# GPN1-LS09

## 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.

一做簡諧運動的物體，從零速度的一個點移動到下一個這樣的點需要0.25 s的時間。這些點之間的距離是36 cm。 計算運動的(a)週期，(b)頻率和(c)幅度。 (03小題)

(a)period, T=＿＿ s

01: **ANS:=0.5**

(b)frequency, f=＿＿＿ Hz

02: **ANS:=2.0**

(c)amplitude, A=＿＿＿ 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 1.0 $\mu$m. At what frequency is the magnitude $a$ of the diaphragm's acceleration equal to $g$?

揚聲器通過振動膜片產生音樂聲，振動膜片的振幅為$1.00\mu$m。若膜片加速度的大小$a = g$，計算頻率是多少？(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. (a)What is the frequency of oscillation on the frictionless floor? (b)Considering non-identical springs, 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?
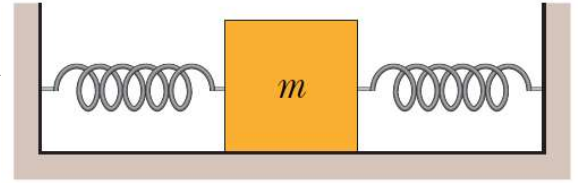


在圖中，兩個有相同的彈性係數7580 N/m的彈簧連接到一塊質量為0.245 kg的塊上。地板無摩擦。(a)振盪頻率是多少？（b）考慮到不同的彈簧，如果去掉了左彈簧，則滑塊以30 Hz的頻率振動。 如果取而代之的是除去右側的彈簧，則滑塊以45 Hz的頻率振盪。 帶有兩個彈簧的彈簧塊以什麼頻率振動？ (02小題)

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(a)identical springs, frequency=＿＿＿ Hz

05: **ANS:=39.6**

(b)2 different springs, 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?

一個質量滑塊在活塞上，活塞以簡諧運動垂直移動。 (a)如果SHM的周期為1.0 s，計算在什麼振幅下，滑塊和活塞將會分開？ (b)如果活塞的振幅為5.0 cm，則滑塊與活塞保持接觸的最大頻率是多少？ (02小題)

(a)A=＿＿ m

**ANS:=0.25**

(b)f=＿＿ Hz

**ANS:=2.2**

## Problem 5

In the figure, a block weighing 14.0 N, which can slide without friction on an incline at angle $\theta = 40.0^o$, 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?
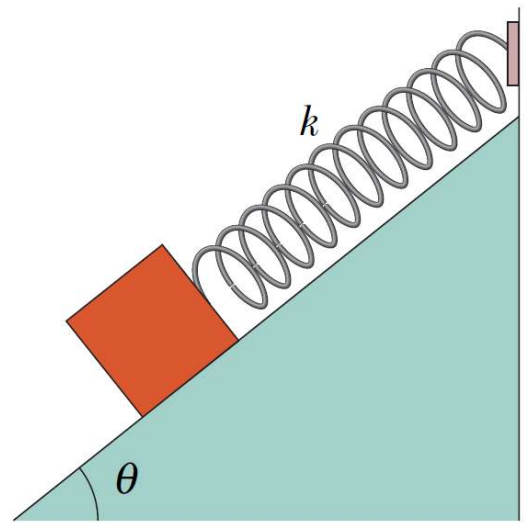
在圖中，一塊重量為14.0 N的塊可以無摩擦地在傾斜角度為 $\theta = 40.0^o$ 的霞面上滑動，斜面的頂部連接了一無質量的彈簧，彈簧原長為0.450 m，彈性係數為120 N/m。(a)在彈簧的下端懸掛質量塊，則質量塊的平衡點位置距斜坡頂部多遠？ (b) 如果將滑塊稍微向斜面下拉並釋放，那麼產生振盪的週期是多少？ (02小題)

(a)x=＿＿ m

09: **ANS:=0.525**

(b)T=＿＿ s

10: **ANS:=0.686**

**Problem 6**

When the displacement in SHM is one-half the amplitude $x_m$, what fraction of the total energy, $E$ is (a) kinetic energy, $K$ and (b) potential energy, $U$? (c) At what displacement, in terms of the amplitude, is the energy of the system half kinetic energy and half potential energy?

當SHM中的位移為振幅$x_m$的一半時，(a)動能$K$和(b)位能$U$佔總能量$E$的部分比例？ (c)在什麼位移下系統的動能和位能各佔一半，以振幅為單位計算？ (03小題)

(a) $\dfrac{K}{E}$ = _____

11: **ANS:=0.75**

(b) $\dfrac{U}{E}$ = _____

12: **ANS:=0.25**

(a)x= _____ $x_m$

13: **ANS:=0.707**

## 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.
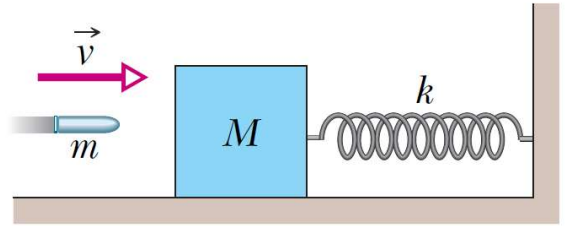
一塊質量為$M = 5.4$ kg的塊靜止在水平無摩擦工作台上，並通過恆定$k = 6000$ N/m的彈簧連接到剛性支撐上。 質量為$m = 9.5$ g且速度為630 m/s的子彈撞擊並嵌入塊中（圖）。 假設直到子彈埋入之前，彈簧的壓縮都可以忽略不計，請確定(a)碰撞後立即移動滑塊的速度，以及(b)得到的簡諧運動的幅度。 (02小題)

