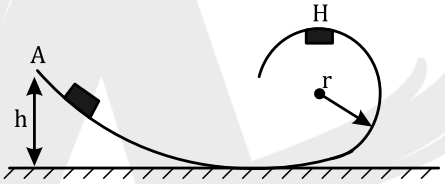
DPP – 6

Vertical circular motion

1. A weightless thread can support tension upto 30 N. A stone of mass 0.5 kg is tied to it and is revolved in a circular path of radius 2 m in a vertical plane. If g = 10 m/s^2, find the maximum angular velocity of the stone.

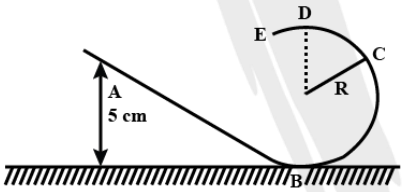
2. A simple pendulum oscillates in a vertical plane. When it passes through the mean position, the tension in the string is 3 times the weight of the pendulum bob. What is the maximum angular displacement of the pendulum of the string with respect to the downward vertical.

3. A small body of mass m = 0.5 kg is allowed to slide on an inclined frictionless track from rest position as shown in the figure. (g = 10 m/s^2)



If h is double of that minimum height required to complete the loop successfully, calculate resultant force on the block at position H in newton

4. A frictionless track ABCDE ends in a circular loop of radius R. A body slides down the track from point A which is at height h = 5 cm. Find the maximum value of R for a body to complete the loop successfully.



5. In a circus, stuntman rides a motorbike in a circular track of radius R in the vertical plane. The minimum speed at highest point of track will be.

(A) $\sqrt{2gR}$ (B) 2gR (C) $\sqrt{3gR}$ (D) $\sqrt{gR}$

6. A particle is moving in a vertical circle. The tensions in the string when passing through two positions at angles 30° and 60° from downward vertical are T_1 and T_2 respectively. Then

(A) $T_1 = T_2$

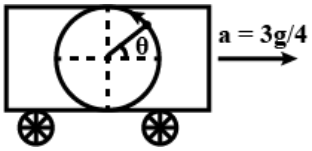
(B) $T_2 > T_1$

(C) $T_1 > T_2$

(D) Tension in the string always remains the same

Passage (7 to 9)

A bus is moving with a constant acceleration a = 3g/4 towards right. In the bus, a ball is tied with a rope of length ℓ and is rotated in vertical circle as shown.



7. At what value of angle θ, tension in the rope will be minimum

(A) $\theta = 37°$ (B) $\theta = 53°$ (C) $\theta = 30°$ (D) $\theta = 90°$

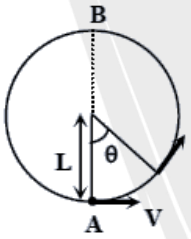
8. At above mentioned position, find the maximum possible speed V_{min} during path whole path to complete the circular motion.

(A) $\sqrt{5g\ell}$ (B) $\frac{5}{2}\sqrt{g\ell}$ (C) $\frac{\sqrt{5g\ell}}{2}$ (D) $\sqrt{g\ell}$

9. For above value of V_{min} find maximum tension in the string during circular motion.

(A) 6 mg (B) $\frac{117}{20}$mg (C) $\frac{15}{2}$mg (D) $\frac{17}{2}$mg

10. A bob of mass M is suspended by a massless string of length L. The horizontal velocity V at position A is just sufficient to make it reach the point B. The angle θ at which the speed of the bob is half of that at A, satisfies. Figure



(A) $\theta = \frac{\pi}{4}$ (B) $\frac{\pi}{4} < \theta < \frac{\pi}{2}$

(C) $\frac{\pi}{2} < \theta < \frac{3\pi}{4}$ (D) $\frac{3\pi}{4} < \theta < \pi$

ANSWER KEY

1. (5 rad/s)
2. (90°)
3. (30)
4. (2 cm)
5. (D)
6. (C)
7. (B)
8. (C)
9. (C)
10. (D)

Home Work

Ex. 1	Q. 14,15,
Ex. 2	Q. 16,20,22,
Ex.3	Q.7,14,23
Ex.4	Q. 3,7,13,20.2128
Ex.5	Q.2,4,7,1618,