PHYSICS

BOOKS - BITSAT GUIDE PHYSICS (HINGLISH)

ROTATIONAL MOTION

Practice Exercise

1. The angular displacement at any time t is given by $\theta(t) = 2t^3 - 6^2$. The torque on the

wheel will be zero at

A. 1 s

B. 0.1 s

C. 2 s

D. 0.2s

Answer:

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2. Four 2 kg masses are connecte dby 1.4 m spokes to an axle. A force of 24 N acts on a lever $\frac{1}{2}$m long to produce angular acceleration α. The magnitude of α (in rad s^{-2} is the angle between r and F is 30°.

A. 24

B. 12

C. 6

D. 3

Answer:

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3. A flywheel of moment of inertia 0.4 kg m^2 and radius 0.2 m is free to rotate about a central axis. If a string is wrapped around it and it is pulled with a force of 10N. Then its angular velocity after 4s will be

A. $10 rads^{-1}$

B. $5 rads^{-1}$

C. $20 rads^{-1}$

D. None

Answer:

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4. The centre of a wheel rolling on a plaen surface moves with a speed v_0. A particle on the rim of the wheel at the same level as the centre will be moving at speed

A. zero

B. v_0

C. $\sqrt{2}v_0$

D. $2v_0$

Answer:

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5. A meter stick is hold vertically with one end on the floor of the sticks does not move. The velocity of the other end when it hits the floor, will be

A. 9.8 m/s

B. 6.2 m/s

C. 8.9 m/s

D. 5.4 m/s

Answer:

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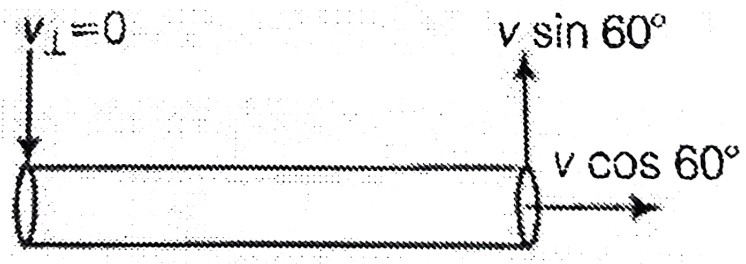
6. The instaneous velocity of point B of the given rod of length 0.5 is 3m/s in the represented direction. The angualr velocity of

the rod for minimum velocity of end A is



A. 1.5 rad/s

B. 5.2 rad/s

C. 2.5 rad/s

D. 3.6 rad/s

Answer:

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7. 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:

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8. If a raw egg and a boiled egg are spinned on the table by applying same torque. Then

A. boiled egg will spin faster

B. raw egg will spin faster

C. moment of intertia of boiled egg will be lesser than that of the raw egg

D. Both a and c are correct

Answer:

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9. The torque τ on a body about a given point is found to be equal to A x L, where A is constant vector and L is the angular momentum of the body that point. From this, it follows that

A. $\frac{dL}{dt}$ is perpendicular to L at all the instant of time

B. the component of L in the direction of A does not change with time

C. The magnitude of L does not change with time

D. all of the above

Answer:

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10. The tricycle weighing 20 kg has a small wheel symmmetrically placed 1m behind the two large wheels, which are also 1m apart. If the center of gravity of machine is at a horizontal distance of 25 cm behind the front wheels and the rider whose weight is 40 kg is 10 cm behind the front wheels. Then, the thrust on each front wheel is

A. 255 N

B. 90 N

C. 200 N

D. 400 N

Answer:

