PHYSICS

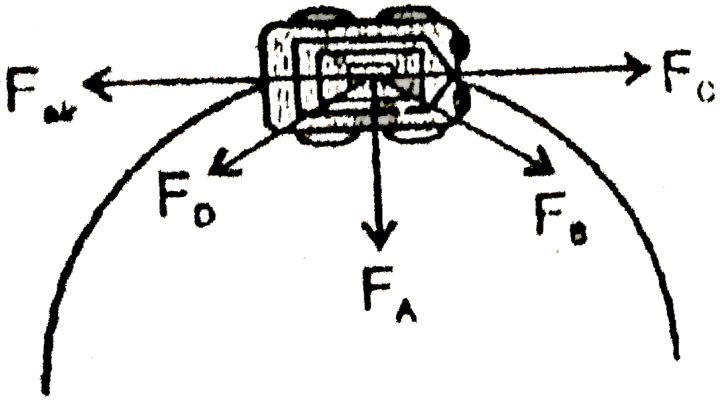
RESONANCE ENGLISH

CIRCULAR MOTION

Exercise

1. A car travels with constant speed on a circular road on level ground. In the figure shown, F_{air} is the force of air resistance on

the car. Which of the other forces best represent the horizontal force of the road on the car's tires ?



A. F_A

B. F_B

C. F_C

D. F_D

Answer: B

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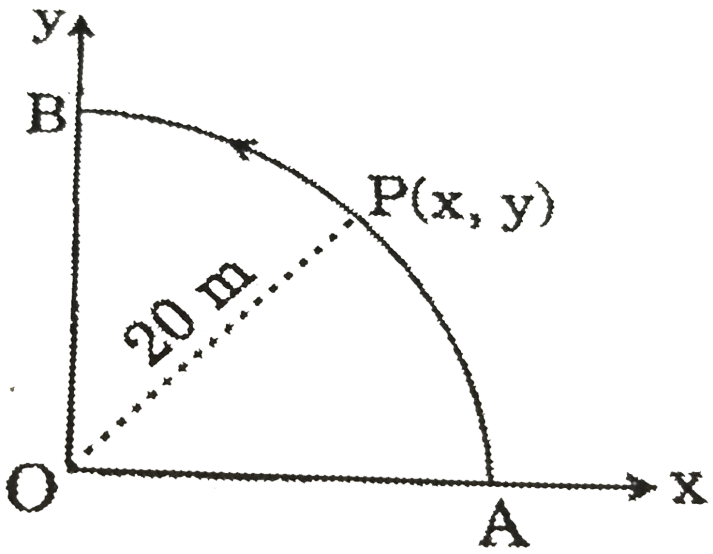
2. A point P moves in counter-clockwise direction on a circular path as shown in the figure. The movement of 'P' is such that it sweeps out a length $s = t^3 + 5$, where s is in metres and t is in seconds. The radius of the path is 20 m. The acceleartion of 'P' when t = 2

s is nearly



A. $13m/s^2$

B. $12m/s^2$

C. $7.2m/s^2$

D. $14m/s^2$

Answer: D

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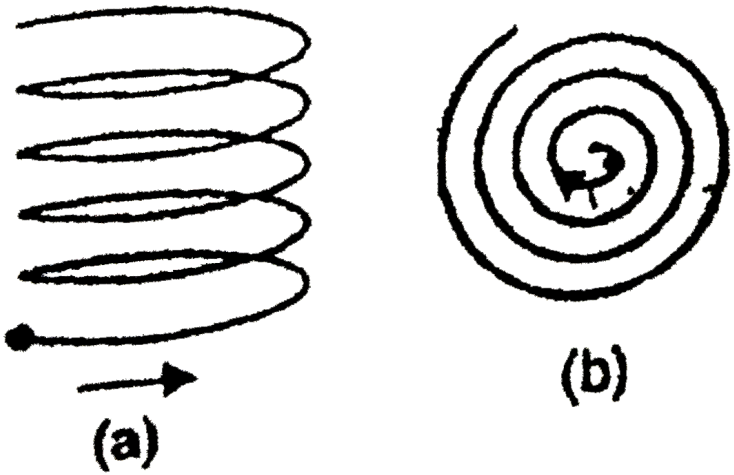
3. A particle is going with constant speed along a uniform helical and spiral path separately as shown in figure



