6.

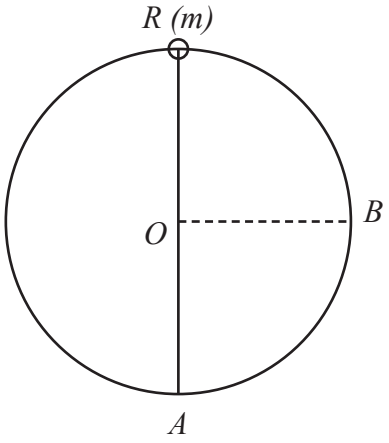


Figure 6

A small smooth ring R of mass m is threaded on to a smooth wire in the shape of a circle with centre O and radius l. The wire is fixed in a vertical plane. The ring R is attached to one end of a light elastic string of natural length l and modulus of elasticity mg. The other end of the elastic string is attached to A, the lowest point of the wire. The point B is on the wire and OB is horizontal.

The ring R is at rest at the highest point of the wire, as shown in Figure 6.

The ring R is slightly disturbed from rest and slides along the wire.

At the instant when R reaches the point B, the speed of R is v and the magnitude of the force exerted on R by the wire is N.

(a) Show that

$$v^2 = 2gl\sqrt{2}$$

(7)

(b) Show that

$$N = \frac{1}{2}mg\left(5\sqrt{2} - 2\right)$$

(7)

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Question 6 continued

(Total for Question 6 is 14 marks)