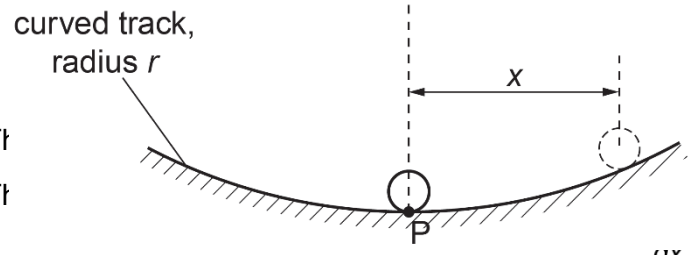
3 A small ball rests at point P on a smooth curved track of radius *r*, as shown in Fig. 3.1.



Th ıen released.

Th s acceleration *a* towards P by the equation

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

where *g* is the acceleration of free fall.

(a) Explain why the expression leads to the conclusion that the ball is performing simple harmonic motion.

._____.

.._____.

._____.

._____.[2]

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

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

[3]

$/ = \_\_\_\_\_$ s

(c) The ball is moved from the point P by a small fixed and positive displacement to one side and is then released.

Sketch on Fig. 3.2,

(i) the variation with displacement x of the velocity v of the ball for one period if there is no friction during motion. Label it as M. [1]

(ii) the variation with displacement x of the velocity v of the ball for one period if the system is subjected to resistive forces. Label it as Q and draw an arrow on your sketch to indicate the direction of the variation with time.

v

x

Fig. 3.2

[2]

[Total: 8]