3

A small ball of mass 0.30 kg is attached to one end of a light inelastic string. The other end C of the string is fixed. The ball is made to rotate about C in a vertical circle of radius 65 cm as shown in Fig. 3.1.

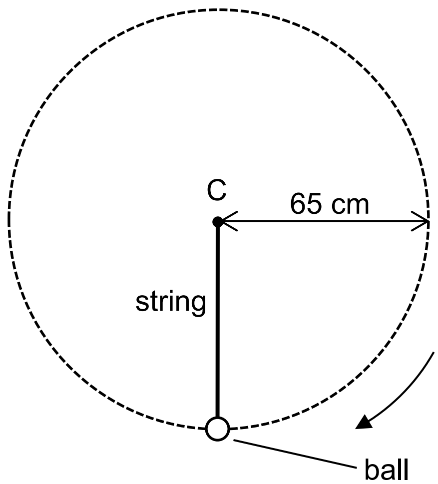

Fig. 3.1

The angular speed of the ball is gradually increased from zero until the string snaps. This happens when the tension in the string is 16 N.

(a)

The string is observed to snap when the ball is vertically below C.

(i)

On Fig. 3.1, sketch the path of the ball after the string snaps.

[1]

(ii)

Calculate the angular speed ω_1 of the ball at the instant the string snaps.

ω_1 =

rad s^{-1}

[2]

(b)

Another experiment is carried out with another set of identical string and ball. The ball is rotated in a horizontal circle, with the string inclined at an angle θ to the vertical, as shown in Fig. 3.2.

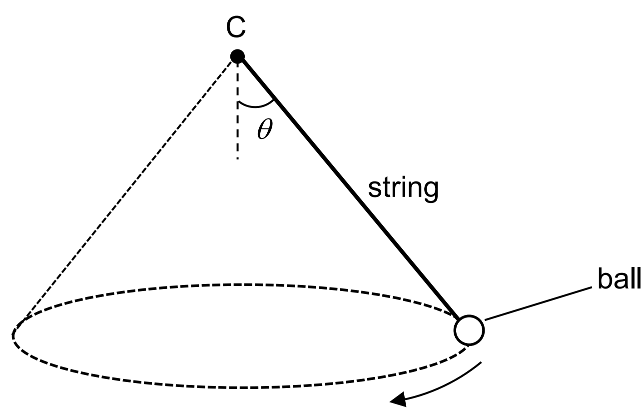

Fig. 3.2

The angular speed of the ball is gradually increased from zero and the ball is observed to rise to a higher horizontal plane. The string snaps when the angular speed is increased to ω_2.

(i)

In terms of the forces acting on the ball, explain the observation that the ball rises to a higher horizontal plane when the angular speed is increased.

[3]

(ii)

Explain, using relevant equations or otherwise, whether ω_2 is larger or smaller than ω_1 in **(a)(ii)** when the string snaps.

[2]