3 **(a)** Two inclined planes RA and LA each have the same constant gradient. They meet at their lower edges, as shown in Fig. 3.1.

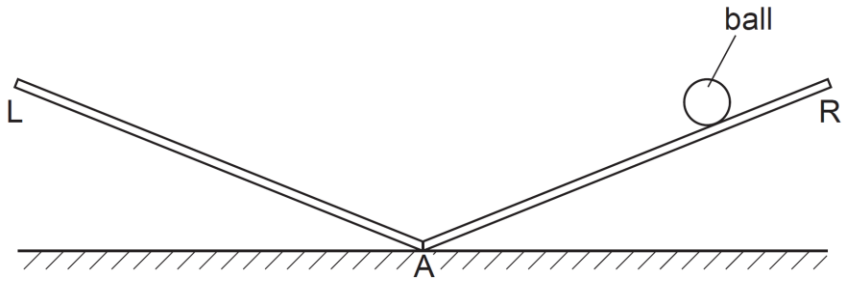

Fig. 3.1

A small ball moves from rest down plane RA and then rises up plane LA. It then moves down plane LA and rises up plane RA to its original height. The motion repeats itself.

Explain why the motion of the ball is not simple harmonic.

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.....

[1]

(b) A small ball rests at point P on a curved track of radius *r*, as shown in Fig. 3.2.

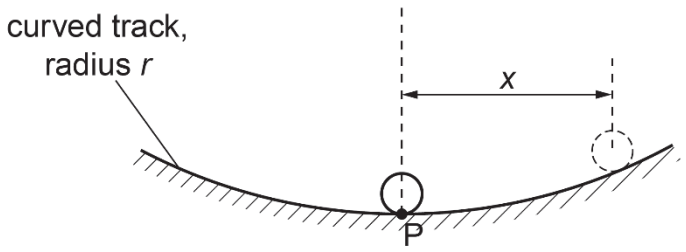

Fig. 3.2

The ball is moved a small distance to one side and is then released. The horizontal displacement x of the ball is related to its acceleration a towards P by the expression

$$a = -\frac{gx}{r}$$

where g is the acceleration of free fall.

(i) With reference to the expression provided, show that the ball undergoes simple harmonic motion.

.....

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.....

[2]

(ii) The radius r of curvature of the track is 28 cm.

Determine the time interval τ between the ball passing point P and then returning to point P.

τ = ... s [2]

(c) The variation with time *t* of the displacement *x* of the ball in **(b)** is shown in Fig. 3.3.

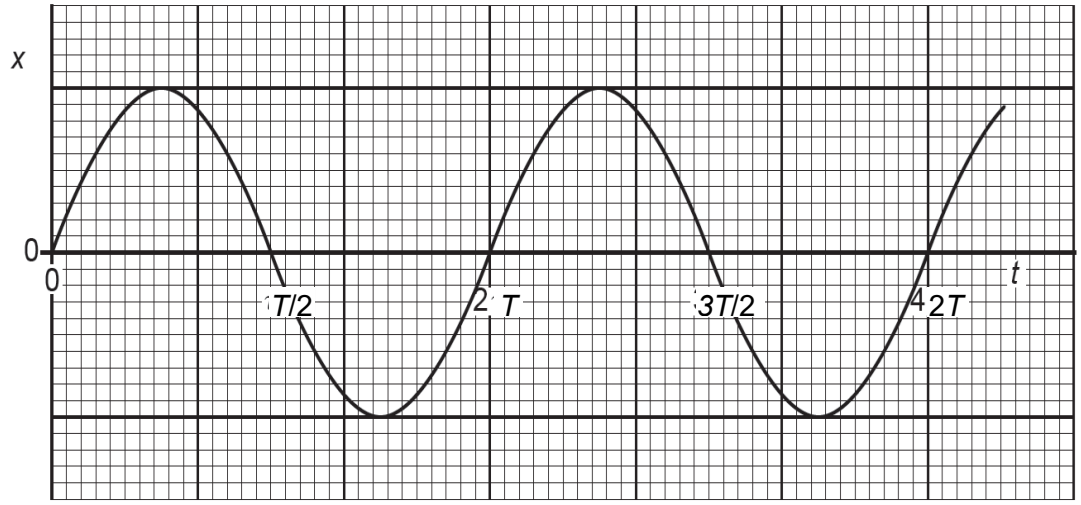

Fig. 3.3

Some moisture now forms on the track, causing the ball to come to rest after approximately several oscillations.

On the axes of Fig. 3.3, sketch the variation with time *t* of the displacement *x* of the ball for the first two periods after the moisture has formed. Assume the moisture forms at time $t = 0$.

[2]

[Total: 7]