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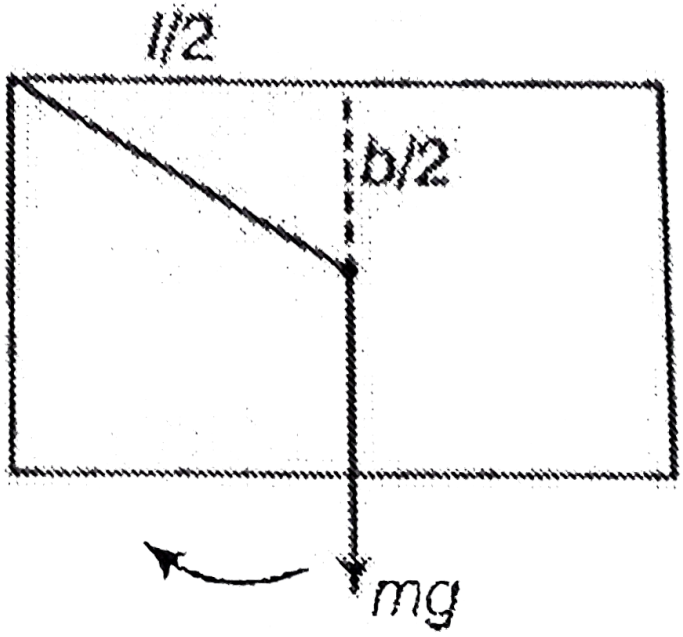
11. A rectangular plate of mass 20 kg is suspended from points A and B as shown. If the pin B is suddenly removed, then determine the angular acceleration (in rad/sec^(2)) of

the plate.



A. 48

B. 19.6

C. 29.4

D. 23.6

Answer:

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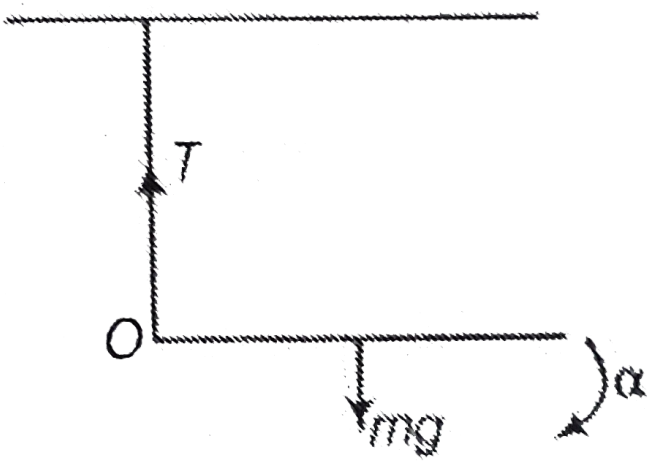
12. A uniform rod of length l and mass m is suspended by two vertical inextensible strings as shwon in figure. Then, tension in the left

string when right string snape, si



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

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

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

D. $\frac{mg}{8}$

Answer:

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13. A rod of length L is hinged from one end. It is brought to a horizontal position and released. The angular velocity of the rod, when it is in vertical position, is

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

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

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

D. $\sqrt{\frac{g}{L}}$

Answer:

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14. A light rod carries three equal masses A, B and C as shown in figure. Find the velocity of B in vertical position of rod, if it is released from horizontal position. As shown in figure.

A. $\sqrt{2gl}$

B. $\sqrt{\frac{18gl}{7}}$

C. $\sqrt{\frac{4gl}{3}}$

D. $\sqrt{\frac{8gl}{7}}$

Answer:

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15. The kinetic energy of a lamina moving in its planeis

A. $M\left(v_{cm}^2 + K^2\omega^2\right)$

B. $\frac{1}{2}M\left(v_{CM}^2 + K^2\omega^2\right)$

C. $\frac{1}{2}k\omega p^2$

D. None of these

Answer:

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16. A wheel has mass of the rim 1 kg, having 50 spokes each of mass 5g. The radius of the wheel is 40 cm. The moment of inertia is

A. 0.273 kg m^2

B. 1.73 kg m^2

C. 0173 kg m^2

D. 2.73 kg m^2

Answer:

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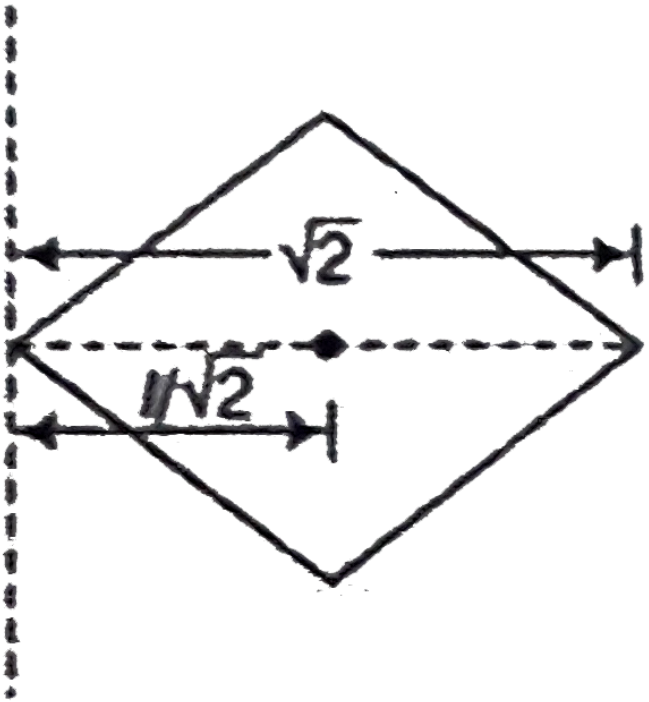
17. The moment of inertia of a system of four rods each of length l and mass m about the

axis shown is



A. $\frac{2}{3}ml^2$

B. $2ml^2$

C. $3\ ml^2$

D. $\frac{8}{3}ml^2$

Answer:

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18. The surface density (mass/area) of a circular disc of radius a depends on the distance from the centre as $\rho(r) = A + Br$. Find its moment of inertia about the line perpendicular to the plane of the disc through its centre.

A. $\pi a^2 \left(\frac{A}{2} + \frac{2a}{5} \right)$ B

B. $\pi a^4\left(\frac{A}{2}+\frac{2B}{5}\right)$

C. $2\pi a^3\left(\frac{A}{2}+\frac{Ba}{5}\right)$

D. None of these

Answer:

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19. A hoop of radius 2m, weight 100 kg. It rolls along horizontal floor so that its center of mass has a speed of $20c\frac{m}{s}$. How much work has to be done to stop it?

A. 4.8 J

B. 4.0 J

C. 6.2 J

D. 7.2 J

Answer:

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20. Mass of bigger disc having radius 2R is M. A disc of radius R is cut from bigger disc. Moment of intertia of disc about an axis

passing through periphery and perpendicular to plane is

A. $\frac{27MR^2}{8}$

B. $\frac{29MR^2}{8}$

C. 3.5 MR

D. 2 MR^2

Answer:

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21. Three thin rods each of length Land mass M are placed along x, y and z-axes such that one of each rod is at origin. The moment of inertia of this system about z-axis is

A. $2.3ML^2$

B. `(4ML^(2))/3

C. `(5ML^(2))/3

D. `(ML^(2))/3

Answer:

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22. If r is the distance between the Earth and the Sun. Then, angular momentum of the Earth around the sun is proportional to

A. $r^{-\frac{1}{2}}$

B. $r^{\frac{1}{2}}$

C. r^2

D. r^{-2}

Answer:

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23. Two wheels A and B are mounted on 6 kg m^2 the same shaft. One of them having their moment of inertia 8 kg m^2 with the angular speed 600 rpm and other is at rest. The value of moment of intertia of another wheel in order to achive the combined angular speed 300 rpm is

A. 4 kg m^2

B. 3 kg m^2

C. 6 kg m^2

D. 9 kg m^2

Answer:

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24. Choose the correct option.

