PHYSICS

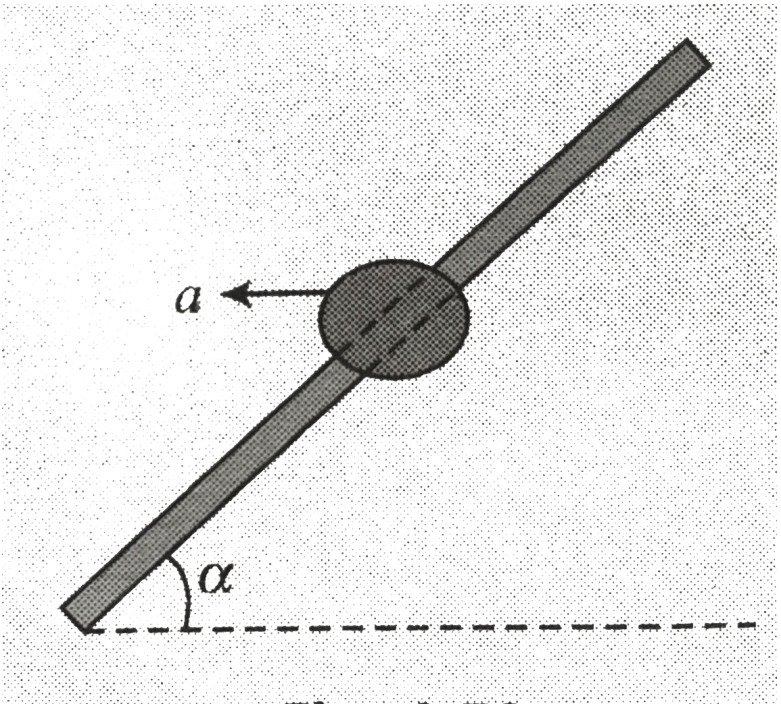
AIMED AT STUDENTS PREPARING FOR IIT JEE EXAMS

CIRCULAR MOTION

Level V

1. A bead of mass m is fitted on to a rod and can move on it without friction. At the initial

moment the bead is in the middle of the rod. The rod moves translationally in a horizontal plane with an acceleration a in a direction forming an angle α with the rod. Find the acceleration of the bead relative to the rod.



A. $g \sin \alpha$

B. $(g + a_0)\sin\alpha$

C. $g\sin\alpha + a_0\cos\alpha$

D. $g\sin\alpha - a_0\cos\alpha$

Answer: A::C

Watch Video Solution

2. A particle is projected with a velocity $8m/\sec$ at an angle 45^0, with the horizontal.What is the radius of curvature of

the trajectory of the particle at the instant of $'\frac{1}{4}th'$ of the time of ascent.

A. $6.25m$

B. $12.5m$

C. $8m$

D. $10m$

Answer: B

Watch Video Solution

3. A particle of mass in is moving in a circular with of constant radius r such that its contripetal accelenation a_c is varying with time t as $a_c = K^2rt^2$ where K` is a constant . The power delivered to the particles by the force action on it is

A. $2\pi mk^2r^2t$

B. mk^2r^2t

C. $\frac{1}{3}mk^4r^2t^5$

D. 0

Answer: B

Watch Video Solution

4. A particle is projected with a velocity $'9m/\sec'$ at an angle 45^0, with the horizontal.What is the radius of curvature of the trajectory of the particle at the position $'x = R/3'$ (R-Range of the projectile).

A. $3\sqrt{20}m$

B. $3\sqrt{10}$

C. $\frac{3\sqrt{10}}{2}m$

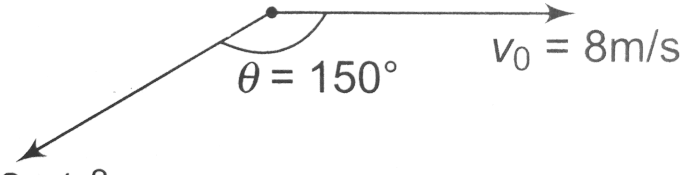
D. $\frac{3}{4}\sqrt{10}m$

Answer: A::B::C

Watch Video Solution

5. The figure shows th velocity and acceleration of a point like body at the initial moment of its motion. The acceleration vector of the body remain constant. The minimum

radius of curvature of trajectory of the body is



A. $2meter$

B. $4meter$

C. $8meter$

D. $16meter$

Answer: D

Watch Video Solution

6. A stone is thrown horizontally with a velocity of $10m/\sec.$ Find the radius of curvature of it's trajectory at the end of $3s$ after motion began. $\left(g = 10m/s^2\right)$

A. $10\sqrt{10}m$

B. $100\sqrt{10}m$

C. $\sqrt{10}m$

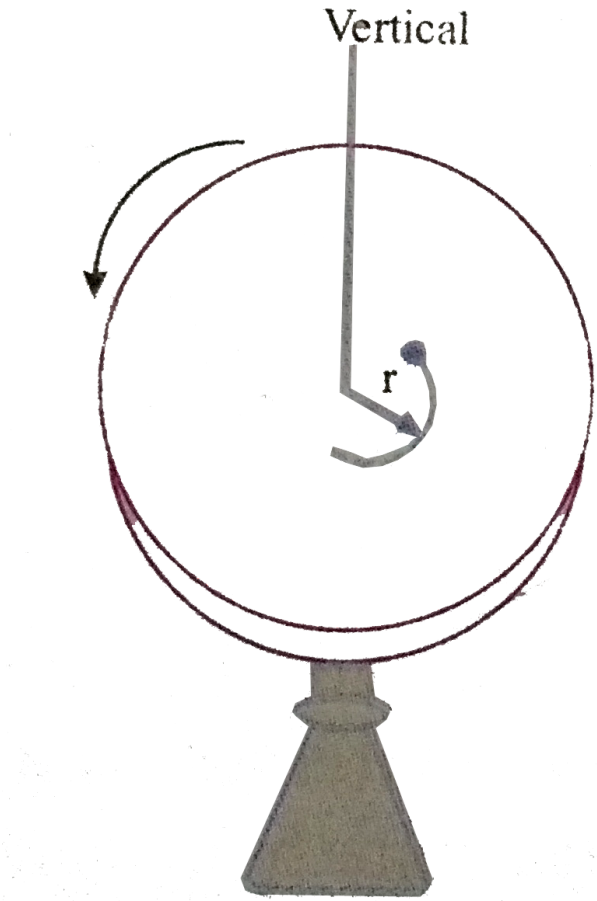
D. $100m$

Answer: A

Watch Video Solution

7. A small coin of mass $80g$ is placed on the horizontal surface of a rotating disc. The disc starts from rest and is given a constant angular acceleration $\alpha = 2rad/s^2$. The coefficient of static friction between the coin and the disc is $\mu_s = 3/4$ and cofficient of kinetic friction is $\mu_k = 0.5$. The coin is placed at a distance $r = 1m$ from the centre of the disc. The magnitude of the resultant force on the coin exerted by the disc just before it

starts slipping on the disc is



A. $0.2N$

B. $0.3N$

C. $0.4N$

D. $1N$

Answer: A

Watch Video Solution

8. Water of density p flows with a linear speed v through a horizontal rubber tube having the form of a ring of radius R. If the diameter of the tube is $d(<<R)$, find the tension in the rubber tube.

A. $\frac{\pi d^2 \rho v^2}{4}$

B. $\frac{\pi d^2 \rho v^2}{8}$

C. $\frac{\pi d^2 \rho v^2}{6}$

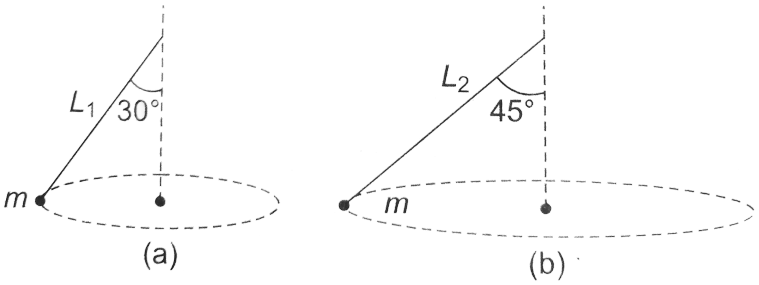
D. None

Answer: B::D

Watch Video Solution

9. Two partical tied to different strings are whirled in a horizontal circle as shown in figure. The ratio of lengths of the string so

that they complete their circular path with equal time priod is:



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

B. $\sqrt{\frac{1}{3}}$

C. 1

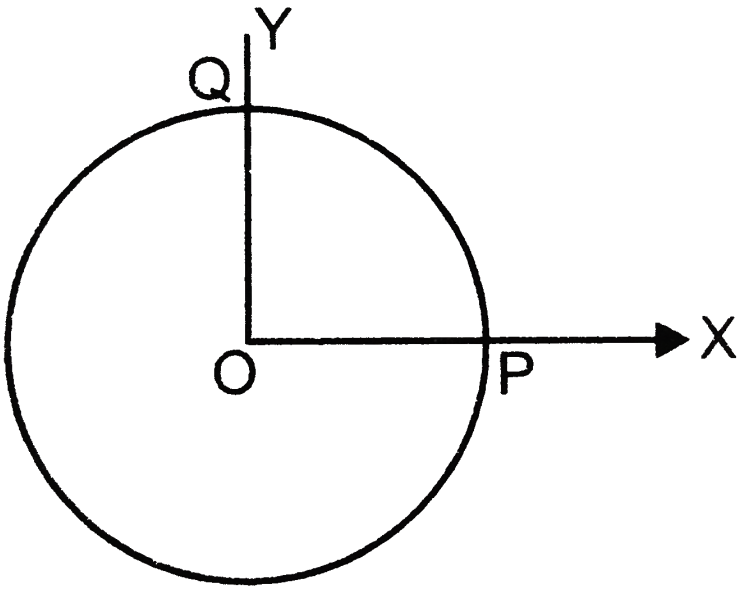
D. $\sqrt{3}$

Answer: A::C

Watch Video Solution

10. A particle moves in a circle of radius $4.0cm$ clockwese at constant speed of $2cmS^{-1}$. If $\hat{x}$ and $\hat{y}$ ar unit accleration vectors along X- asis and Y-axis respectively, find the accleration of the particle at the instant half way between `

PQ. Fig. 2 (d) . 38.



A. $-4(\hat{x}+\hat{y})$

B. $4(\hat{x}+\hat{y})$

C. $-(\hat{x}+\hat{y})\frac{1}{\sqrt{2}}$

D. $(\hat{x}+\hat{y})4$

Answer: A::B

Watch Video Solution

11. A reference frame attached to the earth

A. Is an inertial frame by definition

B. Cannot be an inertial frame because the Earth is revolving around the sun

C. is an inertial frame because Newton's laws of motion are applicable in this

frame

D. Cannot be inertial frame because the Earth is rotating about its own axis.

Answer: A::C

Watch Video Solution

12. A particle is moving along a circular path of radius of R such that radial acceleration of particle is proportional to t^2 then

A. Speed of particle is constant

B. Magnitude of tangential acceleration of particle is constant

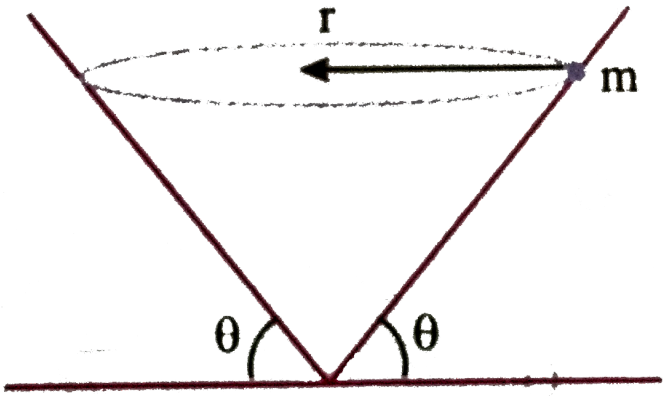
C. Speed of particle is proportional to time

D. Magnitude of tangential acceleration is variable

Answer: B::C

Watch Video Solution

13. A ball of mass m is rotating in a circle of radius r with speed v inside a smooth cone as shown in figure. Let N be the normal reaction on the ball by the cone, then choose the correct option:



A. $N\cos\theta = mg$

B. $g\sin\theta = \dfrac{v^2}{r}\cos\theta$

C. $N\sin\theta - \frac{mv^2}{r} = 0$

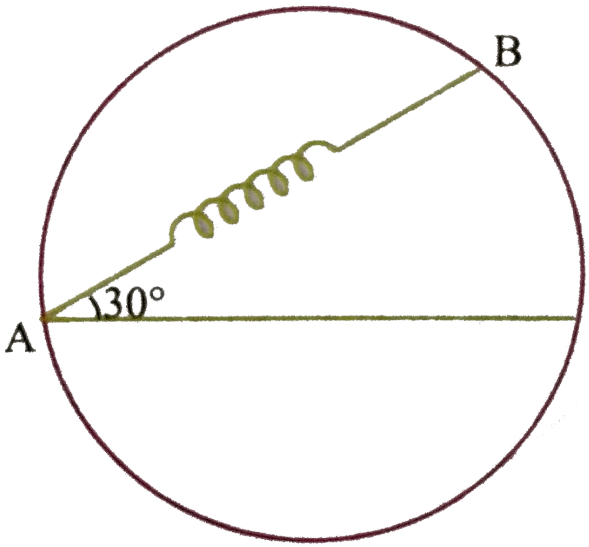
D. None of these

Answer: A::B::C

Watch Video Solution

14. A Bead of mass m is attached to one end of a spring of natural length $'R'$ and spring cosntant $'k = \frac{\left(\sqrt{3}+1\right)mg}{R}'$. The other end of the spring is fixed at point $'A'$ on a

smooth vertical ring of radius $'R'$ as shown



A. The normal reaction at $'B'$ just after the bead is released to move is: $\frac{3\sqrt{3}mg}{2}$

B. The tangential acceleration of the bead just after it is released to move is :$g/2$

C. The normal reaction at $'B'$ just after the bead is released to move is : $\frac{3mg}{2}$

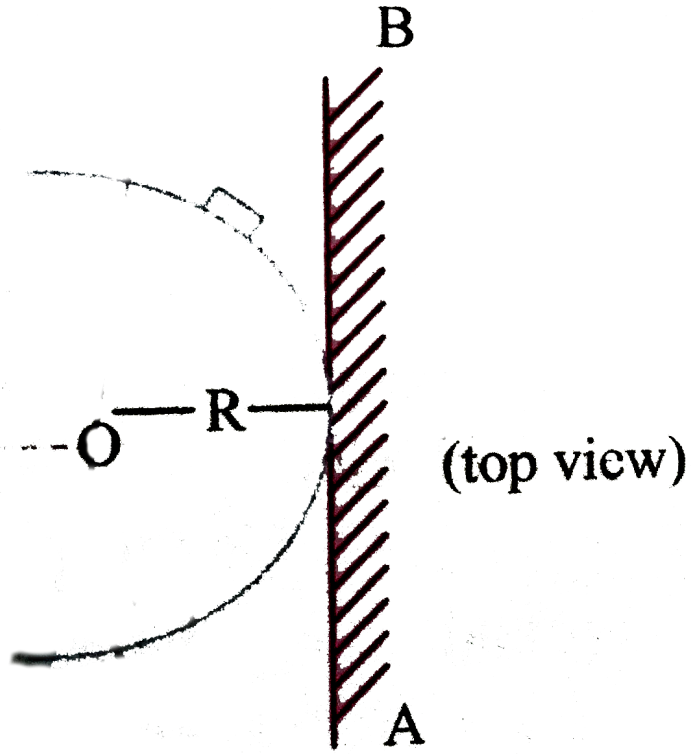
D. Just after the bead is released to move the normal acceleration and Tangential acceleration are numerically equal.

