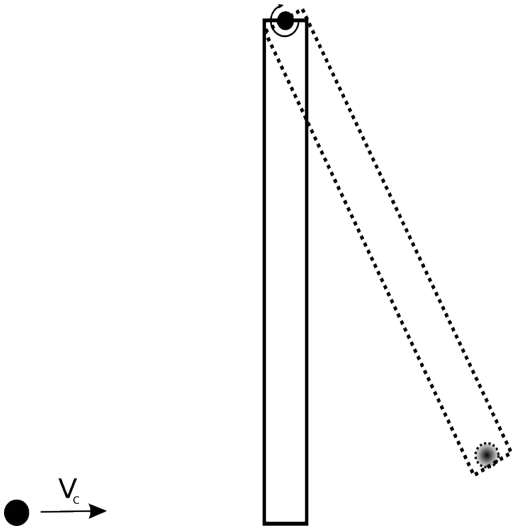


a) Find the frequency of small oscillations.
b) As the spring passes equilibrium, the velocity of the block is V_0. What is the amplitude of oscillations.

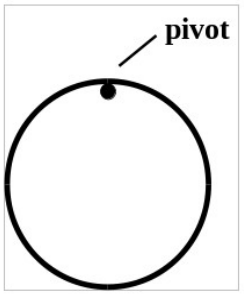
Oscillation – Set 3 5

A 1 kg meter stick is hung from its and allowed to pivot. A small wad of clay with a mass of 0.25 kg with a velocity V_c = 2 m/s impacts the bottom of the meter stick. Assuming that the resulting oscillations are small:

a) Find the angular frequency of the resulting pendulum.
b) Find the phase angle of the resulting oscillator.
c) Find the amplitude of the oscillations.



5. A circular hula-hoop rests on a peg that acts as a pivot point and allowed to oscillate with small angular displacements.



The hoop's mass is M = 0.80 kg, and its radius is R = 0.6 m.

Use Newton's Second Law to find the angular frequency of small oscillations.