

Problem 1

An object undergoing simple harmonic motion takes 0.25 s to travel from one point of zero velocity to the next such point. The distance between those points is 36 cm. Calculate the (a) period, (b) frequency, and (c) amplitude of the motion. (03小題)

(a) period, $T = \underline{\hspace{1cm}}$ s

01: ANS: = 0.5

(b) frequency, $f = \underline{\hspace{1cm}}$ Hz

02: ANS: = 2.0

(c) amplitude, $A = \underline{\hspace{1cm}}$ m

03: ANS: = 0.18

Problem 2

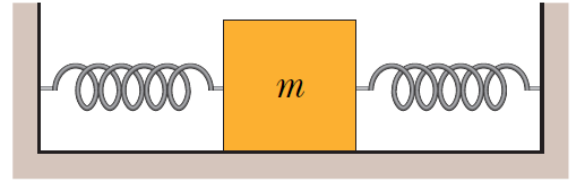
A loudspeaker produces a musical sound by means of the oscillation of a diaphragm whose amplitude is limited to $1.00\mu\text{m}$. At what frequency is the magnitude a of the diaphragm's acceleration equal to g ? (01小題)

frequency=_____ Hz

04: **ANS: =498**

Problem 3

In the figure, two identical springs of spring constant 7580 N/m are attached to a block of mass 0.245 kg . What is the frequency of oscillation on the frictionless floor? (02小題)



frequency=_____ Hz

05: **ANS:=39.6**

In the figure, if the left spring is removed, the block oscillates at a frequency of 30 Hz . If, instead, the spring on the right is removed, the block oscillates at a frequency of 45 Hz . At what frequency does the block oscillate with both springs attached?

f =_____ Hz

06: **ANS:=54**

Problem 4

A block rides on a piston that is moving vertically with simple harmonic motion. (a) If the SHM has period 1.0 s, at what amplitude of motion will the block and piston separate? (b) If the piston has an amplitude of 5.0 cm, what is the maximum frequency for which the block and piston will be in contact continuously? (02 小題)

(a) $A = \underline{\hspace{1cm}}$ m

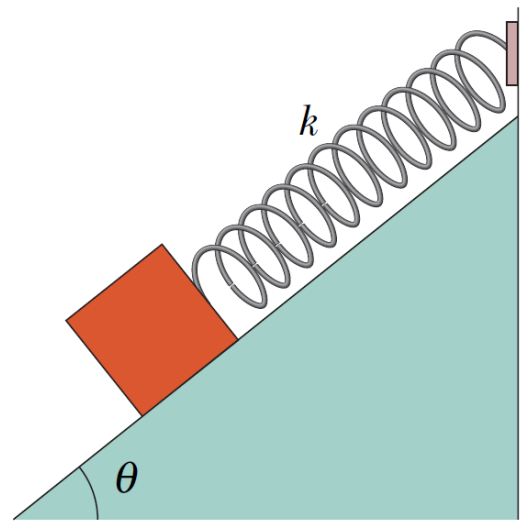
07: ANS: = 0.25

(b) $f = \underline{\hspace{1cm}}$ Hz

08: ANS: = 2.2

Problem 5

In the figure, a block weighing 14.0 N, which can slide without friction on an incline at angle $\theta = 40.0^\circ$, is connected to the top of the incline by a massless spring of unstretched length 0.450 m and spring constant 120 N/m. (a) How far from the top of the incline is the block's equilibrium point? (b) If the block is pulled slightly down the incline and released, what is the period of the resulting oscillations? (02小題)



(a) $x = \underline{\hspace{1cm}}$ m

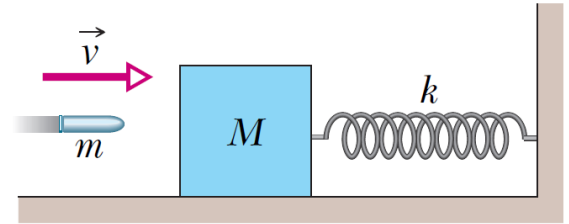
09: **ANS: = 0.075**

(b) $T = \underline{\hspace{1cm}}$ s

10: **ANS: = 0.686**

Problem 7

A block of mass $M = 5.4$ kg, at rest on a horizontal frictionless table, is attached to a rigid support by a spring of constant $k = 6000$ N/m. A bullet of mass $m = 9.5$ g and velocity of



magnitude 630 m/s strikes and is embedded in the block (figure). Assuming the compression of the spring is negligible until the bullet is embedded, determine (a) the speed of the block immediately after the collision and (b) the amplitude of the resulting simple harmonic motion. (02小題)