Answer: A::B::C

Watch Video Solution

15. As shown in figure AB represents an infinite wall tangential to a horizontal semi circular track.O is a point source of light on the ground at the centre of the circle. A block moves along the circular track with speed v starting from the point where the wall touches the circle. If the velocity and acceleration of shadow along the length of

the wall is respectively $'V'$ and $'a'$ then,



A. $V = v\cos\dfrac{vt}{R}$

B. $V = v\sec^2\left(\dfrac{vt}{R}\right)$

C. $a = \dfrac{v^2}{R}\sec^2\left(\dfrac{vt}{R}\right)\tan\left(\dfrac{vt}{R}\right)$

D. $a = \frac{2v^2}{R}\sec^2\left(\frac{vt}{R}\right)\tan\left(\frac{vt}{R}\right)$

Answer: B::D

Watch Video Solution

16. If a_r and a_t respresent radial and tangential acceleration, the motion of a particle will be circular is

A. $a_r = 0$ and $a_t = 0$

B. $a_r = 0$ and $a_t \neq 0$

C. $a_r \neq 0$ and $a_t = 0$

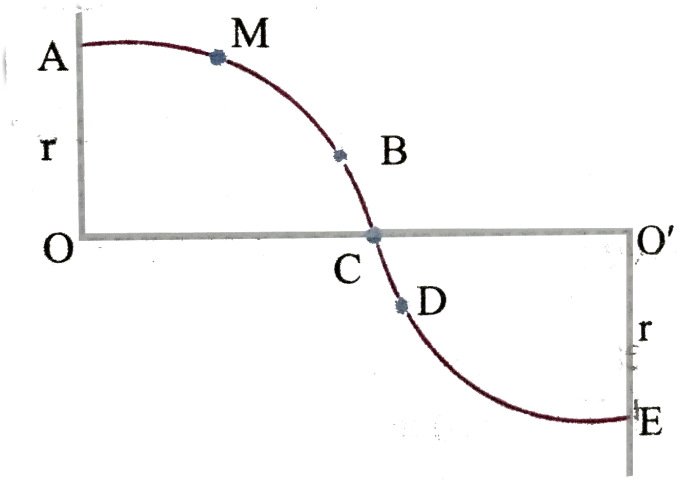
D. $a_r \neq 0$ and $a_t \neq 0$

Answer: C::D

Watch Video Solution

17. $ABCDE$ is a smooth iron track in the vertical plane. The sections ABC and CDE are quarter circles. Points B and D are very close to C. M is a small magnet of mass m. The force of attraction between M and the

track is F, which is constant and always normal to the track. M starts from rest at A, then:



A. If M is not to leave the track at C, then

$$F > 2mg$$

B. At B, the normal reaction of the track is

$F - 2mg$

C. At D, the normal reaction of the track is

$F + 2mg$

D. The normal reaction of the track is equal

to F at some point between A and M

Answer: B::C::D

Watch Video Solution

18. When a cyclist turns on a circular path,the necessary centripetal force is provided by friction between the tyres and the road. If centripetal force is not provided by friction, then for the vehicle to move on circular path, the track is banked.

A cyclist going straight suddenly turns on wet road, then

A. the cyclist is likely to skid

B. the cyclist will skid only if his weight is less than the weight of cycle.

C. the cyclist will skid if his weight is more than weight of cycle.

D. cyclist will not skid at all.

Answer: A

Watch Video Solution

19. When a cyclist turns on a circular path,the necessary centripetal force is provided by friction between the tyres and the road. If centripetal force is not provided by friction,

then for the vehicle to move on circular path, the track is banked.

The correct angle of banking for a curved smooth road of radius $120m$ for a speed of $108km/h\left(g = 10ms^{-2}\right)$ is

A. 30°

B. 37°

C. 45°

D. 60°

Answer: B

Watch Video Solution

20. When a cyclist turns on a circular path,the necessary centripetal force is provided by friction between the tyres and the road. If centripetal force is not provided by friction, then for the vehicle to move on circular path, the track is banked.

If the speed of a vehicle is doubled, then for safety of vehicle

A. the angle of banking must be doubled

B. the angle of banking must be four times

C. the tangent of angle of banking must be doubled

D. the tangent of angle of banking must be increased to four times.

Answer: D

 Watch Video Solution

21. A hemispherical bowl of radius $R = 0.1m$ is rotating about its own axis (which is verticle) with an angular velocity ω. A particle of mass $10^{-2}kg$ on the smooth inner surface of the bowl is also rotating with the same ω. The particle is at a height h from the bottom of the bowl (a) obtain the relation betweemn h and ω. what is the minimum value of ω needed, in order to have a non-zero value of h ? (b) it is desired to measure g using this set up, by measuring h accurately. assuming that R and Ω are known precisely and least count

in the measurement of h is $10^{-4}m$, what is the minimum possible error Δg in the measured value of g? $\left(g = 10m/s^2\right)$

A. $h = \frac{\omega^2}{g}$

B. $h = \frac{R}{2}$

C. $h = R - \frac{g}{\omega^2}$

D. None

Answer: C

Watch Video Solution

22. A hemispherical bowl of radius $R = 0.1m$ is rotating about its own axis (which is verticle) with an angular velocity ω. A particle of mass $10^{-2}kg$ on the smooth inner surface of the bowl is also rotating with the same ω. The particle is at a height h from the bottom of the bowl (a) obtain the relation betweemn h and ω. what is the minimum value of ω needed, in order to have a non-zero value of h ? (b) it is desired to measure g using this set up, by measuring h accurately. assuming that R and Ω are known precisely and least count

in the measurement of h is $10^{-4}m$, what is the minimum possible error Δg in the measured value of g? $\left(g = 10m/s^2\right)$

A. $\sqrt{\frac{g}{R}}$

B. $\sqrt{\frac{g}{2R}}$

C. $\sqrt{\frac{g}{3R}}$

D. None

Answer: A

Watch Video Solution

23. A hemispherical bowl of radius $R = 0.1m$ is rotating about its own axis (which is verticle) with an angular velocity ω. A particle of mass $10^{-2}kg$ on the smooth inner surface of the bowl is also rotating with the same ω. The particle is at a height h from the bottom of the bowl (a) obtain the relation betweemn h and ω. what is the minimum value of ω needed, in order to have a non-zero value of h ? (b) it is desired to measure g using this set up, by measuring h accurately. assuming that R and Ω are known precisely and least count

in the measurement of h is $10^{-4}m$, what is the minimum possible error Δg in the measured value of g? $\left(g = 10m/s^2\right)$

A. $9.8 \times 10^{-3} m/\sec^2$

B. $-9.8 \times 10^{-3} m/\sec^2$

C. $4.9 \times 10^{-3} m/\sec^2$

D. $5.9 \times 10^{-3} m/\sec^2$

Answer: B

Watch Video Solution

24. Two blocks of mass $m_1 = 10kg$ and $m_2 = 5kg$ connected to each other by a massless inextensible string of length $0.3m$ are placed along a diameter of the turntable. The coefficient of friction between the table and m_1 is 0.5 while there is no friction between m_2 and the table. the table is rotating with an angular velocity of $10rad/s$. about a vertical axis passing through its center O. the masses are placed along the diameter of the table on either side of the center O such that the mass m_1 is at a

distance of $0.124m$ from O. the masses are observed to be at a rest with respect to an observed on the tuntable $\left(g = 9.8m/s^2\right)$.

(a) Calculate the friction on m_1

(b) What should be the minimum angular speed of the turntable so that the masses will slip from this position?

(c) How should the masses be placed with the string remaining taut so that there is no friction on m_1.

A. $28N$

B. $32N$

C. $36N$

D. $40N$

Answer: C

Watch Video Solution

25. Two blocks of mass $m_1 = 10kg$ and $m_2 = 5kg$ connected to each other by a massless inextensible string of length $0.3m$ are placed along a diameter of the turntable. The coefficient of friction between the table

and m_1 is 0.5 while there is no friction between m_2 and the table. the table is rotating with an angular velocity of $10rad/s$. about a vertical axis passing through its center O. the masses are placed along the diameter of the table on either side of the center O such that the mass m_1 is at a distance of $0.124m$ from O. the masses are observed to be at a rest with respect to an observed on the tuntable $\left(g = 9.8m/s^2\right)$.

(a) Calculate the friction on m_1

(b) What should be the minimum angular speed of the turntable so that the masses will

slip from this position?

(c) How should the masses be placed with the string remaining taut so that there is no friction on m_1.

A. $12.82 rad / s$

B. $10.28 rad / s$

C. $13.56 rad / s$

D. $11.67 rad / s$

Answer: D

Watch Video Solution

26. Two blocks of mass $m_1 = 10kg$ and $m_2 = 5kg$ connected to each other by a massless inextensible string of length $0.3m$ are placed along a diameter of the turntable. The coefficient of friction between the table and m_1 is 0.5 while there is no friction between m_2 and the table. the table is rotating with an angular velocity of $10rad/s$. about a vertical axis passing through its center O. the masses are placed along the diameter of the table on either side of the

center O such that the mass m_1 is at a distance of $0.124m$ from O. the masses are observed to be at a rest with respect to an observed on the tuntable $\left(g = 9.8m/s^2\right)$.

(a) Calculate the friction on m_1

(b) What should be the minimum angular speed of the turntable so that the masses will slip from this position?

(c) How should the masses be placed with the string remaining taut so that there is no friction on m_1.

A. $0.2m$

B. $0.3m$

C. $0.4m$

D. $0.5m$

Answer: A

Watch Video Solution

27. What is the radius of curvature of the parabola traced out by the projectile.Projected with a speed $u = \sqrt{30}$ at angle $\theta = 60^\circ$ with the horizontal at a point where the particle

velocity makes an angle $\theta/2$ with the horizontal ?

Watch Video Solution

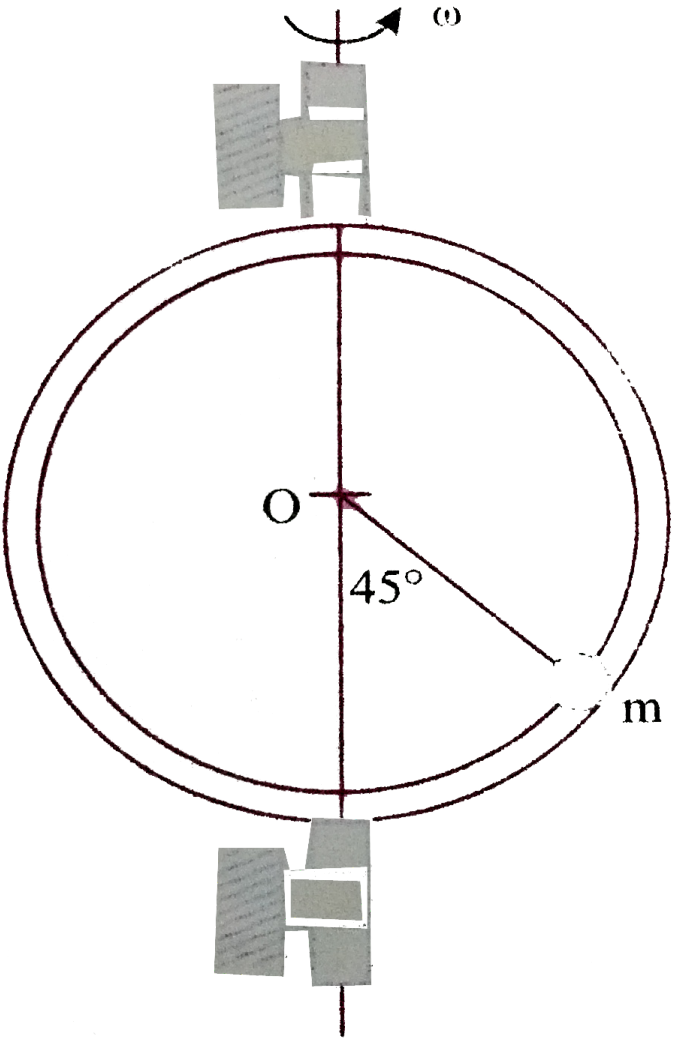
28. An automobile moving with a speed of $10m/s$ enters an unbanked curve of radius $r = 50m$.If $g = 10m/s$, the maximum valve of μ so as to safety negotiate the curve is $1/x$ .Then $x =$

Watch Video Solution

Level Vi

1. A small bead of mass m is carried by a circular hoop having center at O and radius $\sqrt{2}m$ which rotates about a fixed vertical axis. The coefficient of friction between beed and hoop is $\mu = 0.5$. The maximum angular speed of the hoop for which the bead does not have relative motion with respect to hoop.

$(g = 10m/s^2)$



A. $\sqrt{5}$

B. $\sqrt{10}$

C. $\sqrt{15}$

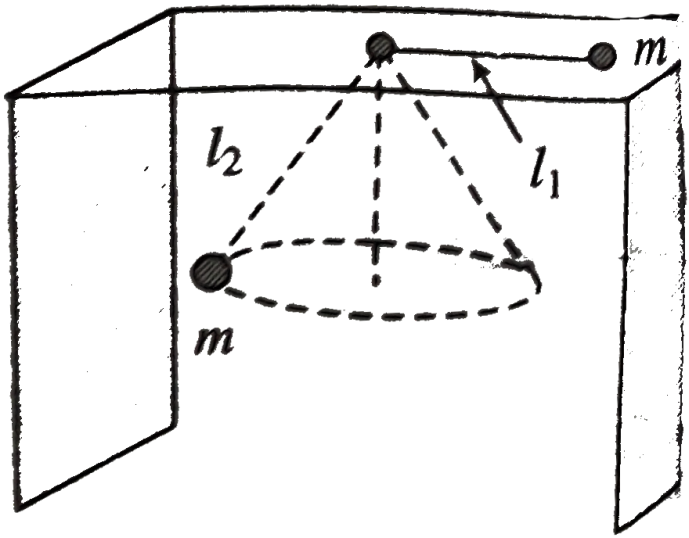
D. $\sqrt{30}$

Answer: D

Watch Video Solution

2. Two identical particles are attached at the end of a light string which passes through a hole at the center of a table One of the partical is made to move in a circle on a table

with angular velocity ω_1 and the ther is made a move is a horizontal ω_2 if $l_1$and l_2 are the length the table , than in order that particle under down the table neither moves down nor move up the ratiol_1 / l_2 is



A. $\frac{\omega_1}{\omega_2}$

B. $\frac{\omega_2}{\omega_1}$

C. $\frac{\omega_1^2}{\omega_2^2}$

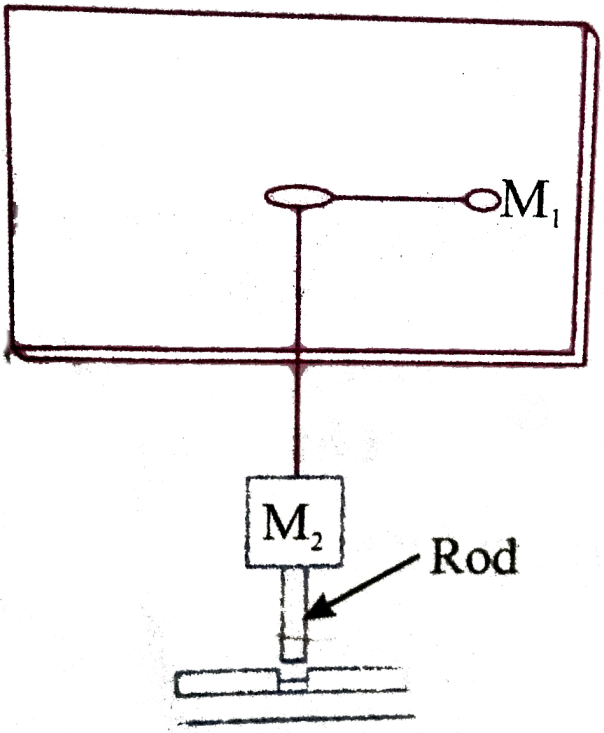
D. $\frac{\omega_2^2}{\omega_1^2}$

Answer: D

Watch Video Solution

3. For the arrangement in the Figure, the particle M_1 attached to one end of string which moves on a horizantal table in a circle of radius $\frac{l}{2}$ (where l is the length of the string)

with constant angular speed ω. The other end of the string attached to to mass M_2 which rest on a vertical rod. When the rod collapse, the acceleration of mass M_2 at that instant



