

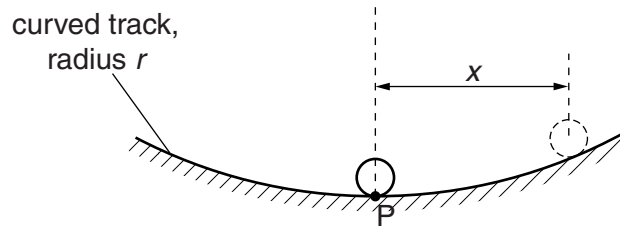
- 4 (a) State what is meant by *simple harmonic motion*.

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..... [2]

- (b) A small ball rests at point P on a curved track of radius  $r$ , as shown in Fig. 4.1.



**Fig. 4.1**

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) Show that the ball undergoes simple harmonic motion.

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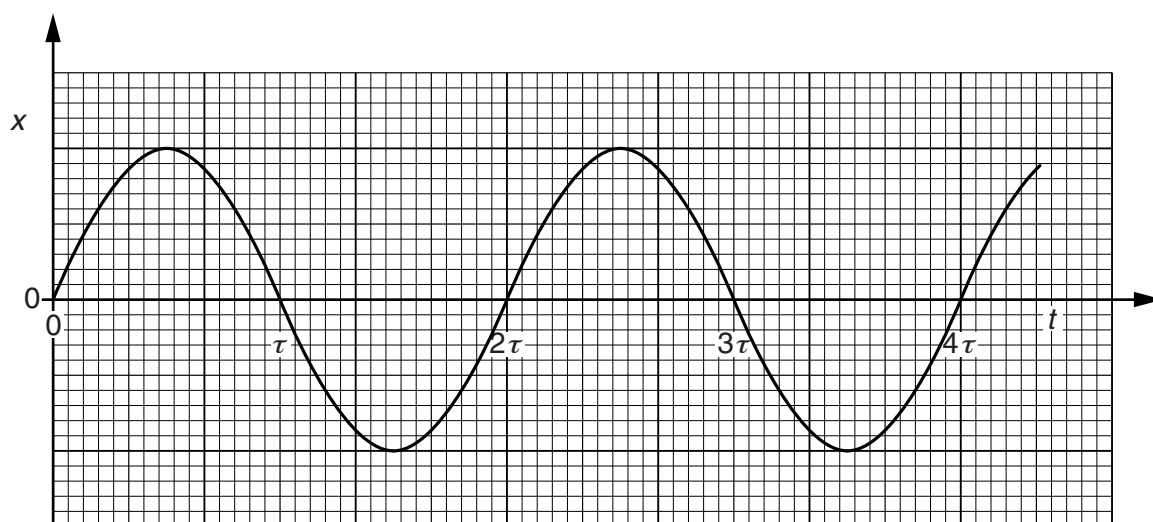
..... [2]

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

Determine the time interval  $\tau$  between the ball passing point P and then returning to point P.

$\tau =$  ..... s [3]

(c) The variation with time  $t$  of the displacement  $x$  of the ball in (b) is shown in Fig. 4.2.



**Fig. 4.2**

Some moisture now forms on the track, causing the ball to come to rest after approximately 15 oscillations.

On the axes of Fig. 4.2, 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  $t = 0$ .  
[3]