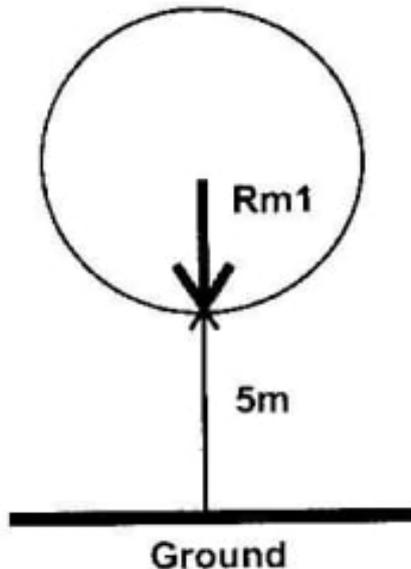


Uniform Circular Motion Questions and Answers - Physics Form 4 Topical Revision

Questions

1. A light inextensible string of length L is fixed at its upper end and support a mass m at the other end. m is rotated at horizontal plane or radius r as shown. The maximum tension the string can withstand without breaking is $2N$. Assuming the string breaks when the radius is maximum, calculate the velocity of the mass when the string breaks, given that $L = 1.25m$, and $m = 0.1kg$.
2. The diagram below shows a mass m , which is rotated in a vertical circle. The speed of the mass is gradually increased until the string breaks. The string breaks when the mass is at its lowest position A and at a speed of $30ms^{-1}$. Point a is $5m$ above the ground.



- a. Show on the diagram.
 - i. The initial direction of the mass at the point the string breaks.
 - ii. The path of the mass from A until it strikes the ground at a point b.
 - b. Calculate;
 - i. The time the mass takes to reach the ground after breaking off.
 - ii. The horizontal distance the mass travels before it strikes the ground.
 - iii. The vertical velocity with which the mass strikes the ground.
3. State the principle by which a speed governor limits the speed of a vehicle.
 4. The rear wheel of a certain car has a diameter of $40cm$. At a certain speed of the car, the wheel makes 7 revolutions per second. A small stone embedded in the tyre tread flies off initially at an angle of 45° to the ground. Determine the initial velocity of the pebble (take $\pi = \frac{22}{7}$)
 5.
 - a. Explain why a pail of water can be swung in a vertical circle without the water pouring out.
 - b. A car of mass $1,200kg$ is moving with a velocity of $25m/s$ around a flat bend of radius $150m$. Determine the minimum frictional force between the tyres and the road that will prevent the car from sliding off.
 6.
 - a. The fig shows the diagram of a set up to investigate the variation of centripetal force with the radius r of the circle in which a body rotates. Describe how the set up can be used to carry out the investigation

acceleration of 9g. What is the maximum number of revolutions per second that the centrifuge can make?

14. A small body of 200g revolves uniformly on a horizontal frictionless surface attached by a cord 20cm long to a pin set on the surface. If the body makes two revolutions per second. Find the tension of the cord.
15. A circular highway curve on a level ground makes a turn 90° . The highway carries traffic at 120 km/h. Knowing that the centripetal force on the vehicle is not to exceed $\frac{1}{10}$ of its weight, calculate the length of the curve
16. A turntable of record player makes 33 revolutions per minute. What is the linear velocity of a point 0.12m from the center?
17. An object 0.5kg on the end of a string is whirled around in a vertical circle of radius 2m, with a speed of 10m/s. What is the maximum tension in the string?

Answers

1. When tension is max then $r = l$

$$T = F = \frac{MV^2}{r}$$

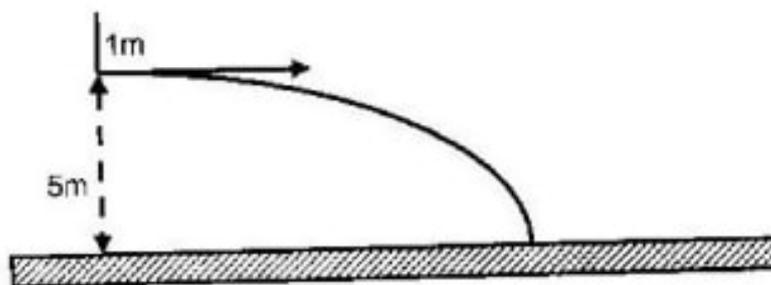
$$2 = \frac{0.1 \times V^2}{1.25}$$

$$\therefore V^2 = \frac{2 \times 1.25}{0.1}$$

$$V = 5 \text{ m/s}$$

- 2.

- a. (i) & (ii)



- b.

- i. $S = Ut + \frac{1}{2} at^2$

$$t = \frac{\sqrt{(2 \times 5)}}{10}$$

$$= 1 \text{ seconds}$$

- ii. $S = Ut = 30 \times 1 = 30\text{m}$

- iii. $V^2 = U^2 + 2as$

$$V = \sqrt{(2 \times 10 \times 5)}$$

$$= 10\text{m}$$

3. Principle of conical pendulum Or principle of circular motion

4. $V = \omega r$

$$\text{But } \omega = \frac{\theta}{T} = \frac{2\pi \times 7}{1} = 14 \text{ rads}^{-1}$$

$$\therefore V = 14\pi \times 0.20$$

$$= 8.8 \text{ m/s}$$

5. Centripetal acceleration of bucket is equal or higher than gravitational acceleration of the water.

- 6.