A. g

B. $\frac{\omega^2 l}{2}$

C. $\frac{2M_2 g - M_1 l\omega^2}{2(M_1 + M_2)}$

D. $\frac{M_2 g + M_1 l\omega^2}{M_1 + M_2}$

Answer: C

Watch Video Solution

4. Two particles A and B separated by a distance $2R$ are moving counter clockwise along the same circular path of radius R each with uniform speed v. At time $t = 0$, A is given

a tangential acceleration of magnitude $a = \frac{32v^2}{25\pi R}$ in the same direction of initial velocity

A. The time lapse for the two bodies to collide is $\frac{6\pi R}{5V}$

B. The angle coverd by A is $\frac{9\pi}{4}$

C. Angular velocity of A is $\frac{11V}{5R}$

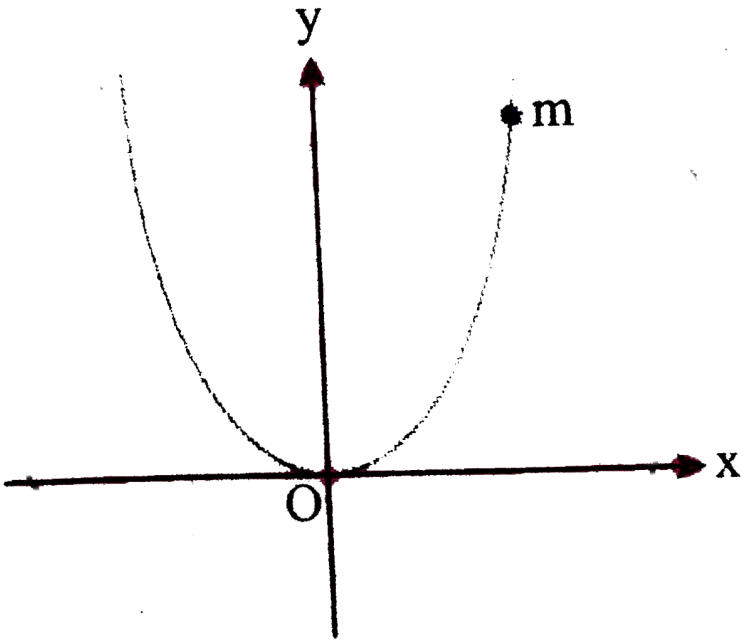
D. Radial acceleration of A is $\frac{289v^2}{5R}$

Answer: B

Watch Video Solution

5. A bead of mass m is located on a parabolic wire with its axis vertical and vertex at the origin as shown in figure and whose equastion is $x^2 = 4ay$. The wire frame is fixed and the bead is released from the point $y = 4a$ on the wire frame from rest. The tangential acceleration of the bead when it reaches the

position given by $y = a$ is



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

B. $\frac{\sqrt{3}g}{2}$

C. $\frac{g}{\sqrt{2}}$

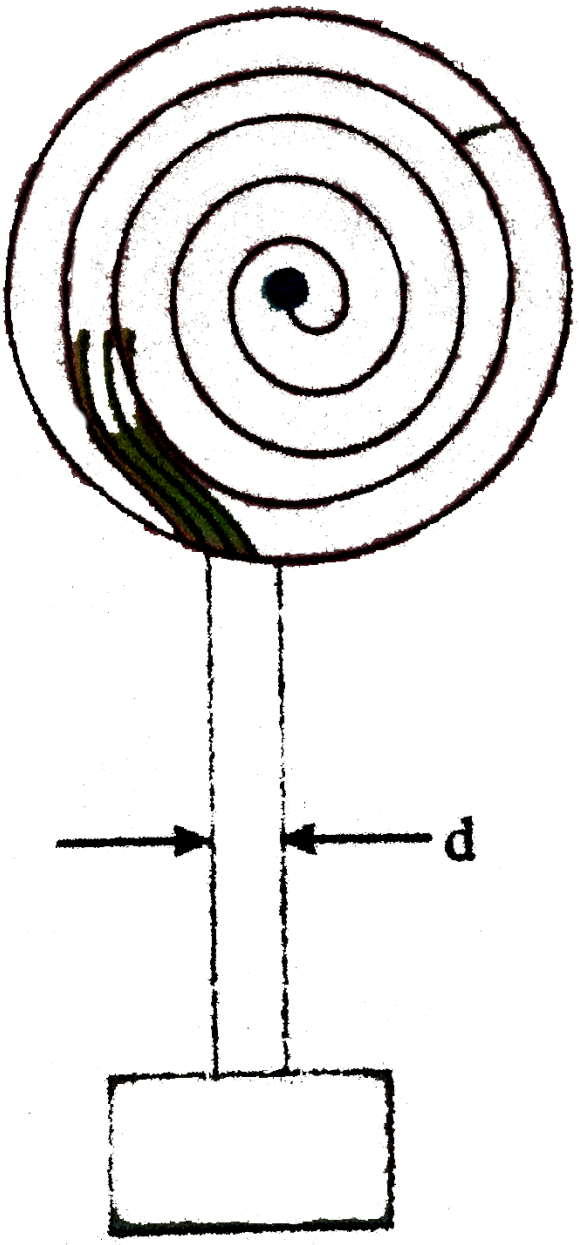
D. g

Answer: C

Watch Video Solution

6. A mass 1kg attached to the end of a flexible rope of diameter $d = 0.25m$is raised vertically by winding the rope on a reel as shown. If the reel is turned uniformly at the rate of $2r.\,p.\,s.$ What is the tension in rope. The inertia of

rope may be neglected.



A. $16.28N$

B. $10N$

C. $20N$

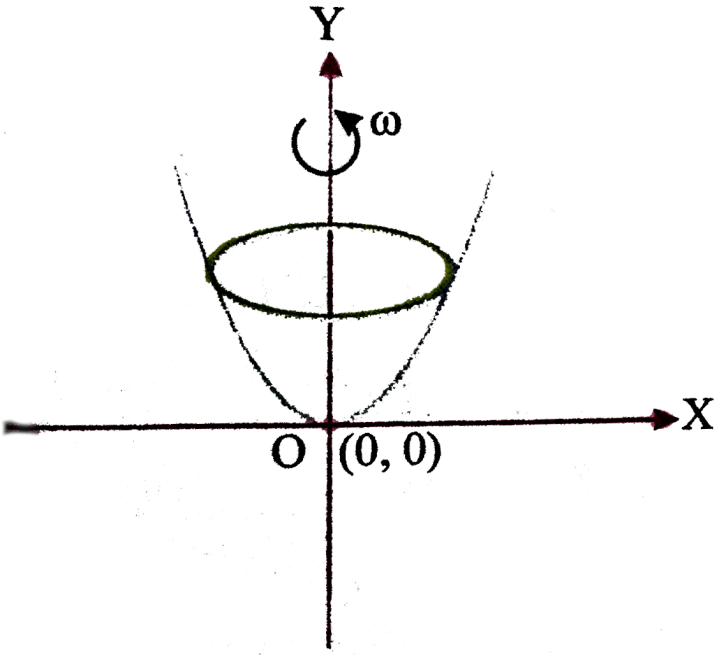
D. $1N$

Answer: A

Watch Video Solution

7. In the given figure, a smooth parabolic wire track lies in the xy-plane (vertical). The shape of track is defined by the equation $y = x^2$. A

ring of mass m which can slide freely on the wire track, is placed at the position $A(1, 1)$. The track is rotated with constant angular speed ω such that there is no relative slipping between the ring and the track. The value of ω is



A. $\sqrt{g/2}$

B. $\sqrt{g}$

C. $\sqrt{2g}$

D. $2\sqrt{g}$

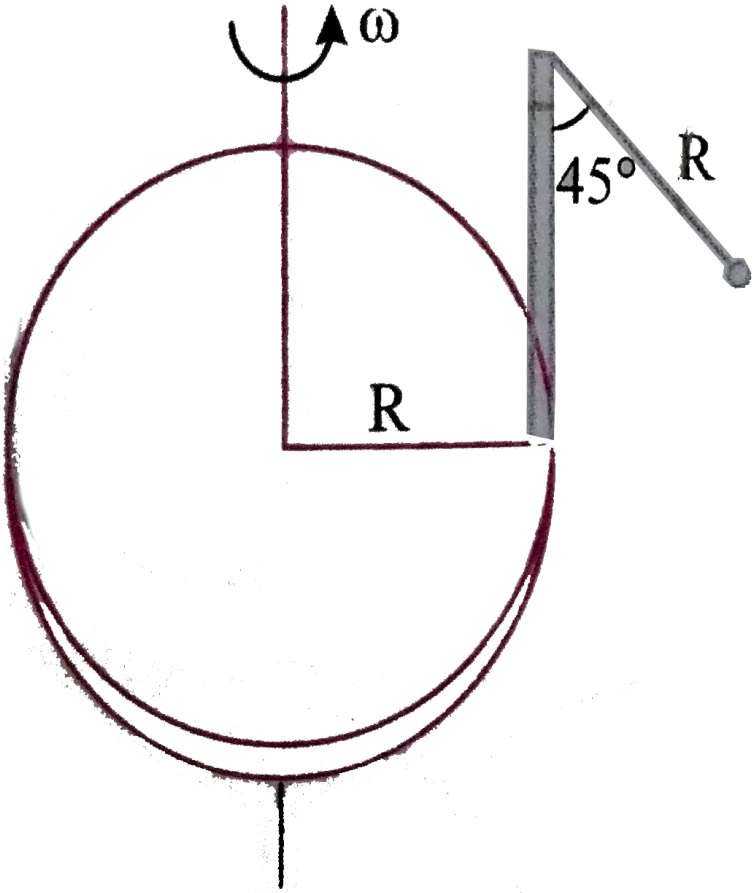
Answer: C

Watch Video Solution

8. A disc of radius R has a light pole fixed perpendicular to the disc at its periphery whish in turn has a pendulum of legth R

attached to its other end as shown in figure. The disc is rotated with a constant angular velocity ω The string is making an angle 45° with the rod. Then the angular velocity ω of

disc is



A. $\left(\frac{\sqrt{3g}}{R}\right)^{1/2}$

B. $\left(\frac{\sqrt{3g}}{2R}\right)^{1/2}$

C. $\left(\frac{g}{\sqrt{3R}}\right)^{1/2}$

D. $\left(\frac{\sqrt{2g}}{\left(\sqrt{2}+1\right)R}\right)^{1/2}$

Answer: D

Watch Video Solution

9. A particle travels along the arc of a circle of radius r. Its speed depends on the distance travelled l as $v = a\sqrt{l}$ where 'a' is a constant.

The angle α between the vectors of net acceleration and the velocity of the particle is

A. $\alpha = \tan^{-1}(2l/r)$

B. $\alpha = \cos^{-1}(2l/r)$

C. $\alpha = \sin^{-1}(2l/r)$

D. $\alpha = \cot^{-1}(2l/r)$

Answer: A

Watch Video Solution

10. A particle is moving in a circle of radius R in such a way that at any instant the normal and tangential components of the acceleration are equal. If its speed at $t = 0$ is u_0 the time taken to complete the first revolution is :

A. R / u_0

B. $\frac{R}{u_0}\left(1 - e^{-2\pi}\right)$

C. $\frac{R}{u_0}\left(1 - e^{2\pi}\right)$

D. $\frac{R}{u_0} e^{-2\pi}$

Answer: C

Watch Video Solution

11. Particle A moves with $4m/s$ along positive $y-$ axis and particle B in a circle $x^2+y^2=4$ (anticlockwise) with constant angular velocity $\omega=2rad/s$. At time $t=0$ particle is at $(2m,0)$. Then

A. magnitude of relative velocity between them at time t is $8\sin t$

B. magnitude of relative velocity between them is maximum at $t = \frac{\pi}{4} s$

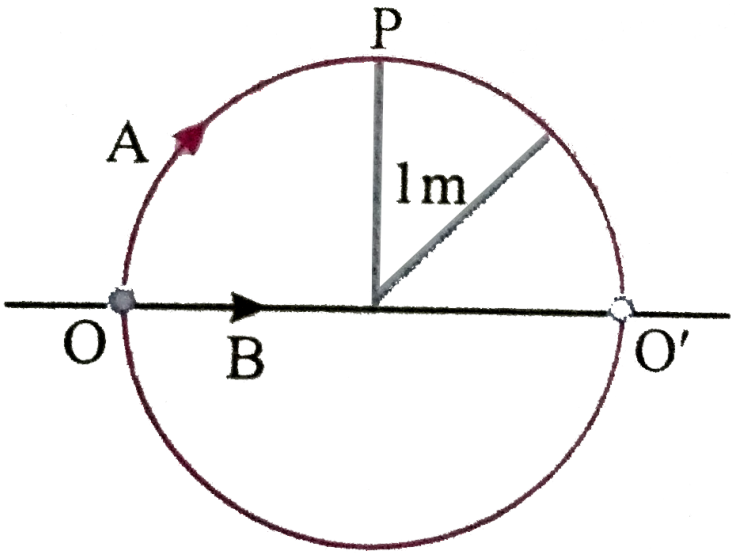
C. magnitude of relative velocity between them is maximum at $t = \frac{\pi}{2} s$

D. magnitude of relative velocity between them at time t is $8 \sin 2t$

Answer: A::C

Watch Video Solution

12. A particle 'A' moves along a circle with a velocity $v = at$, where $a = 0.50m/s^2$. Another particle B moves along a diameter OO' of the circle with the velocity $v = at$. Both the particles start simultaneously at $t = 0$ from the point O on the circle. For these particles, (the radius of circle $= 1m$).



A. The velocity of B relative to A at the instant when A is at the point O' is zero.

B. The velocity of B relative to A when A is at P for the first time is zero.

C. The velocity vector of A with respect to B has zero component along the vector direction OO' at all times.

D. The distances moved by A and B in their respective paths are the same at all

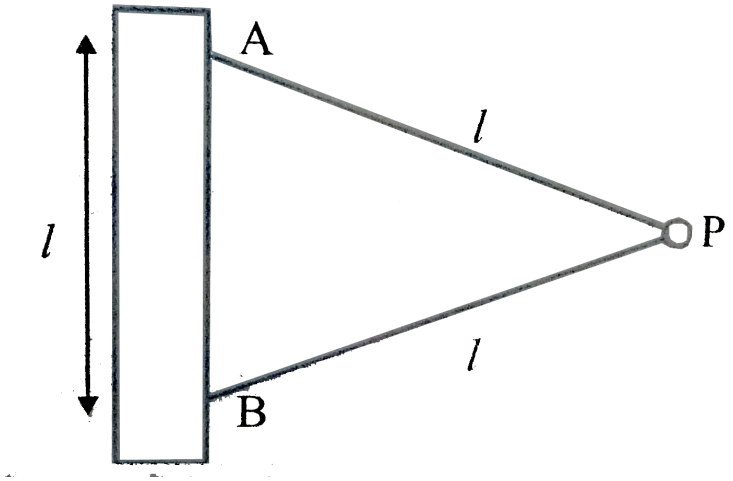
times.

