6.

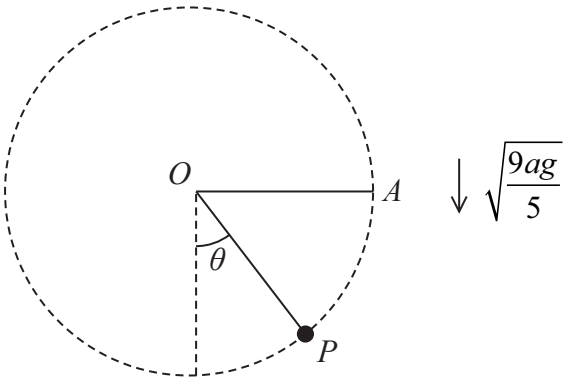


Figure 4

A particle P of mass m is attached to one end of a light inextensible string of length a. The other end of the string is attached to a fixed point O. The particle is held at the point A, where $OA = a$ and OA is horizontal, as shown in Figure 4.

The particle is projected vertically downwards with speed $\sqrt{\frac{9ag}{5}}$

When the string makes an angle θ with the downward vertical through O and the string is still taut, the tension in the string is S.

(a) Show that $S = \frac{3}{5}mg(5\cos\theta + 3)$

(6)

At the instant when the string becomes slack, the speed of P is v

(b) Show that $v = \sqrt{\frac{3ag}{5}}$

(3)

(c) Find the maximum height of P above the horizontal level of O

(4)

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Question 6 continued

(Total for Question 6 is 13 marks)