A. The velocity of the particle is constant in both cases

B. The magnitude of acceleration of the particle is constant in both cases

C. The magnitude of acceleration is constant in (a) and decreasing in (b)

D. The magnitude of acceleration is decreasing continuously in both the cases

Answer: C

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4. A particle P is sliding doen a friction hemispherical bow it passes the point A $u(t=0)$At this instant of time the horizontal component of its velocity is a A bead Q of the same mass an P is ejected from A at $t=0$ along the horizontal string AB with the speed v .Friction between the bead and the string may be neglected Let $t_p$and t_Q be the respectively times taken by P and Q to reach

the point θ then

A. $t_P < t_Q$

B. $t_P = t_Q$

C. $t_P > t_Q$

D. $\frac{t_P}{t_Q} = \frac{\text{length of arc ACB}}{\text{length of chord AB}}$

Answer: A

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5. A stone is projected from level ground at $t = 0$ sec such that its horizontal and vertical components of initial velocity are $10\frac{m}{s}$ and $20\frac{m}{s}$ respectively. Then the instant of time at which tangential and normal components of acceleration of stone are same is: (neglect air resistance)$g = 10\frac{m}{s^2}$.

A. $\frac{1}{2}\text{sec}$

B. $\frac{3}{2}\text{sec}$

C. 3 sec

D. 4 sec

Answer: C

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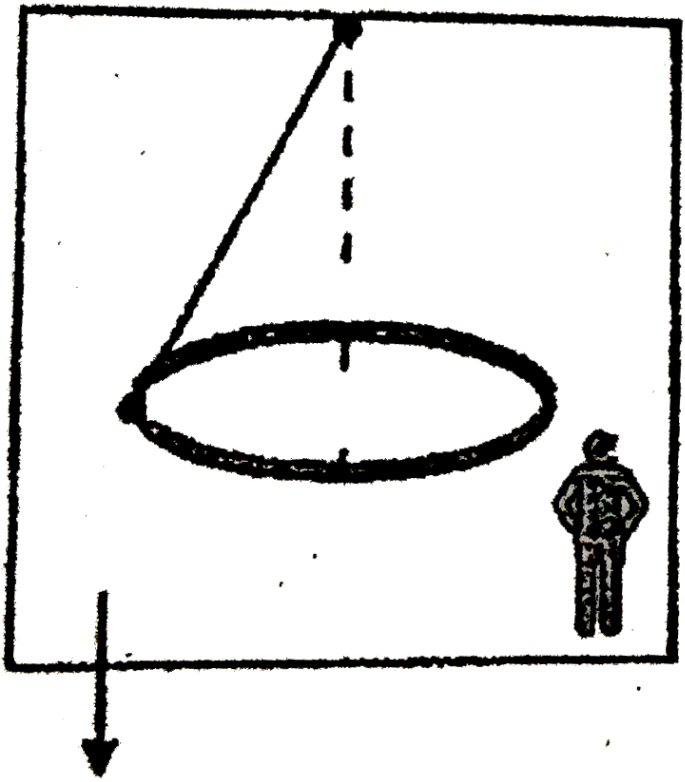
6. In the figure shown a lift goes downwards with a constant retardation. An observer in the lift observers a conical pendulam in the lift, revolving in a horizontal circle with time period 2 seconds. The distance between the centre of the circle and the point of

suspension is 2.0 m. the retardation of the lift in m/s^2 is



A. $1m/s^2$

B. $2m/s^2$

C. $3m / s^2$

D. $4m / s^2$

Answer: A

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7. In the motorcycle stunt called " the well of death" the track is vertical cylindrical surface of 18 m radius.take the motorcyle to be a point mass and $\mu = 0.8$. The minimum angular