Answer: B::D

Watch Video Solution

13. A particle P of mass m is attached to a vertical axis by two strings AP and BP of legth l each. The separation $AB = l$, rotates around the axis with an angular velocity ω. The

tension in the two string are T_1 and T_2. Then



A. $T_1 = T_2$

B. $T_1 + T_2 = m\omega^2 l$

C. $T_1 - T_2 = 2mg$

D. BP will remains taut only if $\omega \geq \sqrt{2g/l}$

Answer: B::C::D

Watch Video Solution

14. A body moves on a horizontal circular road of radius r, with a tangential acceleration a_t. The coefficient of friction between the body and the road surface Is μ. It begins to slip when its speed is v.

(i) $v^2 = \mu r g$

(ii) $\mu g = \left(\frac{v^4}{r^{92}} \right) + a_t \Bigg)$

(iii) $\mu^2 g^2 = \left(\frac{v^4}{r^2 + a_t^2} \right.$

(iv) The force of friction makes an angle

$\tan^{-1}\left(v^2/a_t r\right)$ with the direction of motion at the point of slipping.

A. $v^2 = \mu r g$

B. $\mu g = \frac{v^2}{r} + a_T$

C. $\mu^2 g^2 = \frac{v^4}{r^2} + a_T^2$

D. The force of friction makes an angle $\tan^{-1}\left(\frac{v^2}{a_T \times r}\right)$ with direction of motion of point of slipping.

Answer: C::D

Watch Video Solution

Level Vi Passage

1. A particle of mass M attached to an inextensible strintg is moving in a vertical circle of radius R.about fixed point O. It is imparted a velocity u in horizontal directional at lowest position as shown in figure.

Following information is being given

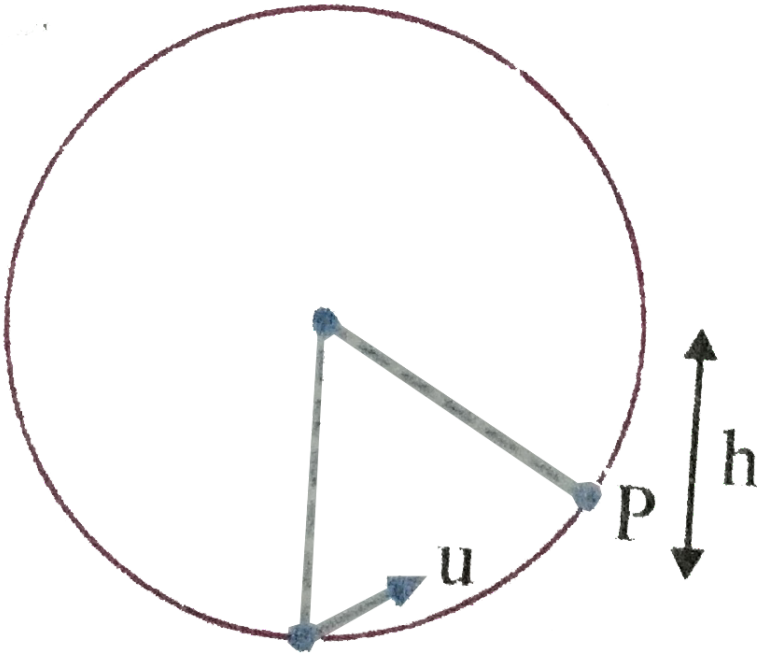
(i) Velocity at a height h can be calculated by using formula $v^2 = u^2 - 2gh$

(ii) Particle will complete the circle if

$u \geq \sqrt{5gR}$

(iii) Particle will oscillates in lower half $(0^\circ < \theta \leq 90^\circ)$ if $0 < u \leq \sqrt{2gR}$

(iv) The magnitude of tension at a height $'h'$ is calculated by using formula $T = \frac{M}{R}\left[u^2 + [gR - 3gh]\right]$



If $R = 2m, M = 2kg$ and $u = 12m/s$. Then value of tension at lowest position is

A. $120N$

B. $164N$

C. $264N$

D. zero

Answer: B

Watch Video Solution

2. A particle of mass M attached to an inextensible strintg is moving in a vertical circle of radius R.about fixed point O. It is imparted a velocity u in horizontal directional at lowest position as shown in figure.

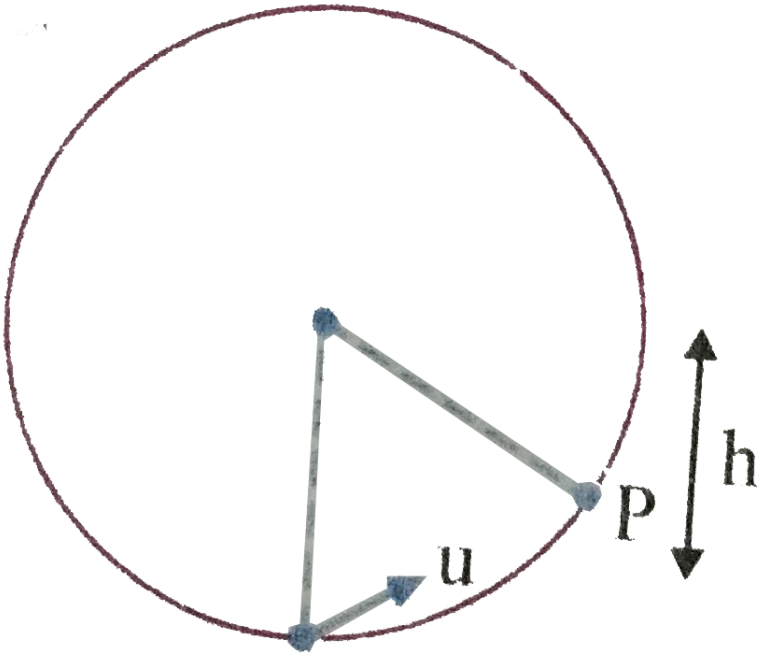
Following information is being given

(i) Velocity at a height h can be calculated by using formula $v^2 = u^2 - 2gh$

(ii) Particle will complete the circle if $u \geq \sqrt{5gR}$

(iii) Particle will oscillates in lower half $(0^\circ < \theta \leq 90^\circ)$ if $0 < u \leq \sqrt{2gR}$

(iv) The magnitude of tension at a height $'h'$ is calculated by using formula $T = \frac{M}{R}\left[u^2 + [gR - 3gh]\right]$



Tension at highest point of its trajectory in above question will be

A. $100N$

B. $44N$

C. $144N$

D. $264N$

Answer: B

Watch Video Solution

3. A particle of mass M attached to an inextensible strintg is moving in a vertical circle of radius R.about fixed point O. It is imparted a velocity u in horizontal directional

at lowest position as shown in figure.

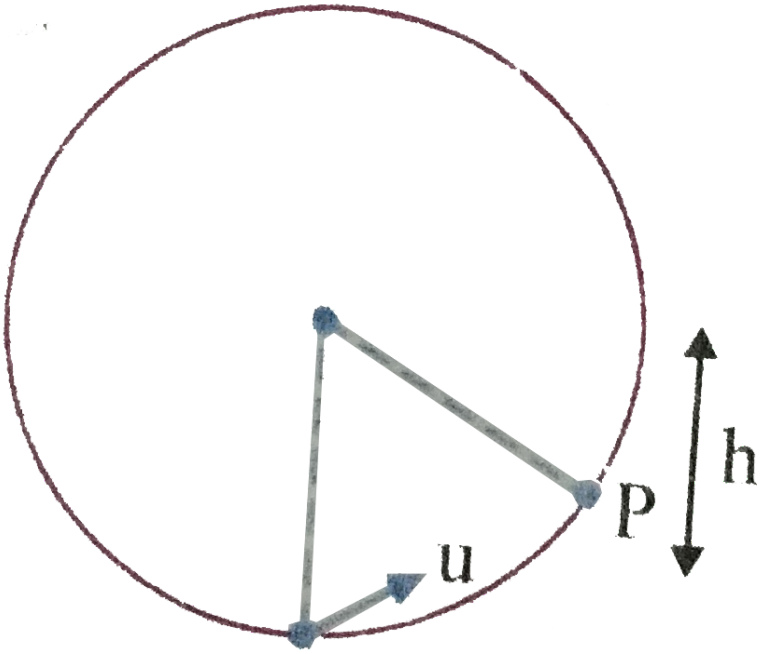
Following information is being given

(i) Velocity at a height h can be calculated by using formula $v^2 = u^2 - 2gh$

(ii) Particle will complete the circle if $u \geq \sqrt{5gR}$

(iii) Particle will oscillates in lower half $(0^\circ < \theta \leq 90^\circ)$ if $0 < u \leq \sqrt{2gR}$

(iv) The magnitude of tension at a height $'h'$ is calculated by using formula $T = \frac{M}{R}\left[u^2 + [gR - 3gh]\right]$



If $M = 2kg, R = 2m$ and $u = 10m/s$. Then velocity of particle when $\theta = 60^\circ$ is

A. $2\sqrt{5}m/s$

B. $4\sqrt{5}m/s$

C. $5\sqrt{2}m/s$

D. $5m/s$

Answer: B

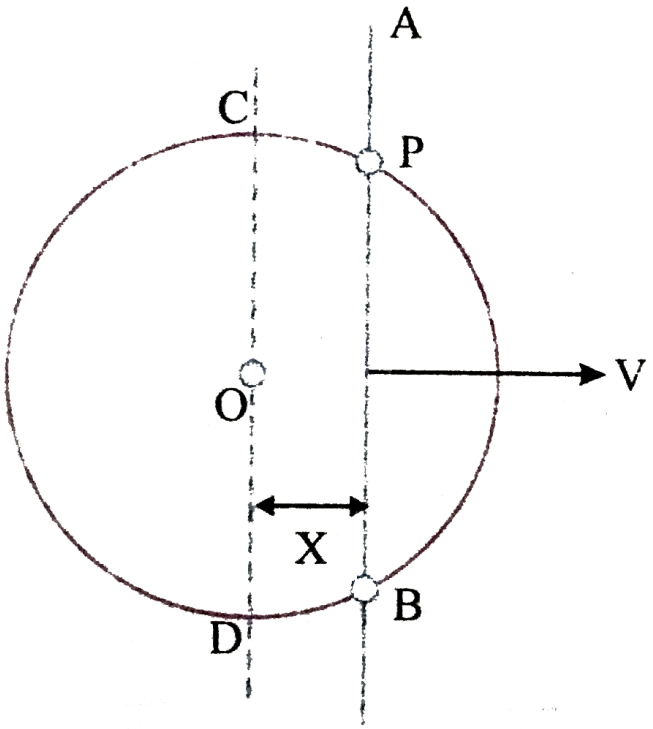
Watch Video Solution

Level Vi Integer

1. A rod AB is moving on a fixed circle of radius $R = 5m$ with constant velocity $v = 4m/s$ as shown in figure. P is the point of intersection of the rod and the circle. At an

instant the rod is at a distance $x = \frac{3R}{5}$ from center of the circle. The velocity of the rodf is perpendicular to its lenght and the rod is always paraller to the diameter (CD)

Speed of point of intersection P is



Watch Video Solution

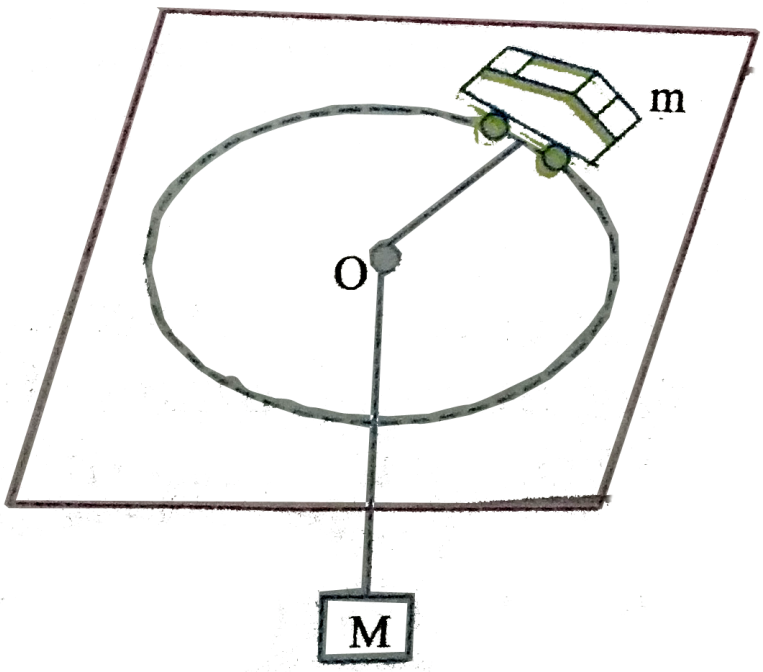
2. In the above problem angular speed of pointof intersection P withrespect to centre is

Watch Video Solution

3. A toy car of mass m can travel at a fixed speed. It moves in circle on a fixed horizantal table. A string is connected to the car and attached to a block os mass M that hangs as shown in figure (the portion of string below

the table is always vertical). The coefficient of friction between the surface of table and tyres of the toy car is μ. Find the ratio of the maximum radius to the minimum radius for which the toy car can move in a circular path with center O on table.

$\left(Given M = 3kg, m = 2kg, \mu = \frac{1}{2} \right)$

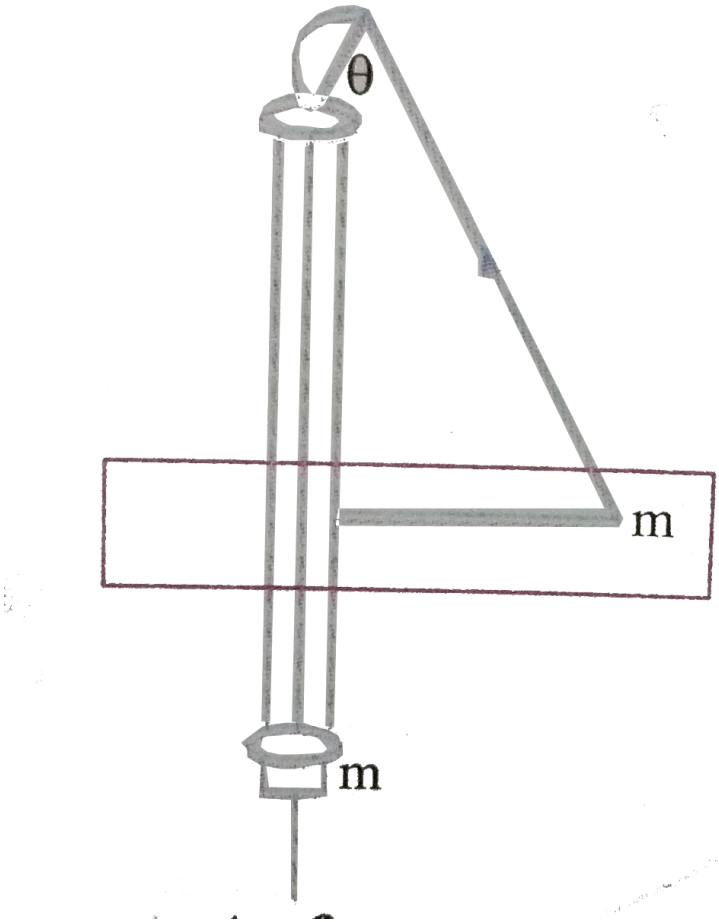


Watch Video Solution

4. A large mass M and a small mass m hang at the two ends of string that passes through a

smooth tube as shown in fig. The mass m moves around in a circular peth which lies in a horizantal plane. The length of the stribng from the mass m to the top of the tube is of length l and θ is the angle this length makes with the vertical, what should be the frequency of rotation of the mass m so that M remains stationary if $M = 16kg, m = 4kg, l = 1m$ and

