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

....

....

....

.... [2]

(b) A small ball rests at point P on a curved track of radius r, as shown in Fig. 2.1.
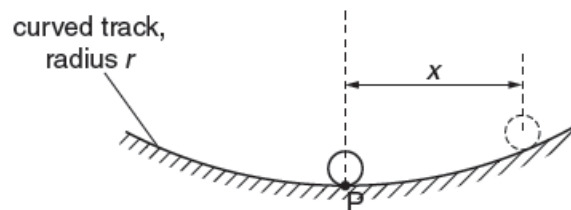

Fig. 2.1

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

$$a = -\frac{g}{r}x$$

where g is the acceleration of free fall.

(i) Show that the ball undergoes simple harmonic motion.

....

....

....

[2]

....

....

(ii) In deriving the above expression, it was assumed that the curved track is smooth. Suggest one other assumption.

....   [1]

....

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

Determine the time interval, **T** between the ball passing point P and then returning to point P.

[3]

T =…................................ s

(iv) Suppose that the ball, of mass 5.0 g, is moved up the curved track through an angle of $1.0°$ before being released.

1. By assuming that the amplitude is approximately equal to the arc length or otherwise, show that the amplitude is 4.89×10^{-3} m .

[1]

2. Calculate the maximum potential energy of the ball.

[2]

maximum potential energy = ………………………..J

[Total: 11]