speed of the motorcycle to prevent him from sliding down should be

A. 6/5 rad/s

B. 5/8 rad/s

C. 25/3 rad/s

D. none of these

Answer: B

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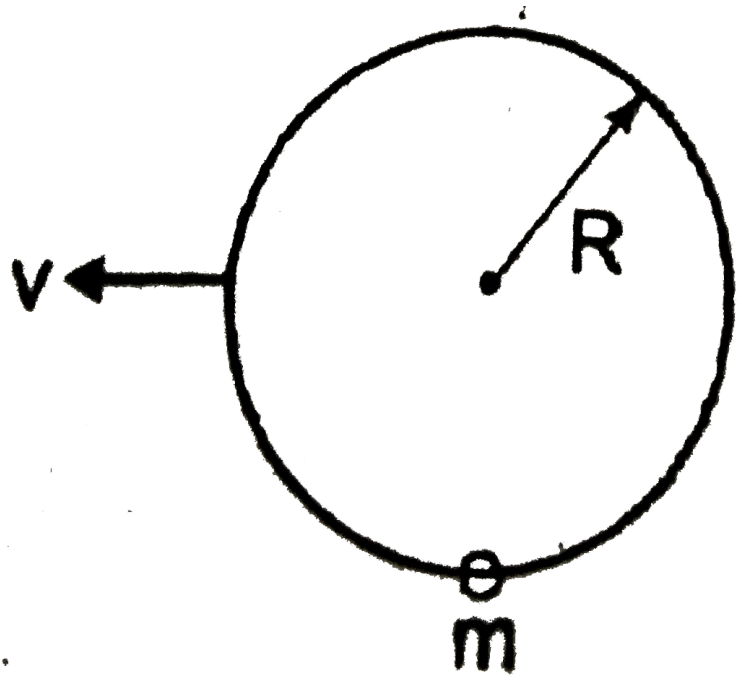
8. A ring of radius R lies in vertical plane. A bead of mass $'m'$ can move along the ring without friction. Initially the bead is at rest the bottom most point on ring. The minimum horizontal speed v with which the ring must be pulled such that the bead completes the

vertical circle.



A. $\sqrt{3gR}$

B. $\sqrt{4gR}$

C. $\sqrt{5gR}$

D. $\sqrt{5.5gR}$

Answer: B

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9. A circular curve of a highway is designed for traffic moving at $72 kmh^{-1}$. If the radius of the curved path is 100 m, the correct angle of banking of the road should be

A. $\tan^{-1}.\frac{2}{3}$

B. $\tan^{-1}.\frac{3}{5}$

C. $\tan^{-1}.\frac{2}{5}$

D. $\tan^{-1}.\ \frac{1}{4}$

Answer: C

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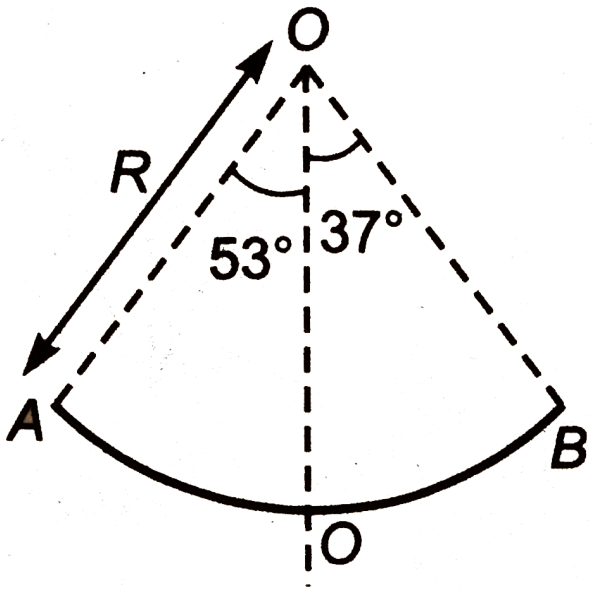
10. A section of fixed smooth circular track of radius R in vertical plane is shown in the figure. A block is released from position A and leaves the track at B The radius of curvature

of its trajectory just after it leaves the track B



is ?

A. R

B. $\frac{R}{4}$

C. $\frac{R}{2}$

D. none of these

Answer: C

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11. A particle of mass m starts to slide down from the top of the fixed smooth sphere. What is the tangential acceleration when it break off the sphere ?

A. $\frac{2g}{3}$

B. $\frac{\sqrt{5}g}{3}$

C. g

D. $\frac{g}{3}$

Answer: B

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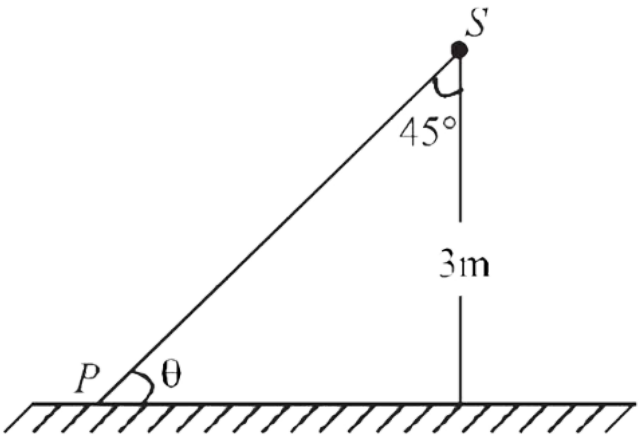
12. Spotlight S rotates in a horizontal plane with constant angular velocity of 0.1 rad/s The spot of light P moves along the wall at a distance of 3 m The velocity of the spot P

when θ = 45 is m/s (see - fig.) is ..... m/s



A. 0.6 m/s

B. 0.5 m/s

C. 0.4 m/s

D. 0.3 m/s

Answer: A

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13. A stone is projected with speed u and angle of projection is θ. Find radius of curvature at t=0.