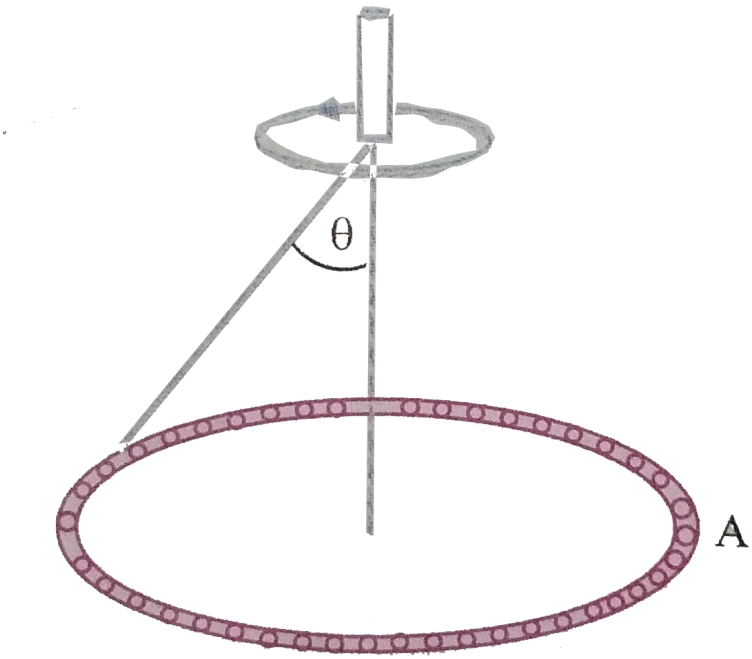
$g = \pi^2 m / s^2$



Watch Video Solution

5. A closed chain A of mass m = 0.36kg is attached to a vertical rotating shaft by means of thread showin in fig. and rotated with a constant angular velocity $\omega = 35 rad/s$. The thread forms an angle $\theta = 45^\circ$ with the

vertical. Then the tension of the thread is



Watch Video Solution

6. A table with smooth horizontal surface is placed in a cabin which moves in a circle of a

large radius R Figure. A smooth pulley of small radius is fastened to the table. Two masses m and 2m placed on te tableare connected through a string going over the pulley. Initially the masses are held by a personwith the strings aslong teh outward radius and then the system is released from rest (with respect to the cabin). Find the magnitude of the initial acceleration of the mases as seen from the

cabin and the tension in the starting.

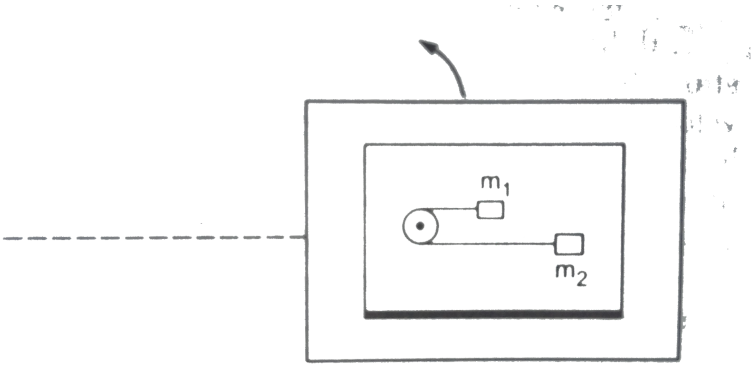


Figure 7-E5

Watch Video Solution

7. A solid body starts rotating about a stationary axis with an angular acceleration $\alpha = \left(2.0 \times 10^{-2}\right) trad/s^2$ here t is in seconds. How soon after the beginning of

rotation will the total acceleration vector of an arbitrary point of the body form an angle $\theta = 60^\circ$ with its velocity vector?

Watch Video Solution

Iit Ques

1. A car is moving in a circular horizonta track of radius 10m with a constant speed of 10 m/s. A pendulum bob is suspended from the roof

of the cat by a light rigid rod of length 1.00m.

The angle made by the rod with track is

A. zero

B. 30°

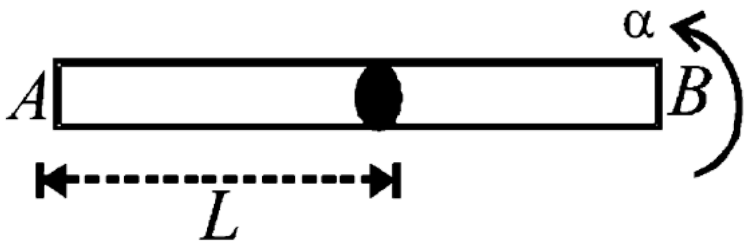
C. 45°

D. 60°

Answer: C

Watch Video Solution

2. A long horizontal rod has a bead which can slide along its length and initially placed at a



distance L from one end A of the rod. The rod is set in angular motion about A with constant angular acceleration α. if the coefficient of friction between the rod and the bead is μ,

and gravity is neglected, then the time after which the bead starts slipping is

A. $\sqrt{\frac{\mu}{\alpha}}$

B. $\frac{\mu}{\sqrt{\alpha}}$

C. $\frac{1}{\sqrt{\mu\alpha}}$

D. infinitesimal

Answer: A

Watch Video Solution

3. A piece of wire is bent in the shape of a parabola $y = Kx^2$ (y - axis vorical) with a bead of mass m on it . The beat can side on the wire without friction , it stays the wire is now accleated parallel to the bead , where the bead can stay at rest with repect to the wire from the y - axis is

A. $\frac{a}{gk}$

B. $\frac{a}{2gk}$

C. $\frac{2a}{gk}$

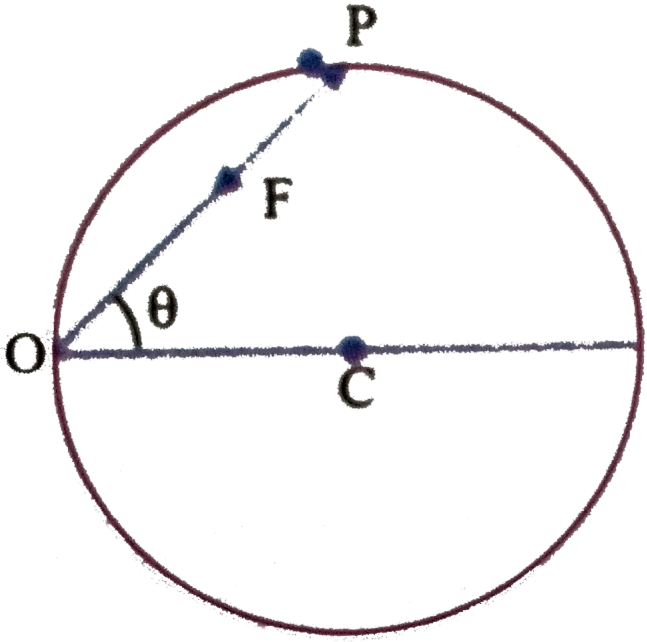
D. $\frac{a}{4gk}$

Answer: B

Watch Video Solution

4. A particle $'P'$ is moving on a circular under the action of only one force action always toward the fixed point $'O'$ on the circumference. Find the ratio of $\frac{d^2\theta}{dt^2}$ &

$\left(\frac{d\theta}{dt}\right)^2$



A. $2\tan\theta$

B. $\tan\theta$

C. $\frac{\tan\theta}{2}$

D. $\frac{\tan\theta}{3}$

Answer: A

Watch Video Solution

Level I H W

1. A horizontal force $''F''$ produces an acceleration of $6m/s^2$ on a block resting on a smooth horizontal surface. The same force produces an acceleration of $3m/s^2$ on a second block resting on a smooth horizontal surface. If the two blocks are tied together and

the same force acts, the acceleration produced will be

A. $9m/s^2$

B. $2m/s^2$

C. $4m/s^2$

D. $1/2m/s^2$

Answer: B

Watch Video Solution

2. A $0.2kg$ object at rest is subjected to a force $\left(0.3\hat{i} - 0.4\hat{j}\right)N$. What is its velocity vector after $6\,\sec$

A. $\left(9\hat{i} - 12\hat{j}\right)$

B. $\left(8\hat{i} - 16\hat{j}\right)$

C. $\left(12\hat{i} - 9\hat{j}\right)$

D. $\left(16\hat{i} - 8\hat{j}\right)$

Answer: A

Watch Video Solution

3. A body of mass $2kg$ is moving with a velocity of $\overrightarrow{u} = 3\hat{i} + 4\hat{j}m/s$.A steady force $\overrightarrow{F} = \hat{i} - 2\hat{j}N$ begins to act on it. After four second, the body will be moving along.

A. X-axis with a velocity of $2m/s$

B. Y-axis with a velocity of $5m/s$

C. X-axis with a velocity of $5m/s$

D. Y-axis with a velocity of $2m/s$

Answer: C

Watch Video Solution

4. Three forces $\overrightarrow{F}_1, \overrightarrow{F}_2$ and $\overrightarrow{F}_3$ are simultaneously acting on a particle of mass $'m'$ and keep it in equlibrium. If $\overrightarrow{F}_1$ force is reversed in direction only, the acceleration of the particle will be.

A. $\overline{F}_1/m$

B. $2\overline{F}_1/m$

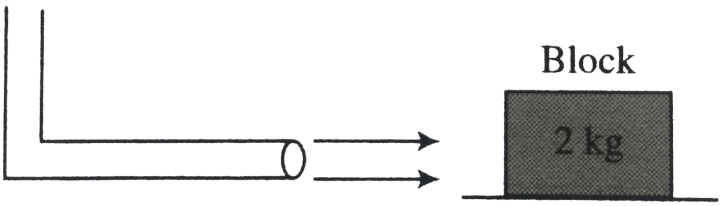
C. $-\overline{F}_1/m$

D. $-2\overline{F}_1/m$

Answer: D

Watch Video Solution

5. A block of metal weighing 2kg is resting on a frictionless plane. It is struck by a jet releasing water at a rate of $1kgs^{-1}$ and at a speed of $5ms^{-1}$. The initial acceleration of the block is



A. $2.5m/s^2$

B. $5m / s^2$

C. $10m / s^2$

D. $20m / s^2$

Answer: A

Watch Video Solution

6. A body of mass $2kg$ moving on a horizantal surface with an initial velocity of comes to rest after 2 second. If one wants to keep this body

moving on the same surface with a velocity of $4ms^{-1}$ the force required is

A. zero

B. $2N$

C. $4N$

D. $8N$

Answer: C

Watch Video Solution

7. Ten one-rupee coins are put on top of each other on a table. Each coin has a mass m . Give the magnitude and direction of

(a) the force on the 7^{th} coin (counted from the bottom due to all the coins on its top .

(b) the force on the 7^{th} coin by the eigth coin.

(c) the reaction of the 6^{th} coin one th 7^{th} coin

.

A. $0.3N$ downwards

B. $0.3N$ upwards

C. $0.7N$ downwards

D. $0.7N$ upwards

Answer: A

Watch Video Solution

8. A body of mass m collides against a wall with the velocity v and rebounds with the same speed. Its magnitude of change of momentum is

A. $2\mathrm{mu}$ towards the wall

B. $2\mathrm{mu}$ away from the wall

C. zero

D. mu away from the wall

Answer: B

Watch Video Solution

9. Bullets of $0.03kg$ mass each hit a plate at the rate of 200 bullets per second with a velocity of $50m/s$ and reflect back with a

velocity of $30m/s$. The average force acting on the plate in newton is

A. 120

B. 180

C. 300

D. 480

Answer: B

Watch Video Solution

10. A vehicle of mass $10kg$ is moving with a velocity of $5ms^{-1}$. To stop it in $1/10$ sec the required force in opposite direction is

A. $500N$

B. $5000N$

C. $50N$

D. $1000N$

Answer: A

Watch Video Solution

11. An impules is supplied to a moving object with the force at an angle 120° with the velocity vector. The angle between the impulse vector and the change in momentum vector is

A. 120°

B. 0°

C. 60°

D. 240°

Answer: B

Watch Video Solution

12. A $20kg$ body is pushed with a force of $7N$ for $1.5\,\text{sec}$ then with a force of $5N$ for $1.7\,\text{sec}$ and finally with the force of $10N$ for $3\,\text{sec}$, the total impulse applied to the body and change in velocity will be

A. $49Ns,\ 12.5ms^{-1}$

B. $49Ns,\ 2.45ms^{-1}$

C. $98Ns,\ 4.9ms^{-1}$

D. $4.9Ns,\ 2.45ms^{-1}$

Answer: B

Watch Video Solution

13. A body is acted on by a force given by $F = (10 + 2t)N$. The impulse received by by the body during the first four second is

A. $40Ns$

B. $56Ns$

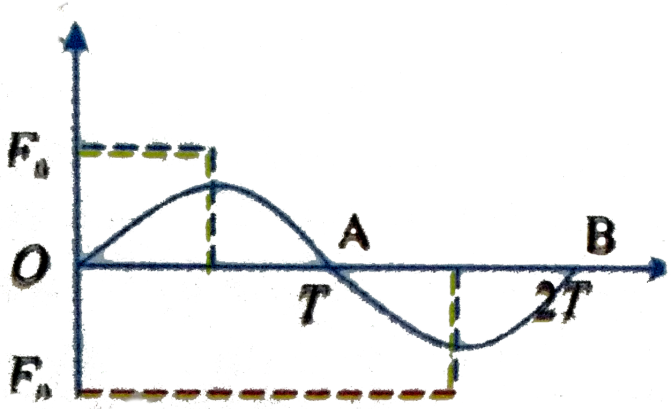
C. $72Ns$

D. $32Ns$

Answer: B

Watch Video Solution

14. A unidirectional force F varying with time t as shown in the Fig. acts on a body initially at rest for a short duration $2T$. Then the velocity acquired by the body is



A. $\frac{\pi F_0 T}{4m}$

B. $\frac{\pi F_0 T}{2m}$

C. $\frac{F_0 T}{4m}$

D. zero

Answer: D

Watch Video Solution

15. If the average velocityof a body moving with uniform acceleration under the action of a force is $''v''$ and the impulse it receives

during a displacement of ''s'' is ''I'', the constant force acting on the body is giving by

A. $\frac{I \times v}{2s}$

B. $\frac{2I \times v}{s}$

C. $\frac{I \times v}{s}$

D. $\frac{I \times s}{v}$

Answer: C

Watch Video Solution

16. A $6.0kg$ object is suspended by a vertical string from the ceilling of an elevator which is acceleration upward at a rate of $2.2ms^{-2}$. the tension in the string is

A. $11N$

B. $72N$

C. $48N$

D. $59N$

Answer: B

Watch Video Solution

Watch Video Solution

17. A young man of mass $60kg$ stands on the floor of a lift which is acceleration downwards at $1m/s^2$ then the reaction of the floor of the lift on the man is (Take $g = 9.8m/s^2$)

A. $528N$

B. $540N$

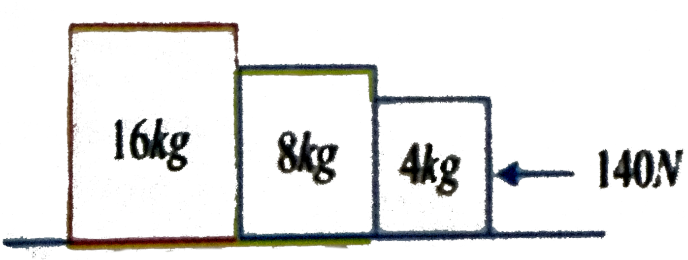
C. $546N$

D. none

Answer: A

Watch Video Solution

18. Three masses of $16kg, 8kg$ and $4kg$ are placed in contact as shown in Figure. If a force of $140N$ is applied on $4kg$ mass, then the force on $16kg$ will be



A. $140N$

B. $120N$

C. $100N$

D. $80N$

Answer: D

Watch Video Solution

19. A block of mass M is pulled along a horizontal frictionless surface by a rope of mass m . Force P is applied at one end of rope.

