6.

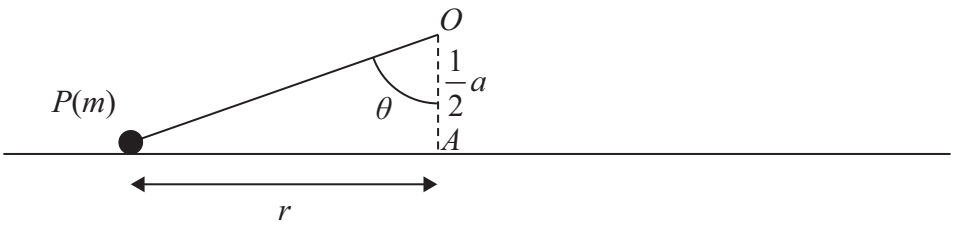


Figure 6

A fixed point O is a distance $\frac{1}{2}a$ above a smooth horizontal table. The point A is on the table, vertically below O.

A light elastic string has natural length a and modulus of elasticity $3mg$. One end of the elastic string is attached to O. The other end of the elastic string is attached to a particle P of mass m.

The particle P moves on the table in a circle centre A, radius r with the elastic string taut and angle $POA = \theta$, where θ is a constant, as shown in Figure 6.

Given that P moves with constant angular speed $\sqrt{\frac{g}{a}}$

(a) show that $OP = \frac{3}{2}a$.

(8)

(b) Find, in terms of m and g, the magnitude of the force exerted on P by the table.

(4)

(c) Find, in terms of m, g and a, the sum of the kinetic energy of P and the elastic energy stored in the string. Give your answer in simplest form.

(4)

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Question 6 continued

(Total for Question 6 is 16 marks)