A. $\frac{u^2 \cos^2 \theta}{g}$

B. $\frac{u^2}{g \sin \theta}$

C. $\frac{u^2}{g \cos \theta}$

D. $\frac{u^2 \sin^2 \theta}{g}$

Answer: C

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14. A particle moving along a circular path due to a centripetal force having constant magnitude is an example of motion with

A. constant speed and velocity

B. variable speed and velocity

C. variable speed and constant velocity

D. constant speed and variable velocity.

Answer: D

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15. A particle is projected horizontally from the top of a tower with a velocity v_0. If v be its velocity at any instant, then the radius of curvature of the path of the particle at that instant is directely proportional to

A. v^3

B. v^2

C. v

D. $1/v$

Answer: A

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16. A car moving on a horizontal road may be thrown out of the road in taking a turn

A. By the gravitational force

B. Due to lack of sufficient centripetal force

C. Due to friction between road and the tyre

D. Due to reaction of earth

Answer: B

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17. A stone of mass m tied to a string of length l is rotated in a circle with the other end of the string as the centre. The speed of the stone is v. If the string breaks, the stone will move

A. $\frac{mv^2}{r} + mg$

B. $\frac{mv^2}{r} - mg$

C. $\frac{mv^2}{r}$

D. mg

Answer: A

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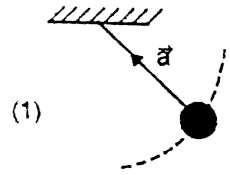
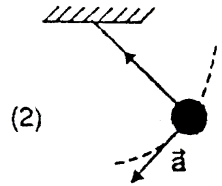
18. A simple pendulum is oscillating without damping. When the displacement of the bob is

less than maximum, its acceleration vector $\overrightarrow{a}$ is correctly shown in

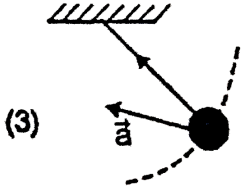
A.



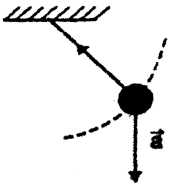
B.



C.



D.



Answer: C

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19. A stone tied to a string of length L is whirled in a vertical circle with the other end of the string at the centre. At a certain instant of time the stone is at lowest position and has a speed u . Find the magnitude of the change in its velocity as it reaches a position, where the string is horizontal.

A. $\sqrt{u^2 - 2gL}$

B. $\sqrt{2gL}$

C. $\sqrt{u^2 - gL}$

D. $\sqrt{2(u^2 - gL)}$

Answer: D

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20. A particle is acted upon by a force of constant magnitude which is always perpendiculr to the velocity of the particle.

The motion of the particle takes place in a plane. It follows that

A. its velocity is constant

B. its acceleration is constant

C. its kinetic energy is constant

D. it moves in a straight line

Answer: C

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21. A bird is flying in the air. To take a turn in the horizontal plane of radius R=10 m with the velocity v=10 m/s at what angle it should bend with the horizontal.

A. 30°

B. 15°

C. 60°

D. 45°

Answer: D

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22. A particle moves along a circle of radius $\left(\frac{20}{\pi}\right)$ m with constant tangential acceleration. If the velocity of the particle is 80 m/s at the end of the second revolution after motion has begun, the tangential acceleration is : -

A. $40m/s^2$

B. $20m/s^2$

C. $10m/s^2$

D. $5m/s^2$

Answer: A

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23. For a body in circular motion with a constant angular velocity, the magnitude of the average acceleration over a period of half a revolution is..... times the magnitude of its instantaneous acceleration

A. $\frac{1}{\pi}$

B. $\frac{2}{\pi}$

C. $\frac{5}{\pi}$

D. $\frac{3}{\pi}$

Answer: B

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24. A ball suspended by a thread swings in a vertical plane so that its acceleration in the extreme position and lowest position are

equal in magnitude. Angle θ of thread deflection in the extreme position will be :

A. 30°

B. 60°

C. 53°

D. 37°

Answer: C

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25. The position vector of a particle in a circular motion about the origin sweeps out equal area in equal time. Its

A. velocity remains constant

B. speed remains constant

C. acceleration remains constant

D. tangential acceleration increases

Answer: B

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26. A car of maas M is moving on a horizontal circular path of radius r. At an instant its speed is v and is increasing at a rate a.