The force which the rope exerts on the block is:

A. $\frac{Pm}{(M+m)}$

B. $\frac{PM}{(M+m)}$

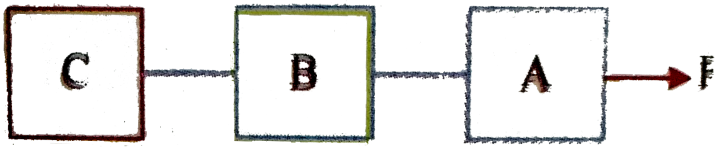
C. $Pm(M+m)$

D. $\frac{P}{(M-m)}$

Answer: B

Watch Video Solution

20. Three equal masses A, B and C are pulled with a constant force F. They are connected to each other with strings. The ratio of the tension between AB and BC is



A. $1:2$

B. $2:1$

C. $3:1$

D. $1:1$

Answer: B

Watch Video Solution

21. A coin is dropped in a lift. It takes time t_1 to reach the floor when lift is stationary. It takes time t_2 when lift is moving up with costant acceleration. Then

A. $t_1 > t_2$

B. $t_2 > t_1$

C. $t_1 = t_2$

D. $t_1 \geq t_2$

Answer: A

Watch Video Solution

22. A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 (vertically). If the acceleration of the system is $g/8$, then the ratio of the masses is

A. $8:1$

B. $4:3$

C. $5:3$

D. $9:7$

Answer: D

Watch Video Solution

23. A pendulum bob is hanging from the roof of an elevator with the help of a light string. When the elevator moves up with uniform acceleration $'a'$ the tension in the string is T_1

. When the elevator moves down with the same acceleration, the tension in the string is T_2. If the elevator were stationary, the tension in the string would be

A. $\frac{T_1 + T_2}{2}$

B. $\sqrt{T_1 + T_2}$

C. $\frac{T_1 T_2}{T_1 + T_2}$

D. $\frac{2T_1 T_2}{T_1 + T_2}$

Answer: A

Watch Video Solution

24. Three block of masses $m_1 = 10kg, m_2 = 20kg$ and $m_3 = 30kg$ are on a smooth horizontal table ,connected to each other by light horizontal string. A horizontal placed force $F = 60N$ is applied to m_3, towards right find

(a) tensionT_1 and T_2 and

(b) tensionT_2 if all of a sudden the string between m_1 and m_2 snaps.

A. $10N, 10N$

B. $30N, 10N$

C. $10N, 30N$

D. $30N, 30N$

Answer: C

Watch Video Solution

25. A bullet of mass $50g$ is fired from a gun of mass $6kg$ with a velocity of $400m/s$. Calculate the recoil velocity of the gun.

A. $0.25m/s$

B. $25m/s$

C. $2.5m/s$

D. $250m/s$

Answer: A

Watch Video Solution

26. A space craft of mass $2000kg$ moving with a velocity of $600m/s$ suddenly explodes into two pieces. One piece of mass $500kg$ is left

stationary. The velocity of the other part must be (in m/s)

A. 600

B. 800

C. 1500

D. 1000

Answer: B

Watch Video Solution

27. A person weighing $60kg$ In a small boat of mass $140kg$ which is at rest, throws a $5kg$ stone in the horizontal direction with a velocity of $14m/s^{-1}$. The velocity of the boat immediately after the throw is (in m/s)

A. 1.2

B. 0.5

C. 0.35

D. 0.65

Answer: C

Watch Video Solution

28. A body of mass 40kg resting on a rough horizontal surface is subjected to a force P which is just enough to start the motion of the body. If $\mu_s = 0.5\mu_k = 0.4, g = 10ms^{-2}$ an dthe force P is continuously applied on the body, then the accceleration of the body is.

A. 0.98

B. 3.92

C. 4.90

D. Zero

Answer: A

Watch Video Solution

29. What is the angle of friction between two surfaces in contact , if coefficient of friction is $1/\sqrt{3}$?

A. 30°

B. 60°

C. 45°

D. 37°

Answer: B

Watch Video Solution

30. The coefficient of friction between the ground and the wheels of a car between the ground and the wheels of acar moving on a horizontal road is 0.5 If the car starts from rest , what is the minimum distance in which it

can acquire a speed of $72km/h$? take $g = 10ms^{-2}$.

A. $0m$

B. $20m$

C. $30m$

D. $40m$

Answer: D

Watch Video Solution

31. An eraser weighing $2N$ is pressed against the black board with a force of $5N$. The coefficient of friction is 0.4. How much force parallel to the black board is required to slide the eraser upwards

A. $2N$

B. $2.8N$

C. $4N$

D. $4.8N$

Answer: C

Watch Video Solution

32. A marble block of mass 2 kg lying on ice when given a velocity of $6m/s$ is stopped by friction in 10s. Then the coefficient of friction is

A. 0.02

B. 0.03

C. 0.06

D. 0.01

Answer: C

Watch Video Solution

33. A block of weight $100N$ is pushed by a force F on a horizontal rough plane moving with an acceleration $1m/s^2$ when force is doubled its acceleration becomes $10m/s^2$. The coefficient of friction is $\left(10m/s^{-2}\right)$

A. 0.4

B. 0.6

C. 0.5

D. 0.8

Answer: D

Watch Video Solution

34. A block of mass $5kg$ is lying on a rough horizontal surface. The coefficient of static and Kinetic friction are $0.3 \text{ and } 0.1$ and $g = 10m/s^{-2}$ If a horizontal force of $50N$ is applied on the block, the frictional force is

A. $25N$

B. $5N$

C. $10N$

D. Zero

Answer: B

 Watch Video Solution

35. A heavy uniform chain lies on horizantal table top. If the coefficient of friction between the chain and the table surface is 0.5, the

maximum percentage of the length of the chain that can hang over one edge of the table is

A. 20%

B. 33.3%

C. 76%

D. 50%

Answer: B

Watch Video Solution

36. A body is sliding down an inclined plane forming an angle 30° with the horizantal. If the coefficient of friction is0.3 then acceleration of the body is

A. $1.25.\ ms^{-2}$

B. $2.35ms^{-2}$

C. $3.4ms^{-2}$

D. $4.9ms^{-2}$

Answer: B

Watch Video Solution

37. In the above problem its velocity after 3 seconds in ms^{-1} is

A. 7.05

B. 14.7

C. 29.4

D. zero

Answer: A

Watch Video Solution

38. In the above problem its displacement after 3 seconds is

A. $78.4m$

B. $44.15m$

C. $10.57m$

D. Zero

Answer: C

Watch Video Solution

39. A block sliding down on a rough 45° inclined planes has half the velocity it would have been, the inclined plane is smooth. The coefficient of sliding friction between the the block and the inclined plane is

A. $\frac{1}{4}$

B. $\frac{3}{4}$

C. $\frac{1}{2\sqrt{2}}$

D. $\frac{1}{\sqrt{2}}$

Answer: B

Watch Video Solution

40. A body of mass $10kg$ is lying on a rough inclined plane of inclination 37° and $\mu = 1/2$, the minimum force required to pull the body up the plane is

A. $5.4N$

B. $10.8N$

C. $2.7N$

D. $18N$

Answer: B

Watch Video Solution

41. A body moves along a circular path of radius $5m$. The coefficient of friction between the surface of the path and the body is 0.5. The angular velocity in rad/s with which the body should move so that it does not leave the path is $(g - 10m/s^{-2})$

A. 4

B. 3

C. 2

D. 1

Answer: D

Watch Video Solution

42. A van is moving with a speed of $72Kmph$ on a level road, where the coefficient of friction between tyres and road is 0.5. The

minimum radius of curvature, the road must have, for safe driving of van is

A. $80m$

B. $40m$

C. $20m$

D. $4m$

Answer: A

Watch Video Solution

43. A van is moving with a speed of $72Kmph$ on a level road, where the coefficient of friction between tyres and road is 0.5. The minimum radius of curvature, the road must have, for safe driving of van is

A. $10m$

B. $20m$

C. $5m$

D. $15m$

Answer: B

Watch Video Solution

Level Ii H W

1. A ball of mass 0.2 kg is thrown vertically upwards by applying a force by hand. If the hand moves 0.2 m while applying the force and the ball goes upto 2 m height further, find the magnitude of the force. (Consider $g = 10m/s^2$).

A. $20N$

B. $220N$

C. $4N$

D. $16N$

Answer: B

 Watch Video Solution

2. A body of mass $3kg$ is moving alone a straight line with a velocity of $24ms^{-1}$.When it is at a point P a force of $9N$ acts on the

body in a direction opposite to its motion.The time after which it will be at P again is.

A. $8s$

B. $16s$

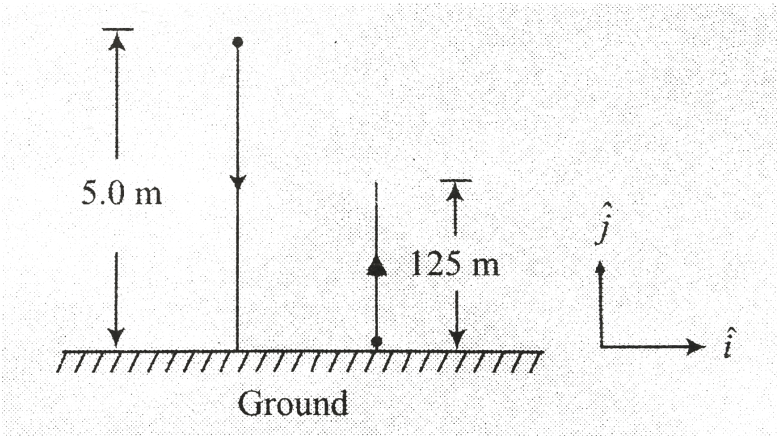
C. $12s$

D. $24s$

Answer: B

Watch Video Solution

3. A rubber ball of mass 50 g falls from a height of 5m and rebounds to a height of 1.25 m. Find the impulse and the average force between the ball and the ground if the time for which they are in contact was $0.1s$



A. $0.5N$

B. $1.5N$

C. $0.15N$

D. $2.5N$

Answer: B

Watch Video Solution

4. A stream of water flowing horizontally with a speed of $15ms^{-1}$ pushes out of a tube of cross sectional area $10^{-2}m^2$ and hits a vertical wall near by what is the force exerted on the wall by the impact of water

assuming.that it does not rebound? (Density of water $= 1000 kgm^3$)

A. $1250N$

B. $2250N$

C. $4500N$

D. $2550N$

Answer: B

Watch Video Solution

5. What is the magnitude of the total force on a driver by the racing car he operates as it accelerates horizontally along a straight line from rest to $60m/s$ in $8.0s$ (mass of the driver $= 80kg$)

A. $0.06KN$

B. $0.78KN$

C. $1.0KN$

D. $1.4KN$

Answer: C

Watch Video Solution

6. A base ball of mass $150gm$ travelling at speed of $20m/s$ is caught by a fielder and brought to rest in $0.04s$.The force applied to the ball and the distance over which this force acts are respectively

A. $75N, 0.8m$

B. $37.5N, 0.4m$

C. $75N, 0.4m$

D. $37.5N, 0.8m$

Answer: C

Watch Video Solution

7. A dynamometer D is attached to two blocks of masses $6kg$ and $4kg$.Forces of $20N$ and $10N$ are applied on the blocks as shown in Fig. The dynamometer reads

A. $10N$

B. $20N$

C. $6N$

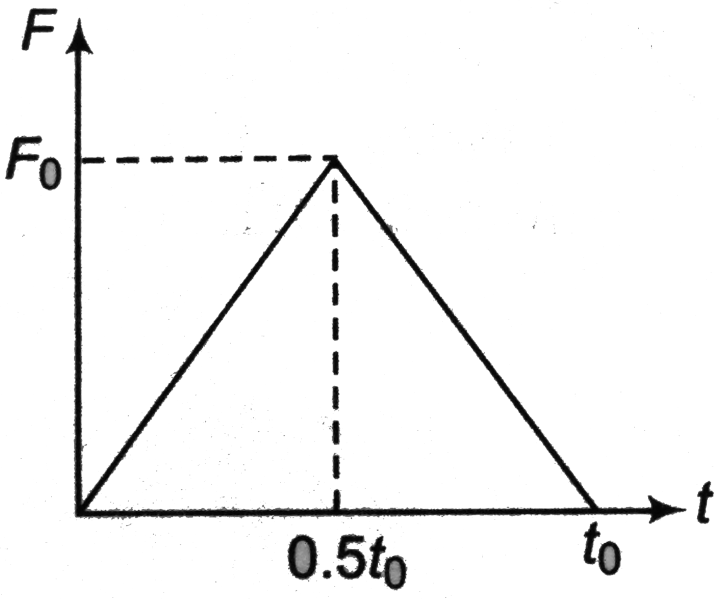
D. $14N$

Answer: D

View Text Solution

8. A particle of mass m moving with velocity u makes an elastic one-dimentional collision with a stationary particle of mass m. They come in contact for a very small time t_0. Their

force of interaction increases from zero to F_0 linearly in time $0.5t_0$, and decreases linearly to zero in further time $0.5t_0$ as shown in figure. The magnitude of F_0 is



A. $\frac{\mathrm{mu}}{T}$

B. $\frac{2\mathrm{mu}}{T}$

C. $\frac{mu}{2T}$

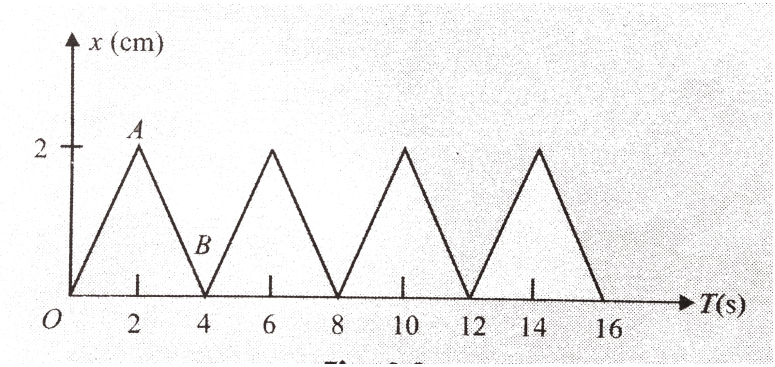
D. $\frac{3mu}{2T}$

Answer: B

Watch Video Solution

9. Figure shows the position-time graph of a particle of mass $0.04kg$. Suggest a suitable physical context for this motion. What is the time between two consecutive impulses received by the particle? What is the

magnitude of each impluse?