(a)v=＿＿ m/s

14: **ANS:=1.1**

(b)A=＿＿ m

15: **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.
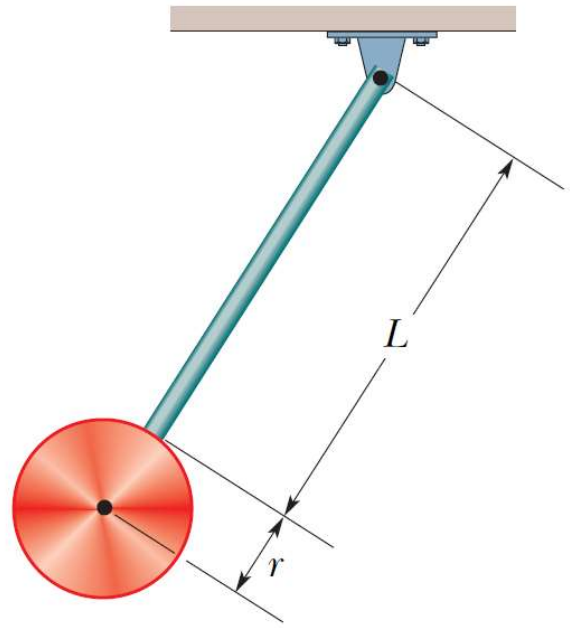
在圖中，擺錘由半徑為$r = 10.0$ cm 且質量為500 g的均勻圓盤組成，該 圓盤附著在長度為$L = 500$ mm且質量為270 g的均勻桿上。 (a)計算擺錘繞樞軸轉動的慣量。 (b)樞軸點與擺錘的質心之間 的距離是多少？ (c)計算振盪週期。 (03小題)

(a)I=_____ kg.m$^2$

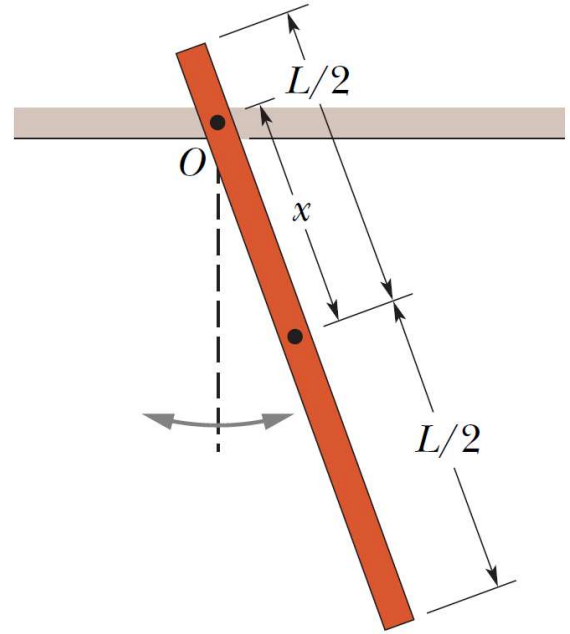16: ANS:=**0.205**

(b)d=_____ ,

17: ANS:=**0.477**

(c)T=_____ s

18: 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? 在圖中，長度為$L = 1.85$ m的搖桿作為一個物理擺振動。 (a)桿的質心與其樞軸點$O$之間的距離x值可使周期最小？ (b)最小周期是多少？ (02小題)
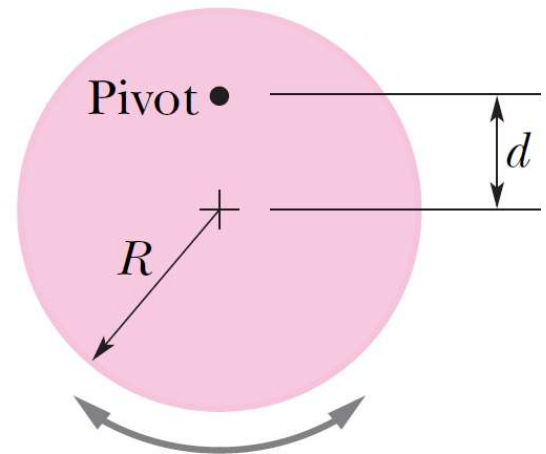


(a)x=＿＿ m

19: **ANS:=0.53**

(b)T=＿＿ s

20: **ANS:=2.1**

nprob= 10 10

## Problem 10

In the figure, a physical pendulum consists of a uniform solid disk (of radius R) supported in a vertical plane by a pivot located a distance d from the center of the disk. The disk is displaced by a small angle and released. What is the period of the resulting simple harmonic motion? 在該圖中，物理擺由一個均勻的實心圓盤（半徑為R）組成，該圓盤在垂直平面中由樞軸支撐，該樞軸位於距圓盤中心d處。 磁盤以小角度移動並釋放。 產生的簡單諧波運動的周期是多少？ (01小題)

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$T=$ _____ [m,R,g,d]

21: ANS:=2*pi*sqrt((0.5*m*R**2+m*d**2)/(m*g*d))