A. Friction is necessary for rolling motion

B. Frictioin is necessary for pure accelerated rolling motion

C. Friction is necessary for pure accelerated rolling on an inclined plane

D. None of the above

Answer:

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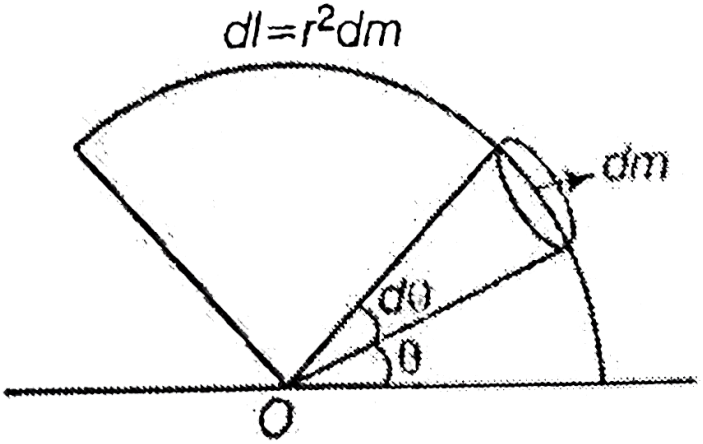
25. An arm making an angle of 120° at the center of ring of mass m and radius r is cut from the ring. The arc is made to rotate about z-axis perpendicular to its plane and passing

through the center of the ring. The moment of inertia of the arc about the z-axis is



A. mr^2

B. $\frac{mr^2}{3}$

C. $\frac{mr^2}{2}$

D. $\left(m\frac{r^2}{4}\right.$

Answer:

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26. A particle of mass m rotates in a circle of radius a with uniform angular speed ω_0. It is viewed from a frame rotating about the z-axis with a uniform angualr speed ω. The centrifugal force on the particle is

A. $m\omega^2 a$

B. $m\omega_0^2 a$

C. $m\frac{\omega+\omega_0}{2^2}a$

D. $m\omega\omega_0$

Answer:

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27. At any instant, a rolling body may be considered to be in pure rotation about an axis through the point of contact. This axis is translating forward with speed

A. equal to center of mass

B. zero

C. Twice of center of mass

D. No sufficient data

Answer:

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28. In the given figure, the spheres rolls without slipping on the plank which is moving with constant velocity v_0. The radius and

angualr velocity of the sphere is r and ω, respectively. The velocity of center fo mass of the sphere is

A. $v_0 + r\omega$

B. $V_0 - r\omega$

C. $r\omega$

D. v_0

Answer:

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29. A uniform cube of mass m and edge a moves on a horizontal surface along the positive x-axis, with initial velocity v_0. Then

A. During motion , Ngtmg

B. During motion, normal reactions acts on the center of mass

C. during motion, the normal reaction shifts towards positive x-axis from the center of mass

D. during motion, normal reaction shifts in the direction of the force of friction.

Answer:

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30. In the case of toppling of the body about the point A (shown in the figure),

A. $v_c > v_2 > v_1 > v_A$

B. $v_1 > v_2 > v_c > v_A$

C. $v_A > -0$

D. $v_C < V_1 < V_2 < V_A$

Answer:

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31. In q. 30. acceleration of the point A is

A. $a > -0$

B. gt0

C. $\mathrm{It}0$

D. 0

Answer:

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32. Two cubes A and B of same shape, size and mass are placed on a rough surface in the same manner. Equal forces are applied on the both cubes. But at the cube A, the force is applied at the top in horizontal direction. But

at the cube B just above the center of mass of the cube in the same manner. Then,

A. A will topple first

B. B will topple first

C. Both will topple at the same time

D. None of the above

Answer:

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33. A regular polygon of n sides is placed on a rough surface vertically as such one of the side of regular polygaon touches the surface. A force is applied horizontally at the top. The chosen value of n are 3,5 and 8. For which value of n, the polygon first is likely to topple?

A. 3

B. 5

C. 8

D. All of these

Answer:

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34. A particle performs uniform circular velocity along a line parallel to the x-axis, away from the origin. Its angular momentum with respect to the origin.