A. $4\,\text{sec}, 4 \times 10^{-4} kgm/s$

B. $2\,\text{sec}, 8 \times 10^{-4} kgm/s$

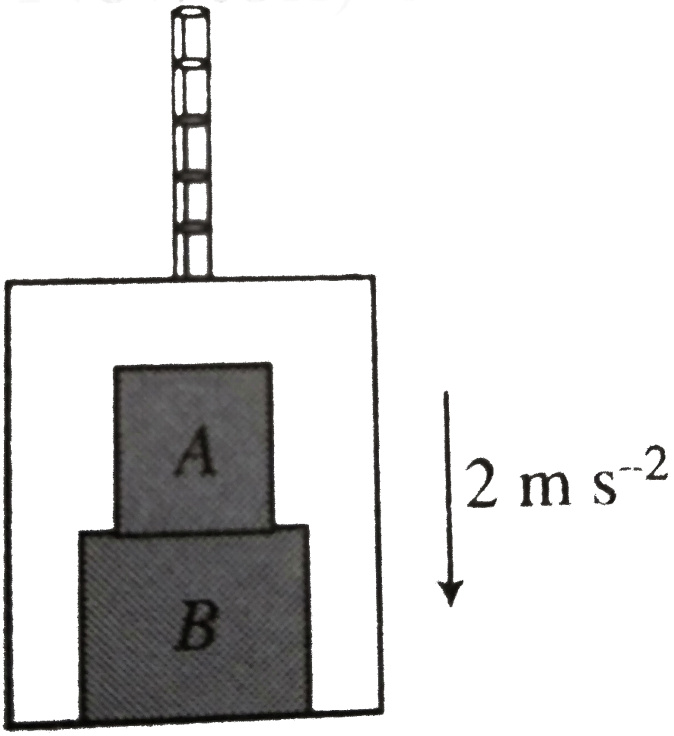
C. $6\,\text{sec}, 4 \times 10^{-4} kgm/s$

D. $8\,\text{sec}, 8 \times 10^{-4} kgm/s$

Answer: B

Watch Video Solution

10. The elevator shown in fig. is descending with an acceleration of $2ms^{-2}$. The mass of the block $A = 0.5kg$. Find the force (in Newton) exerted by block A on block B.



A. $2N$

B. $4N$

C. $6N$

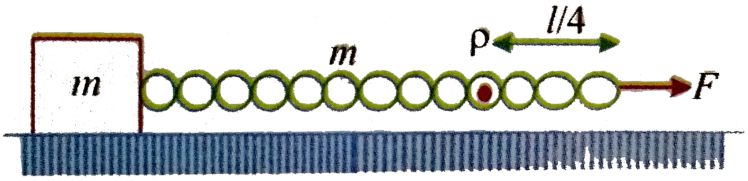
D. $8N$

Answer: B

Watch Video Solution

11. A block of mass m is pulled by a uniform chain of mass m tied to it by applying a force F at the other end of the chain.The tension at

a point P which is at a distance of quarter of the length of the chain from the free end,will be



A. $\frac{3F}{4}$

B. $\frac{7F}{8}$

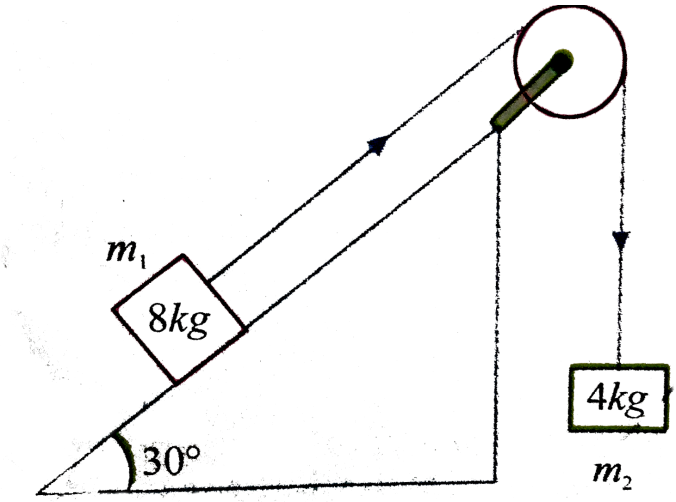
C. $\frac{6F}{7}$

D. $\frac{4F}{5}$

Answer: B

Watch Video Solution

12. Two masses of $8kg$ and $4kg$ are connected by a string as shown in figure over a frictionless pulley.The acceleration of the system is



A. $4m/s^2$

B. $2m / s^2$

C. zero

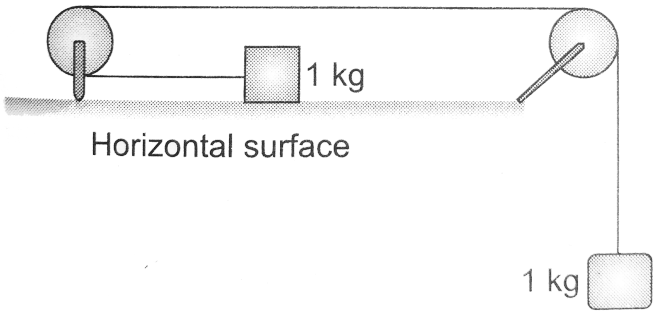
D. $9.8m / s^2$

Answer: C

Watch Video Solution

13. Consider the system as shown in the figure. The pulley and the string are light and all the surfaces are frictionless. The tension in the

string is $\left(g = 10m/s^2\right)$.



A. $0N$

B. $1N$

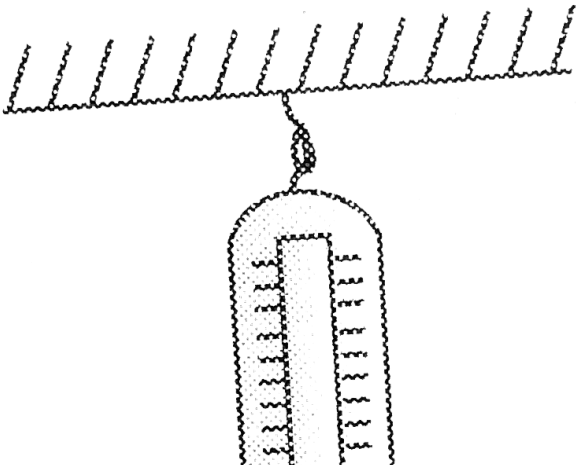
C. $2N$

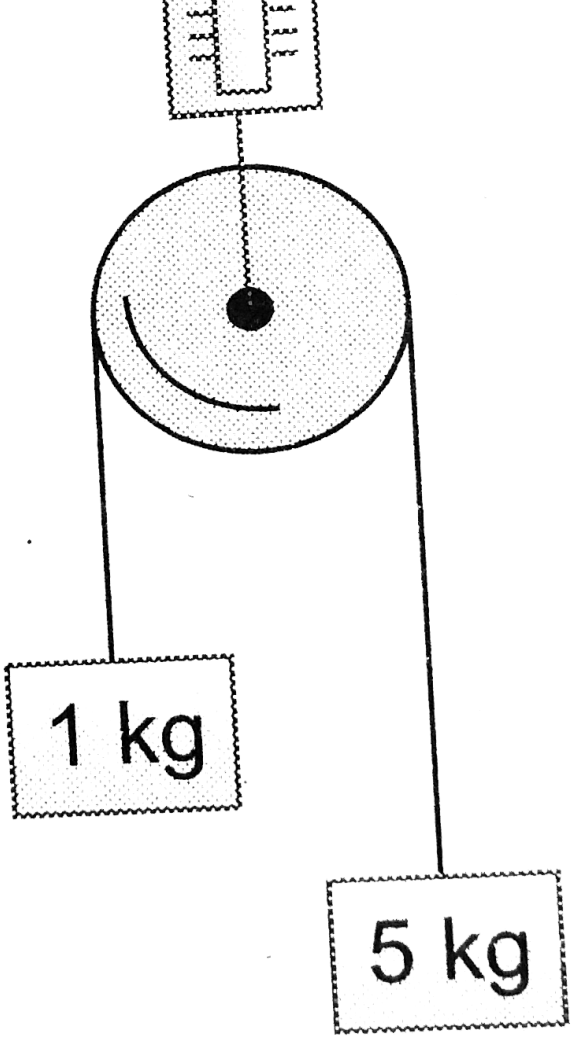
D. $5N$

Answer: D

Watch Video Solution

14. Two masses of 1kg and 5kg are attached to the ends of a massless string passing over a pulley of negligible weight. The pulley itself is attached to a light spring balance as shown in figure. The masses start moving during this interval, the reading of spring balance will be:





A. $6kg$

B. less than $6kg$

C. more than $6kg$

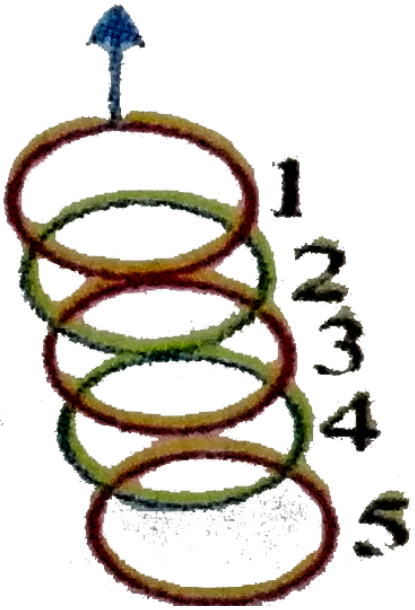
D. may be more or less than $6kg$

Answer: B

Watch Video Solution

15. A chain consisting of 5 links each of mass d $0.1kg$ is lifted vertically up with a constant acceleration of $2.5m/s^2$.The force of interaction between $1st$ and $2nd$ links as

shown



A. $6.15N$

B. $4.92N$

C. $9.84N$

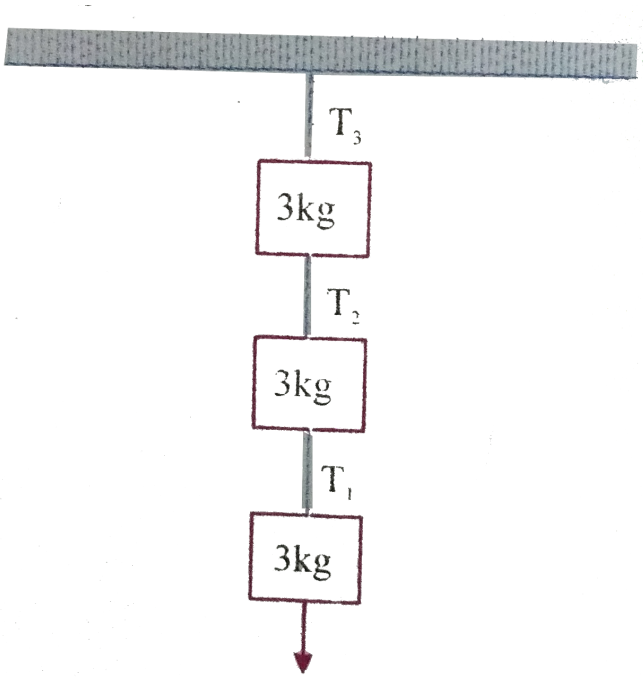
D. $2.46N$

Answer: B

Watch Video Solution

16. Three blocks of equal masses (each $3kg$) are suspended by weightless strings as shown. If applied force is $100N$,then T_1 is equal to

$(g = 10m/s^2)$



A. $130N$

B. $190N$

C. $100N$

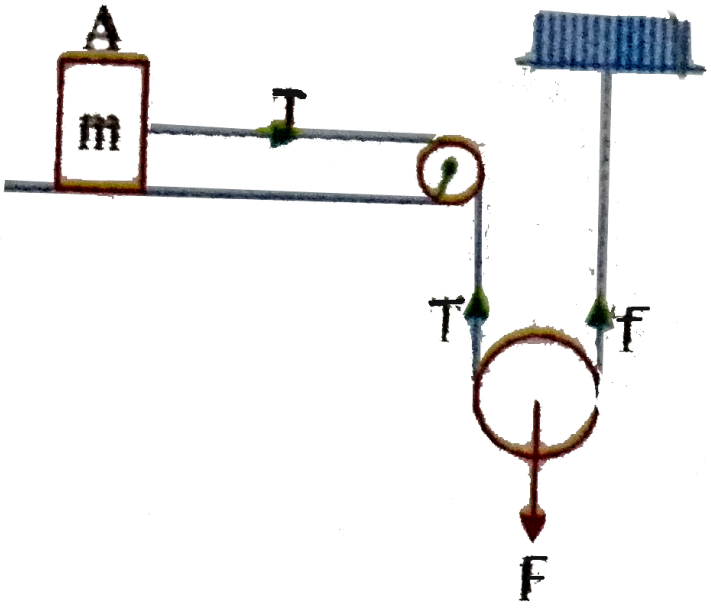
D. $160N$

Answer: A

Watch Video Solution

17. Pulleys and strings are massless.The horizontal surface is smooth.What is the

acceleration of the block



A. $\frac{F}{2m}$

B. $\frac{F}{m}$

C. $\frac{2F}{m}$

D. $\frac{m}{2F}$

Answer: A

Watch Video Solution

18. When a train starting from rest is uniformly accelerating, a plumb bob hanging from the roof of a compartment is found to be inclined at an angle of 45° with the vertical.The time taken by the train to travel a distance of $1/2km$ will be nearly

A. $7s$

B. $10s$

C. $15s$

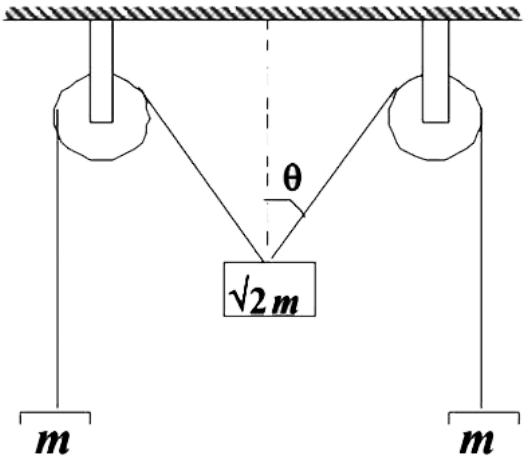
D. $25s$

Answer: B

Watch Video Solution

19. The pulleys and strings shown in the figure are smooth and of negligible mass. For the system to remain in equilibrium, the angle θ

should be



A. 0°

B. 30°

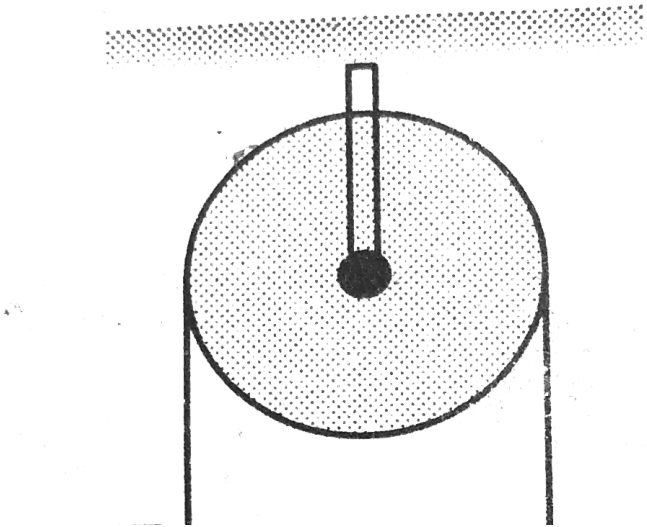
C. 45°

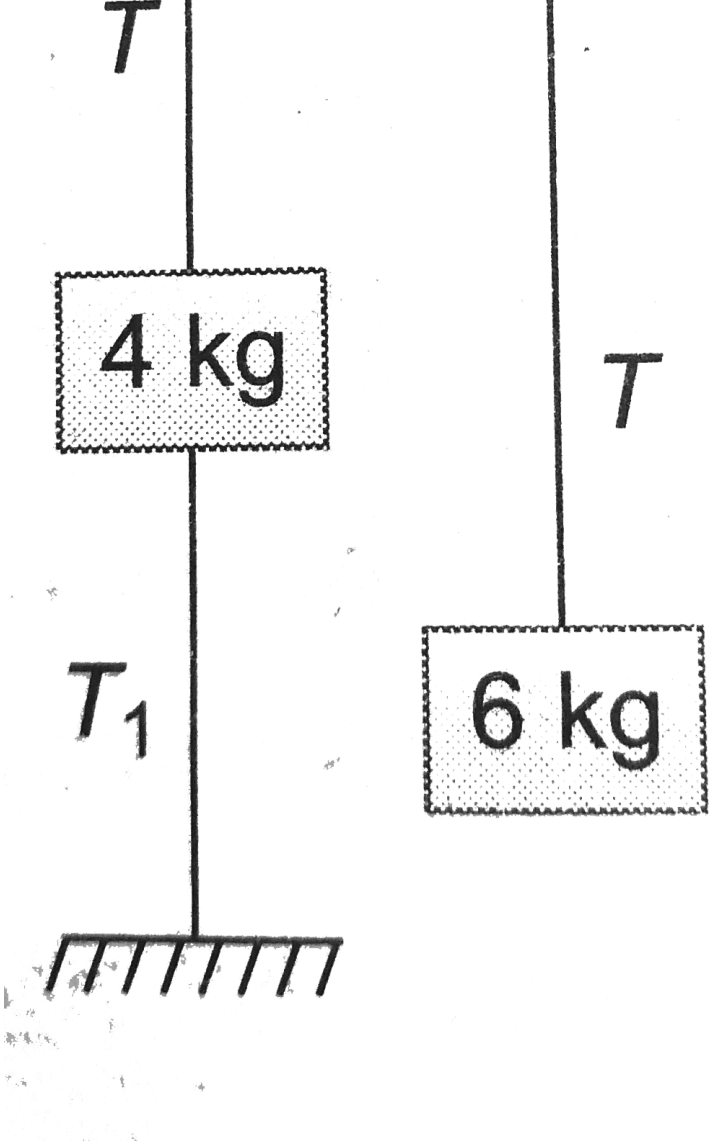
D. 60°

Answer: C

Watch Video Solution

20. Two bodies of mass 4kg and 6kg are attached to the ends of a string passing over a pulley. The 4kg mass is attached to the table top by another string. The tension in this string T_1 is equal to: Take





