Non-uniform Circular Motion

1. 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) $\sqrt{gR}$

2. A block of mass m at the end of a string is whirled round in a vertical circle of radius R. The critical speed of the block at the top of its swing below which the string would slacken before the block reaches the top is

(a) Rg (b) $(Rg)^2$

(c) R/g (d) $\sqrt{Rg}$

3. A sphere is suspended by a thread of length l. What minimum horizontal velocity has to be imparted the ball for it to reach the height of the suspension

(a) gl (b) $2gl$

(c) $\sqrt{gl}$ (d) $\sqrt{2gl}$

4. A bottle of sodawater is grasped by the neck and swing briskly in a vertical circle. Near which portion of the bottle do the bubbles collect

(a) Near the bottom

(b) In the middle of the bottle

(c) Near the neck

(d) Uniformly distributed in the bottle

5. A bucket tied at the end of a 1.6 m long string is whirled in a vertical circle with constant speed. What should be the minimum speed so that the water from the bucket does not spill, when the bucket is at the highest position (Take $g = 10m/sec^2$)

(a) 4 *m/sec* (b) 6.25 *m/sec*

(c) 16 *m/sec* (d) None of the above

6. A wheel is subjected to uniform angular acceleration about its axis. Initially its angular velocity is zero. In the first 2 *sec*, it rotates through an angle θ_1. In the next 2 *sec*, it rotates through an additional angle θ_2. The ratio of $\sqrt{3}mg$ is

(a) 1 (b) 2

(c) 3 (d) 5

7. A 1 *kg* stone at the end of 1 *m* long string is whirled in a vertical circle at constant speed of 4 *m/sec*. The tension in the string is 6 *N*, when the stone is at (g = 10 m/sec^2)

(a) Top of the circle

(b) Bottom of the circle

(c) Half way down

(d) None of the above

8. A cane filled with water is revolved in a vertical circle of radius 4 *meter* and the water just does not fall down. The time period of revolution will be

(a) 1 *sec* (b) 10 *sec*

(c) 8 *sec* (d) 4 *sec*

9. A 2 *kg* stone at the end of a string 1 *m* long is whirled in a vertical circle at a constant speed. The speed of the stone is 4 *m/sec*. The tension in the string will be 52 *N*, when the stone is

(a) At the top of the circle

(b) At the bottom of the circle

(c) Halfway down

(d) None of the above

10. A body slides down a frictionless track which ends in a circular loop of diameter D, then the minimum height h of the body in term of D so that it may just complete the loop, is

(a) $h = \frac{5D}{2}$ (b) $h = \frac{5D}{4}$

(c) $h = \frac{3D}{4}$ (d) $h = \frac{D}{4}$

11. A car is moving with speed 30 $m/\sec$ on a circular path of radius 500 *m*. Its speed is increasing at the rate of $2m/sec^2$, What is the acceleration of the car

(a) $2m/sec^2$

(b) $2.7m/sec^2$

(c) $1.8m/sec^2$

(d) $9.8m/sec^2$

12. The string of pendulum of length l is displaced through 90^o from the vertical and released. Then the minimum strength of the string in order to withstand the tension, as the pendulum passes through the mean position is

(a) mg (b) $3mg$

(c) $5mg$ (d) $6mg$

13. 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 $g = 10m/s^2$, then the maximum angular velocity of the stone will be

(a) $5rad/s$ (b) $\sqrt{30}rad/s$

(c) $\sqrt{60}rad/s$ (d) $10rad/s$

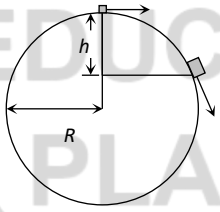
14. A particle originally at rest at the highest point of a smooth vertical circle is slightly displaced. It will leave the circle at a vertical distance *h* below the highest point such that

(a) $h = R$

(b) $h = \frac{R}{3}$

(c) $h = \frac{R}{2}$

(d) $h = \frac{2R}{3}$



15. A heavy mass is attached to a thin wire and is whirled in a vertical circle. The wire is most likely to break

(a) When the mass is at the highest point of the circle

(b) When the mass is at the lowest point of the circle

(c) When the wire is horizontal

(d) At an angle of $cos^{-1}(1/3)$ from the upward vertical

16. A weightless thread can bear tension upto 3.7 *kg wt*. A stone of mass 500 *gms* is tied to it and revolved in a circular path of radius 4 *m* in a vertical plane. If $g = 10ms^{-2}$, then the maximum angular velocity of the stone will be

(a) 4 *radians/sec*

(b) 16 *radians/sec*

(c) $\sqrt{21}$ *radians/sec*

(d) 2 *radians/sec*

17. The maximum velocity at the lowest point, so that the string just slack at the highest point in a vertical circle of radius l

(a) $\sqrt{gl}$ (b) $\sqrt{3gl}$

(c) $\sqrt{5gl}$ (d) $\sqrt{7gl}$

18. If the equation for the displacement of a particle moving on a circular path is given by $(\theta) = 2t^3 + 0.5$, where θ is in radians and t in seconds, then the angular velocity of the particle after 2 *sec* from its start is

(a) 8 *rad/sec* (b) 12 *rad/sec*

(c) 24 *rad/sec* (d) 36 *rad/sec*

19. A body of mass m hangs at one end of a string of length *l*, the other end of which is fixed. It is given a horizontal velocity so that the string would just reach where it makes an angle of 60^o with the vertical. The tension in the string at mean position is

(a) $2mg$ (b) mg

(c) $3mg$ (d) $\sqrt{3}mg$

20. In a vertical circle of radius *r*, at what point in its path a particle has tension equal to zero if it is just able to complete the vertical circle

(a) Highest point

(b) Lowest point

(c) Any point

(d) At a point horizontally from the centre of circle of radius *r*

21. The tension in the string revolving in a vertical circle with a mass m at the end which is at the lowest position

(a) $\frac{mv^2}{r}$ (b) $\frac{mv^2}{r} - mg$

(c) $\frac{mv^2}{r} + mg$ (d) mg

22. A hollow sphere has radius 6.4 *m*. Minimum velocity required by a motor cyclist at bottom to complete the circle will be

(a) 17.7 *m/s* (b) 10.2 *m/s*

(c) 12.4 *m/s* (d) 16.0 *m/s*

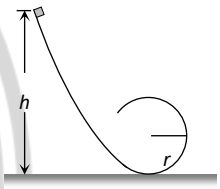
23. A block follows the path as shown in the figure from height h. If radius of circular path is r, then relation that holds good to complete full circle is

(a) $h < 5r/2$

(b) $h > 5r/2$

(c) $h = 5r/2$

(d) $h \geq 5r/2$



24. A pendulum bob on a 2 *m* string is displaced 60° from the vertical and then released. What is the speed of the bob as it passes through the lowest point in its path

(a) $\sqrt{2}m/s$ (b) $\sqrt{9.8}m/s$

(c) 4.43 *m/s* (d) $1/\sqrt{2}m/s$

25. A fan is making 600 revolutions per *minute*. If after some time it makes 1200 revolutions per *minute*, then increase in its angular velocity is

(a) $10\pi rad/sec$ (b) $20\pi rad/sec$

(c) $40\pi rad/sec$ (d) $60\pi rad/sec$