

Chapter 8
Short answer question

Fig. 1 shows a flexible track, part of which has been bent into a circle of radius 0.4m. A toy car of mass 0.1 kg runs down the track from A, 'loops the loop' and continues to C. Friction should be ignored throughout this question.

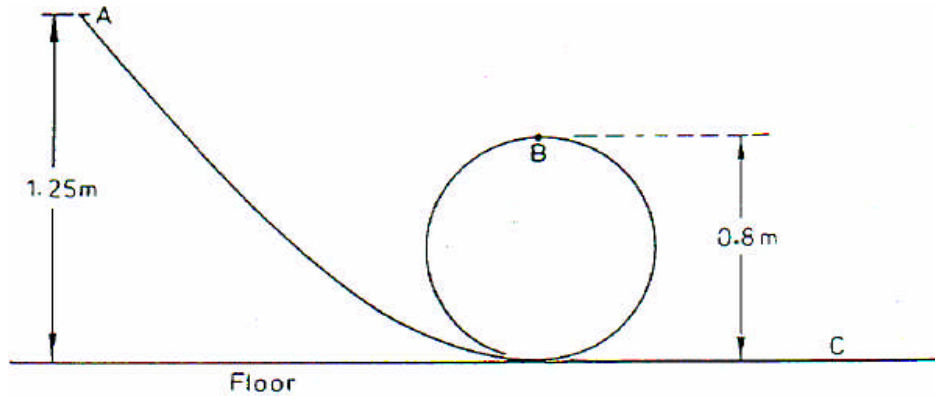


Fig. 1

- (a) Calculate the potential energy lost by the car travelling from A to B.

$$\begin{aligned} \text{PE lost} &= mg\Delta h = 0.1 \times 10 \times (1.25 - 0.8) \\ &= 0.45 \text{ J} \end{aligned}$$

- (b) Calculate the speed of the car as it passes B.

$$\text{PE loss} = \text{KE gain}$$

$$0.45 = \frac{1}{2} \times 0.1 \times v^2$$

$$\therefore v = 3 \text{ m/s}$$

- (c) What two forces are acting on the car as it passes B?

Weight downwards and the 'reaction' force up.

- (d) These two forces combine to provide the centripetal force at B. In which direction does this force act?

Towards centre of circle

The end of the track is lowered so that the car passes B at a speed of 2 m/s.

- (e) When the car moves at this speed, a small piece of track could be removed and the car would continue in a circle as shown in Fig. 2. Explain this

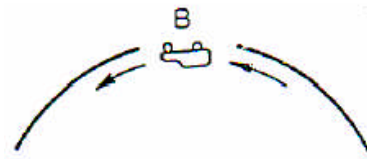


Fig. 2

Weight exactly matches centripetal force caused by

$$M \times \frac{\Delta v}{\Delta t}$$

- (f) The end A is lowered further until it is about 0.7m above the floor. Draw a diagram to show the path taken by the car.

Projectile from B to the track.

- (g) What is the maximum height at which the end A can be placed so that the car fails to 'loop the loop', but does not come off the track. Explain.

0.4 m. Car reaches half-way up circular track and then rolls back down.