7.

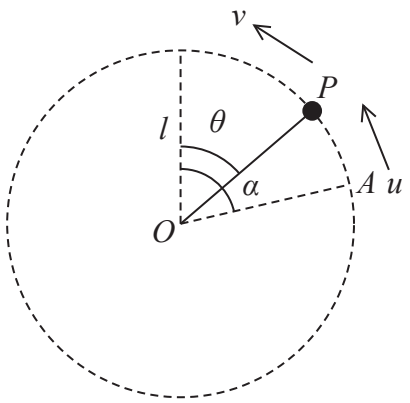


Figure 4

A particle P of mass m is attached to one end of a light rod of length l. The other end of the rod is attached to a fixed point O. The rod can rotate freely in a vertical plane about O. The particle is projected with speed u from a point A. The line OA makes an angle α with the upward vertical through O, where $\alpha < \frac{\pi}{2}$

When OP makes an angle θ with the upward vertical through O, the speed of P is v, as shown in Figure 4.

(a) Show that $v^2 = u^2 - 2gl(\cos\theta - \cos\alpha)$

(4)

Given that $\cos\alpha = \frac{2}{5}$ and that $u = \sqrt{3gl}$

(b) show that P moves in a complete vertical circle.

(4)

As the rod rotates, the least tension in the rod is T and the greatest tension is kT

(c) Find the exact value of k

(9)

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TOTAL FOR PAPER IS 75 MARKS

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