(a) $v = \underline{\hspace{1cm}}$ m/s

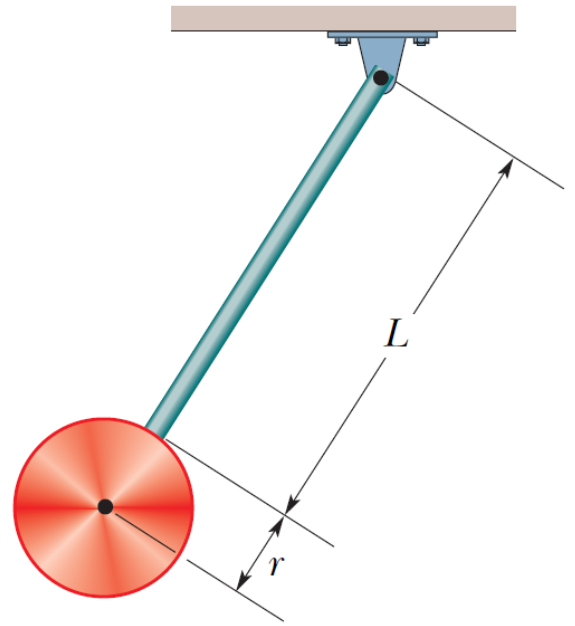
11: ANS: = 1.1

(b) $A = \underline{\hspace{1cm}}$ m

12: ANS: = 0.033

Problem 8

In the figure, the pendulum consists of a uniform disk with radius $r = 10.0$ cm and mass 500 g attached to a uniform rod with length $L = 500$ mm and mass 270 g. (a) Calculate the rotational inertia of the pendulum about the pivot point. (b) What is the distance between the pivot point and the center of mass of the pendulum? (c) Calculate the period of oscillation. (03小題)



(a) $I = \underline{\hspace{1cm}} \text{ kg.m}^2$

13: ANS: = 0.205

(b) $d = \underline{\hspace{1cm}},$

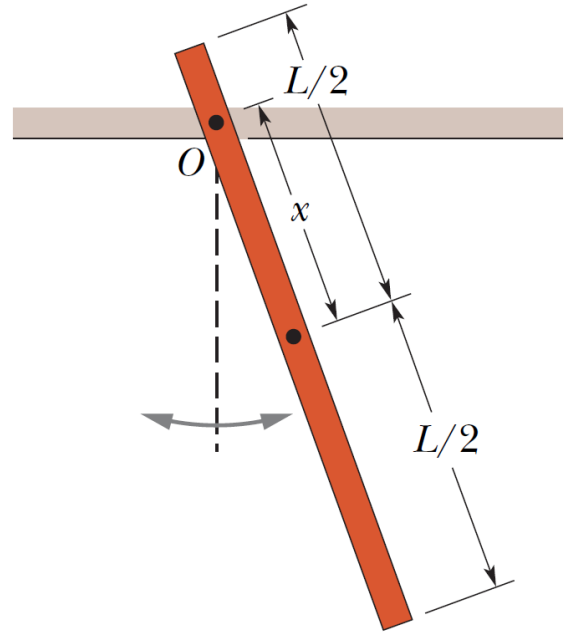
14: ANS: = 0.477

(c) $T = \underline{\hspace{1cm}} \text{ s}$

15: ANS: = 1.5

Problem 9

In the figure, 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? (b) What is that least period? (02小題)



(a) $x = \underline{\hspace{1cm}}$ m

16: ANS: = 0.53

(b) $T = \underline{\hspace{1cm}}$ s

17: ANS: = 2.1

Problem 10

The amplitude of a lightly damped oscillator decreases by 3.0% during each cycle. What percentage of the mechanical energy of the oscillator is lost in each cycle? (01小題)

the percentage=_____ %

18: **ANS:=6**