7.

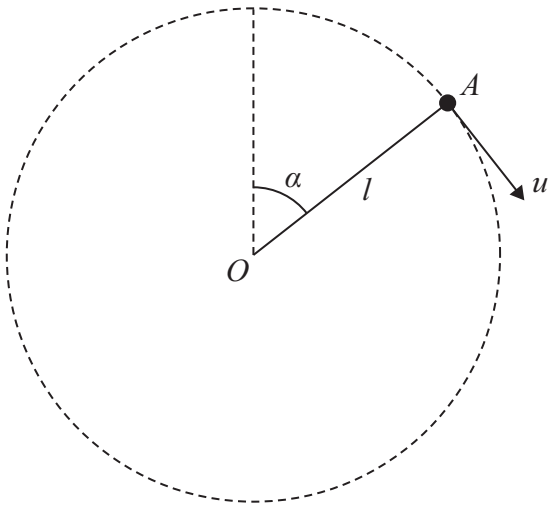


Figure 2

A particle 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 turn freely in a vertical plane about a horizontal axis through O.

The particle is projected with speed u from a point A, where OA makes an angle α with the upward vertical through O, as shown in Figure 2.

The particle moves in complete vertical circles.

Given that $\cos\alpha = \frac{4}{5}$

(a) show that $u > \sqrt{\frac{2gl}{5}}$

(4)

As the rod rotates, the least tension in the rod is T and the greatest tension is $4T$.

(b) Show that $u = \sqrt{\frac{17}{5}gl}$

(11)

(Total for Question 7 is 15 marks)

TOTAL FOR PAPER IS 75 MARKS