A. The acceleration of the car is towards the centre of the path

B. The magnitude of the frictional force on the car is greater than $\frac{mv^2}{r}$

C. The friction coefficient between the ground and the is less than a/g.

D. The friction coefficient between the ground and the car is $\mu = \tan^{-1}.\frac{v^2}{rg}$

Answer: B

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27. A car moves at a constant speed on a road as shown in figure. The normal force by the road on the car is N_A and N_B when it is at

the points A and B respectively

Figure 7-Q2

A. $N_A = N_B$

B. $N_A > N_B$

C. $N_A < N_B$

D. $N_C = N_A$

Answer: B

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28. Which of the following quantities may remain constant during the motion of an object along a curved path.

A. speed

B. velocity

C. acceleration

D. momentum

Answer: A

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29. A $1-kg$ stone at the end of $1m$ long string is whirled in a vertical circle at a constant speed of $4ms^{-1}$. The tension in the string is $6N$ when the stone is

A. 2m/sec

B. 10 m/sec

C. 4 m/sec

D. 5 m/sec

Answer: C

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30. When the road is dry and coefficient of friciton is μ, the maximum speed of a car in a circular path is $10ms^{-1}$. If the road becomes wet and coefficient of friction becomes $\frac{\mu}{4}$, what is the maximum speed permited ?

A. $5ms^{-1}$

B. $10ms^{-1}$

C. $20ms^{-1}$

D. $4ms^{-1}$

Answer: A

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31. A coin placed on a rotating turntable just slips if it is placed at a distance of 4 cm from the centre. If the angular velocity of the turntable is doubled, it will just slip at a distance of

A. 2 cm

B. 3 cm

C. 4 cm

D. 5 cm

Answer: C

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32. A heavy & big sphere is hang with a string of length l. This sphere move in a horizontal

circular path making an angle θ with vertical then its time period is

A. $T = 2\pi\sqrt{\frac{l}{g}}$

B. $T = 2\pi\sqrt{\frac{l\sin\theta}{g}}$

C. $T = 2\pi\sqrt{\frac{l\cos\theta}{g}}$

D. $T = 2\pi\sqrt{\frac{l}{g\cos\theta}}$

Answer: C

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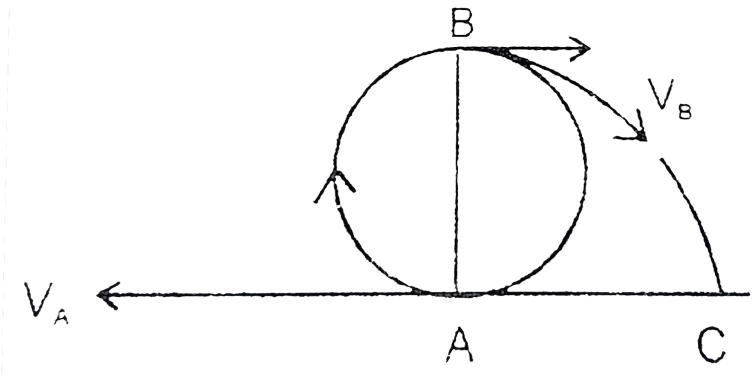
33. A body is tied up by a string of length l and is rotated in verticle circle at minimum speed. When it reaches the heightest point string breaks and body moves on a parabolic path in presence of according to fig. In the plane of point A, value of horizontal range AC will be



A. x=l

B. x=2l

C. $x = \sqrt{2l}$

D. $x = 2\sqrt{2l}$

Answer: B

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34. 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. $\sqrt{7gl}$

Answer: C

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35. The breaking tension of a string is 10 N. A particle of mass 0.1 kg tied to it is rotated along a horizontal circle of radius 0.5 meter.

The maximum speed with which the particle can be rotated without breaking the string is

A. $\sqrt{5}m/\sec$

B. $\sqrt{(50)}m/\sec$

C. $\sqrt{(500)}m/\sec$

D. $\sqrt{(1000)}m/\sec$

Answer: B

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36. A mass is supported on a frictionless horizontal surface. It is attached to a string and rotates about a fixed centre with a angular velocity ω_0. If the length of the string and angular velocity are doubled, the tension in the string which was initially T_0 is now

A. T_0

B. $T_0 / 2$

C. $4T_0$

D. $8T_0$

Answer: D

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