Oxford Cambridge and RSA

A Level Physics A

H556/03 Unified physics

Question Set 6

1 This question is about the motion of a ball suspended by an elastic string above a bench. The mass of the string is negligible compared to that of the ball. Ignore air resistance.

Fig. 6.1

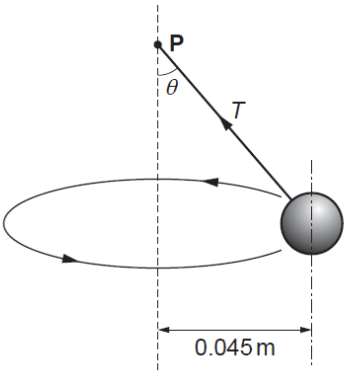

Fig. 6.2 (not to scale)

In Fig. 6.1 the ball of weight 1.2 N hangs vertically at rest from a point **P**. The extension of the string is 0.050 m. The string obeys Hooke's law.

In Fig. 6.2 the ball is moving in a horizontal circle of radius 0.045 m around a vertical axis through **P** with a period of 0.67 s. The string is at an angle θ to the vertical. The tension in the string is T.

(a) On Fig. 6.2 draw and label one other force acting on the ball. **[1]**

(b) **(i)** Resolve the tension T horizontally and vertically and show that the angle θ is 22°.

[2]

(ii) Calculate the extension x of the string shown in Fig. 6.2.

x = ... m **[3]**

(c) Whilst rotating in the horizontal plane the ball suddenly becomes detached from the string. The bottom of the ball is 0.18 m above the bench at this instant. The ball falls as a projectile towards the bench beneath. Fig. 6.3 shows the view from above.

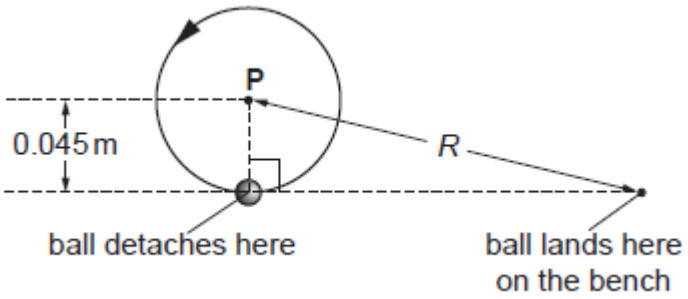

Fig. 6.3

Calculate the horizontal distance *R* from the point on the bench vertically below the point **P** to the point where the ball lands on the bench.

R = ... m **[4]**

(d) Returning to the situation shown in Fig. 6.2, state and explain what happens when the rate of rotation of the ball is increased.

[2]

Total Marks for Question Set 6: 12