A. is zero

B. remains constant

C. goes on increasing

D. goes on decreasing

Answer:

35. A mass m is moving with a constant velocity along a line parallel to the x-axis, away from the origin. Its angular momentum with respect to the origin.

A. is zero

B. remains constant

C. goes on increasing

D. goes on decreasing

Answer:

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36. A particle of mass m is projected with a velocity v making an angle of 45° with the horizontal. The magnitude of the angular momentum of the projectile abut the point of

projection when the particle is at its maximum height h is.

A. zero

B. $\frac{mv^3}{4\sqrt{2g}}$

C. $\frac{mv^3}{\sqrt{2g}}$

D. $m\sqrt{2}gh^3$

Answer:

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37. A uniform rod of length 2a is held with one end resulting on a smooth horizontal table makin an angle α with the vertical. When the rod is released,

A. its center of mass moves vertically downwards on a straight line

B. Its center of mass remains in rest

C. the rod rotates about a vertical axis

D. Both a and c are correct

Answer:

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38. A 70 kg man standing on ice throws a 3 kg body horizontally at 8m//s. The friction coefficient between the ice and his feet is 0.02. The distance, the man slip is

A. 0.3 m

B. 2 m

C. 1 m

D. ∞

Answer:

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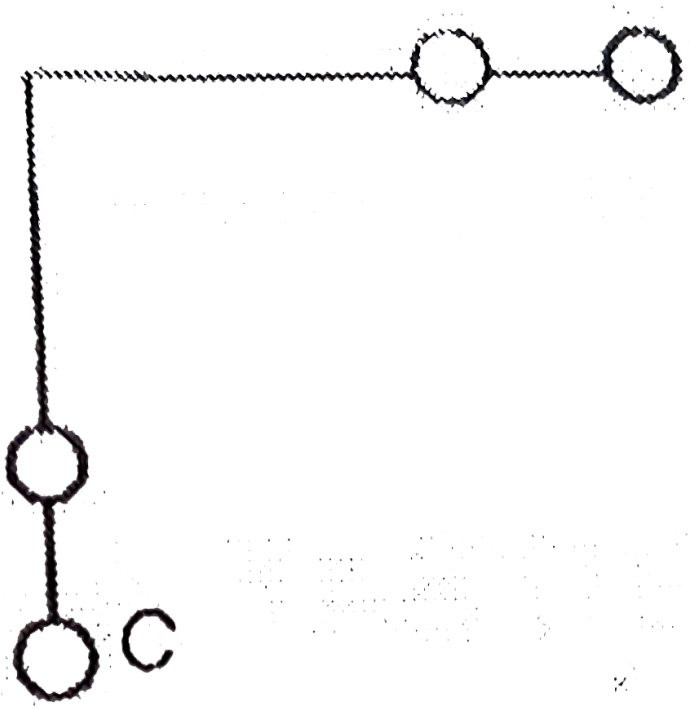
39. A weightless rod of length l carries two equal masses m one fixed at the end and other in the middle ofhte rod. The rod can revolve in a vertical plane about A. Then, horizontal velocity which must be imparted to end C of

rod to deflect it to horizontal position is



A. $\frac{\sqrt{12}}{5}$gl

B. $\sqrt{3gl}$

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

D. $\sqrt{2gl}$

Answer:

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40. Two balls A and B of angular velocities ω_A and ω_B collide with each other. Then, after collision

A. both have same angular velocities

B. $\omega_A > \Omega_B$

C. $\omega_A = \omega_B$ when balls are smooth

D. $\omega_A > \omega_B$ when balls are smooth

Answer:

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41. A uniform rod OA of mass M and length 2a rests on a smooth table and is free to turn about a smooth pivot at its end O, in contact with it at a distance b from O is an inelastic particle of mass m, a horizontal blow of impulse p is given to rod at a distance x from O in a direction perpendicular to the rod. The

resultant intantaneous angular velocity of the rod is

A. $\frac{px}{\frac{4Ma^2}{3}+mb^2}$

B. $\frac{px}{M}$

C. $\frac{px}{ma^2+mb^2}$

D. none of these

Answer:

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42. A uniform rod AB of mass m and length l is at rest on a smooth horizontal surface. An impulse p is applied to the end B. The time taken by the rod to turn through a right angle is

A. $\left(2\pi\frac{ml}{p}\right.$

B. $(2\pi)\left(\frac{p}{ml}\right.$

C. $\frac{\pi ml}{12p}$

D. $\frac{\pi p}{ml}$

Answer:

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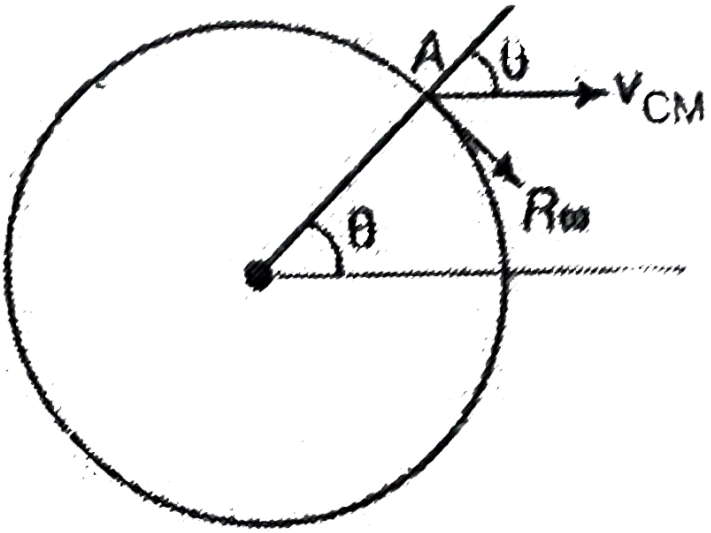
43. A sphere of radius R is rolling on a rough horizontal surface. The magnitude of velocity of A with respect to ground will be



A. $\sqrt{2}v_{CM}$

B. $2V_{CM}\sin\theta$

C. $\sqrt{2}v_{CM}\sqrt{1+\sin\theta}$

D. No sufficient information

Answer:

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44. When a wheel moves a distance shorter than $2\pi R$ while making one rotation. Then,

A. $v_{CM} < R\omega$

B. $v_{CM} \leftarrow R\omega$

C. $v_{CM} > R\omega$

D. $v_{CM} > -R\omega$

Answer:

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45. If a body moves through a distance greater than $2\pi R$ in one full rotation. Then,

A. $v_{CM} < R\omega$

B. $v_{CM} \leftarrow R\omega$

C. $v_{CM} > R\omega$

D. $v_{CM} > -R\omega$

Answer:

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46. A uniform sphere of radius a rotating with an angular velocity ω about an axis perpendicualr to the plane of motion and its cener impinges on a horizontal plane, let u

and v are horizontal and vertical component of velocity before impact. Then

A. if u = aω, then u and ω are unaltered

B. if u = aω, then surface is frictionless

C. If ugt aω, then angular velocity increases

D. all of the above

Answer:

47. In the given figure, a solid sphres is placed on a plank having acceleration a_0 (shown in the figure). Then,

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A. if $a_p = a_0$, then pure rolling takes place

B. if $v_p = v_0$, then pure rolling takes place

C. if $a_p = a_0$, $v_p \neq v_0$, then pure rolling takes place

D. if $a_p = a_0$, $v_p = v_0$ then pure rolling takes place

Answer:

