

(7)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- (a) the greatest speed of P ,

(7)

- (b) the magnitude of the greatest acceleration of P .

(2)

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[illegible]

3.

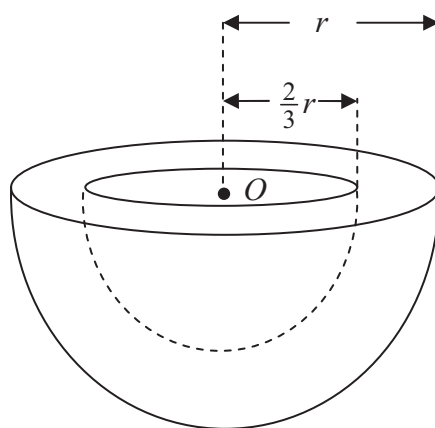


Figure 1

A bowl B consists of a uniform solid hemisphere, of radius r and centre O , from which is removed a solid hemisphere, of radius $\frac{2}{3}r$ and centre O , as shown in Figure 1.

- (a) Show that the distance of the centre of mass of B from O is $\frac{65}{152}r$. (5)

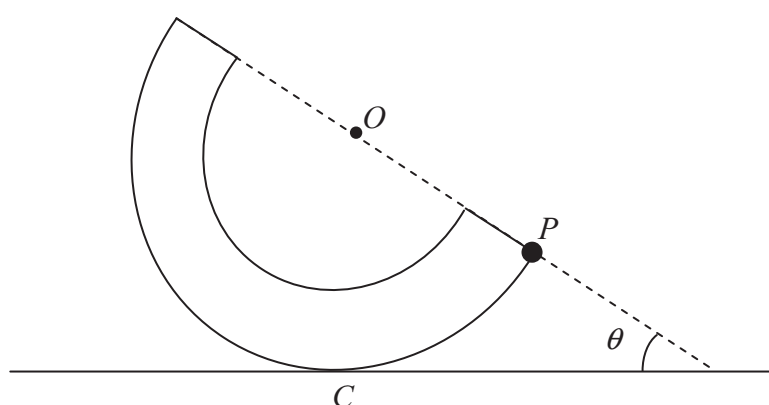


Figure 2

The bowl B has mass M . A particle of mass kM is attached to a point P on the outer rim of B . The system is placed with a point C on its outer curved surface in contact with a horizontal plane. The system is in equilibrium with P , O and C in the same vertical plane. The line OP makes an angle θ with the horizontal as shown in Figure 2. Given that

$$\tan \theta = \frac{4}{5},$$

- (b) find the exact value of k . (5)



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Question 3 continued



A diagram showing a particle P suspended by a string from a fixed point O . A horizontal force of 30 N is applied to P to the right. A vertical dashed line is drawn through O .

A particle P of weight 40 N is attached to one end of a light elastic string of natural length 0.5 m . The other end of the string is attached to a fixed point O . A horizontal force of magnitude 30 N is applied to P , as shown in Figure 3. The particle P is in equilibrium and the elastic energy stored in the string is 10 J .

(10)

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[illegible]

5.

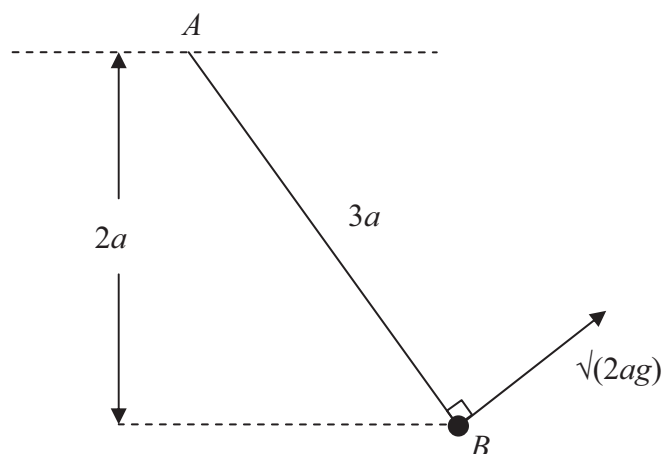


Figure 4

One end A of a light inextensible string of length $3a$ is attached to a fixed point. A particle of mass m is attached to the other end B of the string. The particle is held in equilibrium at a distance $2a$ below the horizontal through A , with the string taut. The particle is then projected with speed $\sqrt{2ag}$, in the direction perpendicular to AB , in the vertical plane containing A and B , as shown in Figure 4. In the subsequent motion the string remains taut. When AB is at an angle θ below the horizontal, the speed of the particle is v and the tension in the string is T .

- (a) Show that $v^2 = 2ag(3 \sin \theta - 1)$. (5)
- (b) Find the range of values of T . (6)

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[illegible]

- (a) Show that the coefficient of friction between the motorcycle and the track is $\frac{2}{3}$. (6)

(b) Find the value of $\tan \alpha$. (8)

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This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal grey lines across its entire surface, typical of notebook or school paper. There are no margins, text, or other markings present.

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