A. $10N$

B. $10.6N$

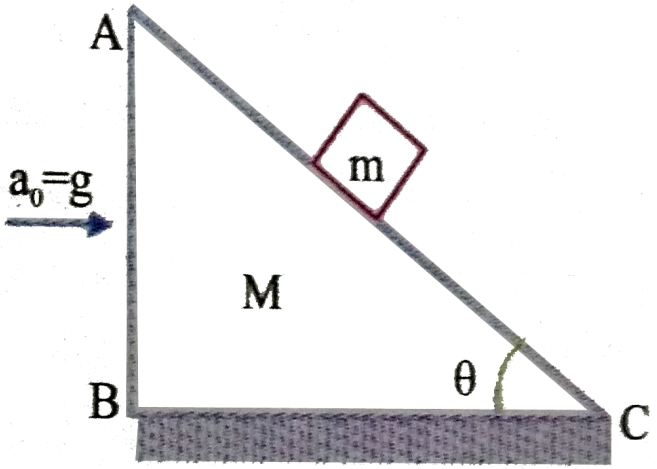
C. $25N$

D. $20N$

Answer: D

 Watch Video Solution

21. Accelertion of block m is $(\theta < 45^\circ)$



A. $g \sin \theta$

B. $g \cos \theta$

C. $g(\cos \theta + \sin \theta)$

D. $g(\cos \theta - \sin \theta)$

Answer: D

Watch Video Solution

22. A stationary shell breaks into three fragments The momentum of two of the fragments is P each and move at 60° to each other.The momentum of the third fragment is

A. P

B. 2P

C. $\frac{P}{\sqrt{3}}$

D. $\sqrt{3}P$

Answer: D

Watch Video Solution

23. A body of mass $1kg$ initially at rest explodes and breaks into three parts of masses in the ration $1:1:3$. If the two pieces of equal masses fly off perpendicular to each other with a speed of $30m/s$ The speed of third piece will be .

A. $\sqrt{2}v$

B. $v/2$

C. $v/\sqrt{2}$

D. $\sqrt{2}v$

Answer: A

Watch Video Solution

24. A man of $50kg$ is standing at one end on a boat of length $25m$ and mass $200kg$.If he starts running and when he reaches the other

end, has a velocity $2ms^{-1}$ with respect to the boat.The final velocity of the boat is

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

B. $\frac{2}{5}ms^{-1}$

C. $\frac{8}{5}ms^{-1}$

D. $\frac{8}{3}ms^{-1}$

Answer: B

Watch Video Solution

25. A stationary body of mass $3kg$ explodes into three equal pieces.Two of the pieces fly off at right angles to each other, one with a velocity $2\hat{i}m/s$ and the other with a velocity $3\hat{j}m/s$.If the explosion takes place in $10\,\sec$,the average force acting on the third place in Newtons is:

A. $\left(2\hat{i}+3\hat{j}\right)10^{-5}$

B. $-\left(2\hat{i}+3\hat{j}\right)10^{+5}$

C. $\left(3\hat{j}-2\hat{i}\right)10^{-5}$

D. $\left(2\hat{j}-2\hat{i}\right)10^{-5}$

Answer: B

Watch Video Solution

26. A particle is placed at rest inside a hollow hemisphere of radius R. The coefficient of friction between the particle and the hemisphere is $\mu=\frac{1}{\sqrt{3}}$. The maximum height up to which the particle can remain stationary is

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

B. $\left(1-\frac{\sqrt{3}}{2}\right)R$

C. $\frac{\sqrt{3}}{2}R$

D. $\frac{3R}{8}$

Answer: B

Watch Video Solution

27. A horizontal force is applied on a body on a rough horizontal surface produces an

acceleration a.If coefficient of friction between the body and surface which is a is reduced to $\mu/3$,the acceleration increses by $2units$.The value of μ is

A. $2/3g$

B. $3/2g$

C. $3/g$

D. $1/g$

Answer: C

Watch Video Solution

28. A block of mass $4kg$ is placed in contact with the front vertical surface of a lorry.The coefficient of friction between the vertical surface and block is 0.8.The lorry is moving with an acceleration of $15m/s^2$.The force of friction between lorry and block is $(g = 10ms^{-2})$

A. $48N$

B. $24N$

C. $40N$

D. Zero

Answer: C

Watch Video Solution

29. A person of mass $72kg$ sitting on ice pushes a block of mass of $30kg$ on ice horizontally with a speed of $12ms^{-1}$.The coefficient of friction between the man and ice and between block and ice is 0.02.If

$g = 10ms^{-1}$,the distance between man and the block, when they come to rest is

A. $360m$

B. $10m$

C. $350m$

D. $422.5m$

Answer: D

Watch Video Solution

30. Consider a $14-tyre$ truck, whose only rear 8 wheels are power driven (means only these 8 wheels can produce an acceleration).These $8wheels$ are supporting approximately half of the load.If coefficient of friction between road and each type is 0.6 ,then what could be the maximum attainable acceleration by the truck is

A. $6ms^{-2}$

B. $24ms^{-2}$

C. $3ms^{-2}$

D. $10ms^{-2}$

Answer: C

Watch Video Solution

31. A block is sliding on a rough horizontal surface. If the contact force on the block is $\sqrt{2}$ times the frictional force, the coefficient of friction is

A. 0.25

B. $\frac{1}{\sqrt{2}}$

C. $\sqrt{2}$

D. 1

Answer: D

Watch Video Solution

32. A block is sliding on a rough horizontal surface. If the contact force on the block is $\sqrt{2}$ times the frictional force, the coefficient of friction is

A. $\sqrt{2}$

B. $\frac{1}{\sqrt{2}}$

C. 0.5

D. $\frac{1}{\sqrt{3}}$

Answer: A

Watch Video Solution

33. A block of mass $2kg$ is placed on the surface of trolley of mass $20kg$ which is on a smooth surface.The coefficient of friction

between the block and the surface of the trolley is 0.25.If a horizontal force of $2N$ acts on the block, the acceleration of the system in ms^{-2} is $\left(g = 10ms^{-2}\right)$

A. 1.8

B. 1.0

C. 0.9

D. 0.09

Answer: D

Watch Video Solution

34. A man slides down on a telegraphic pole with an acceleration equal to one-fourth of acceleration due to gravity.The frictional force between man and pole is equal to (in terms of man's weight W)

A. $\frac{W}{4}$

B. $\frac{3W}{4}$

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

D. W

Answer: B

Watch Video Solution

35. A box is placed on the floor of a truck moving with an acceleration of $7ms^2$.If the coeffecient of kenetic friction between the box and surface of the truck is 0.5,find the acceleration of the box relative to the truck

A. $1.7ms^{-2}$

B. $2.1ms^{-2}$

C. $3.5ms^{-2}$

D. $4.5ms^{-2}$

Answer: B

Watch Video Solution

36. A block is placed at a distance of $2m$ from the rear on the floor of a truck $\left(g = 10ms^{-2}\right)$ .When the truck moves with an acceleration of $8ms^{-2}$ the block takes $2\sec$ to fall off from

the rear of the truck.The coefficient of sliding friction between truck and the block is

A. 0.5

B. 0.1

C. 0.8

D. 0.7

Answer: D

Watch Video Solution

37. Sand is piled up on a horizontal ground in the form of a regualr cone of a fixed base of radius R.The coefficient of static friction between sand layers is μ.The maximum volume of sand that can be piled up, without the sand slipping on the surface is

A. $\frac{\mu R^3}{3\pi}$

B. $\frac{\mu R^3}{\pi}$

C. $\frac{\pi R^3}{3\mu}$

D. $\frac{\mu \pi R^3}{3}$

Answer: D

Watch Video Solution

38. A body is allowed to slide from the top along a smooth inclined plane of length $5m$ at an angle of inclination 30°.If $g = 10ms^{-2}$, time taken by the body to reach the bottom of the plane is

A. $\frac{\sqrt{3}}{2}s$

B. $1.414s$

C. $\frac{1}{\sqrt{2}}s$

D. $2s$

Answer: B

Watch Video Solution

39. A body slides down a smooth inclined plane of height h and angle of inclination 30° reaching the bottom with a velocity v.Without changing the height, if the angle of inclination

is doubled, the velocity with which it reaches the bottom of the plane is

A. v

B. $v/2$

C. $2v$

D. $\sqrt{2}v$

Answer: A

Watch Video Solution

40. A body is projected up along an inclined plane from the bottom with speed is $2v$.If it reaches the bottom of the plane with a velocity v,if θ is the angle of inclination with the horizontal and μ be the coefficient of friction.

A. $\frac{5}{3}\tan\theta$

B. $\frac{3}{5}\tan\theta$

C. $\frac{1}{5}\tan\theta$

D. $\frac{2}{5}\tan\theta$

Answer: B

Watch Video Solution

41. The minimum force required to move a body up on an inclined plane is three times the minimum force required to prevent it from sliding down the plane. If the coefficient of friction between the body and the inclined plane is $\frac{1}{2\sqrt{3}}$ the angle of the inclined plane is

A. 60°

B. 45°

C. 30°

D. 15°

Answer: C

Watch Video Solution

42. The time taken by a body to slide down a rough 45° inclined plane is twice that required to slide down a smooth 45° inclined

plane. The coefficient of kinetic friction between the object and rough plane is given by

A. 0.25

B. 0.33

C. 0.50

D. 0.75

Answer: D

Watch Video Solution

43. A body is sliding down a rough inclined plane The coefficient of friction between the body and the plane is 0.5.The ratio of the net force required for the body to slide down and the normal reaction on the body is $1:2$ Then the angle of the inclined plane is

A. 15°

B. 30°

C. 45°

D. 60°

Answer: C

Watch Video Solution

44. A body takes $1\frac{1}{3}$ times as much time to slide down a rough inclined plane as it takes to slide down an identical but smooth inclined plane,If the angle of inclination is 45° find the coefficient of friction.

A. $\frac{1}{16}$

B. $\frac{3}{16}$

C. $\frac{5}{16}$

D. $\frac{7}{16}$

Answer: D

Watch Video Solution

45. A body is sliding down an inclined plane $\left(\mu = \frac{1}{2}\right)$. If the normal reaction is twice that of the resultant downward force along the incline , the inclination of plane is

A. $\tan^{-1}\left[\frac{1}{2}\right]$

B. $\tan^{-1}(2)$

C. $\tan^{-1}\left(\frac{2}{3}\right)$

D. $\tan^{-1}\left(\frac{3}{2}\right)$

Answer: C

Watch Video Solution

46. A box of mass $8kg$ placed on a rough inclined plane of inclened θ its downward motion can be prevented by applying an

upward pull F and it can be made to slide upward appliying a force $2F$ .The coefficient of friction between the box and the inclined plane is

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

B. $\frac{\sqrt{3}}{2}$

C. $\frac{1}{\sqrt{2}}$

D. $\frac{1}{2}$

Answer: B

Watch Video Solution

47. A block of weight $100N$ is lying on a rough horizontal surface.If coefficient of friction $\frac{1}{\sqrt{3}}$ .The least possible force that can move the block is

A. $\frac{100}{\sqrt{3}}N$

B. $100\sqrt{3}N$

C. $50\sqrt{3}N$

D. $50N$

Answer: D

Watch Video Solution

48. A weight W rests on a rough horizontal plane,If the angle of friction is θ,the least force that can move the body along the plane will be

A. $W\cos\theta$

B. $W\tan\theta$

C. $W\cot\theta$

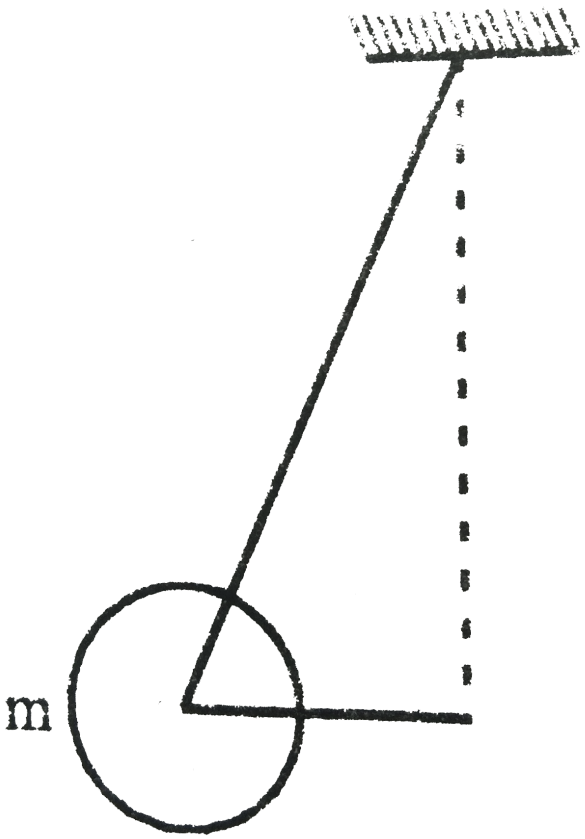
D. $W\sin\theta$

Answer: D

Watch Video Solution

49. A ball of mass $(m)0.5kg$ is attached to the end of a string having length $(L)0.5m$. The ball is rotated on a horizontal circular path about vertical axis. The maximum tension that the string can bear is $324N$. The maximum possible value of angular velocity of ball (in

radian//s) is -



A. 9

B. 18

C. 27

D. 36

Answer: D

Watch Video Solution

50. A disc rotates at $60 rev / \min$ around a vertical axis.A body lies on the disc at the distance of $20 cm$ from the axis of rotation.What should be the minimum value of coefficient of friction between the body and

the disc,so that the body will not slide off the disc

A. $8\pi^2$

B. $0.8\pi^2$

C. $0.08\pi^2$

D. $0.008\pi^2$

Answer: C

Watch Video Solution

51. A car is moving on a circular level road of curvature $300m$. If the coefficient of friction is 0.3 and acceleration due to gravity is $10m/s^2$, the maximum speed of the car be

A. $30km/h$

B. $81km/h$

C. $108km/h$

D. $162km/h$

Answer: C

Watch Video Solution

Watch video solution