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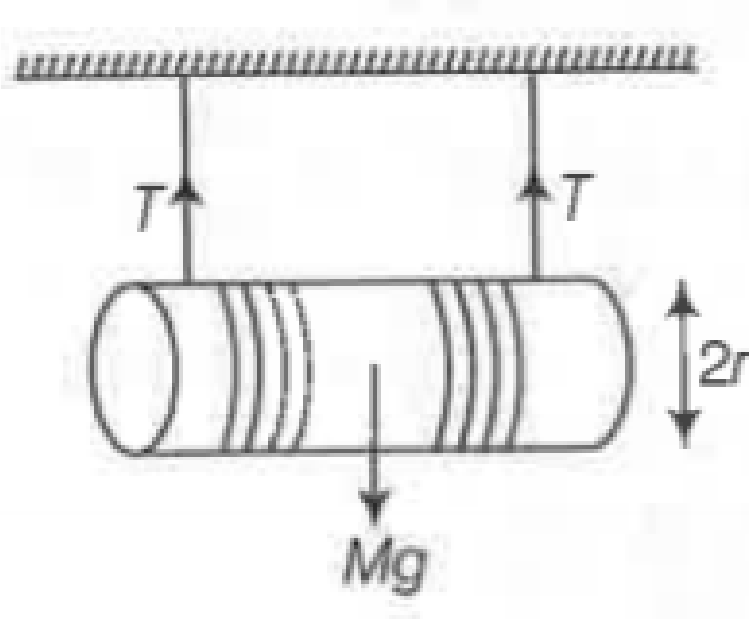
48. The cylinder of mass M is suspended through two strings as shown in figure. The speed of cylinder after descending through a

depth h, is



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

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

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

D. $\sqrt{\frac{8gh}{3}}$

Answer:

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Bitsat Archives

1. Two rings of radius R and nR made of same material have the ratio of moment of inertia about an axis passing through center is $1:8$. The value of n is

A. 2

B. $2\sqrt{2}$

C. 4

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

Answer:

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2. A mass m is moving with a constant velocity along a line parallel to the x-axis, away from the origin. Its angular momentum with respect to the origin.

A. zero

B. remains constant

C. goes on increasing

D. goes on decreasing

Answer:

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3. The moment of inertia of the body about an axis is 1.2 kg m^2. Initially the body is at rest. In order to produce a rotational kinetic energy of

1500J, an angualr acceleration of 25 $ra\frac{d}{s^2}$ must be applied about the axis for the duration of

A. 2s

B. 4s

C. 8s

D. 10 s

Answer:

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4. When the mass is rotated in a plane about an fixed point, then angualr momentum is directed along the

A. radius

B. tangent to orbit

C. axis of rotation

D. line at an angle of 45° to plane of rotation

Answer:

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5. A solid cylinder of mass 2kg rolls down (pure rolling) an inclined plane from a height of 4m. Its rotational kinetic energy, when its reaches the foot of the plane is (Take g=10ms^{-2})

A. 20 J

B. 40 J

C. $\frac{80}{3}$J

D. 80 J

Answer:

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6. The radius of a wheel is R and its radius of gyration about its axis passing through its center and perpendicualr to its plane is K. If the wheel is roling without slipping. Then the ratio of tis rotational kinetic energy to its translational kinetic energy is

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

B. $\left(\frac{R^2}{K^2}\right)$

C. $\left(\frac{R^2}{R^2+K^2}\right.$

D. $\left(\frac{K^2}{R^2+K^2}\right.$

Answer:

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7. The moment of inertia of an thin circular disc about an axis passing through its center and perpendicualr to its plane, is I. Then, the moment of intertia of the disc about an axis parallel to its diameter and touching the edge of the rim is

A. I

B. 2I

C. 3/2I

D. $\frac{5}{2}$I

Answer:

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8. The moment of inertia of a circular disc about an axis passing through the

circumstances perpendicular to the plane of the disc is

A. $\left(MR^2\right.$

B. $\frac{3}{2}MR[\hat{}(2)$

C. $\frac{MR^2}{2}$

D. $\frac{5}{4}MR^2$

Answer:

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9. Angular momentum is conserved

A. Always

B. never

C. when external force is absent

D. when external torque is absent

Answer:

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