PHYSICS

BOOKS - MTG-WBJEE PHYSICS (HINGLISH)

MOTION OF CENTRE OF MASS, CONNECTED SYSTEMS, FRICTION

Wb Jee Workout Category 1 Single Option Corred Type 1 Mark

1. A solid homogenous sphere of mass M and radius r is moving on a rough horizontal surface, partly rolling and partly sliding. During this kind of motion of this sphere

A. total kinetic energy is conserved

B. the angular momentlim of the sphere about the point of contact with the plane is conserved

C. only the rotational kinetic energy about the centre of mass is conserved

D. angular momentum about the centre of mass of conserved.

Answer: B

View Text Solution

2. A ring of mass m and radius r rotates about an axis passing through its centre and perpendicular to its plane with angular velocity ω. Its kinetic energy is

A. $\frac{1}{2}mr^2\omega^2$

B. $mr\omega^2$

C. $mr^2\omega^2$

D. $\frac{1}{2}mr\omega^2$

Answer: A

View Text Solution

3. The speed of a homogenous solid sphere after rolling down an inclined plane of vertical height h from rest without sliding is

A. $\sqrt{\frac{10}{7}gh}$

B. $\sqrt{gh}$

C. $\sqrt{\frac{6}{5}gh}$

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

Answer: A

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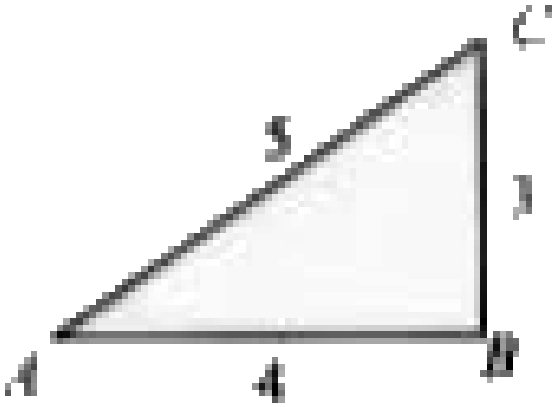
4. The ABC is a triangular plate of uniform thickness. The sides are in the ratio shown in the figure. I_{AB}, I_{BC} and l_{CA} are the moments

of inertia of the plate about AB, BC and CA respectively. Which one of the following relation is correct?



A. $I_{AB} + I_{BC} = I_{CA}$

B. I_{CA} is maximum

C. $I_{AB} > I_{BC}$

D. $I_{BC} > I_{AB}$

Answer: D

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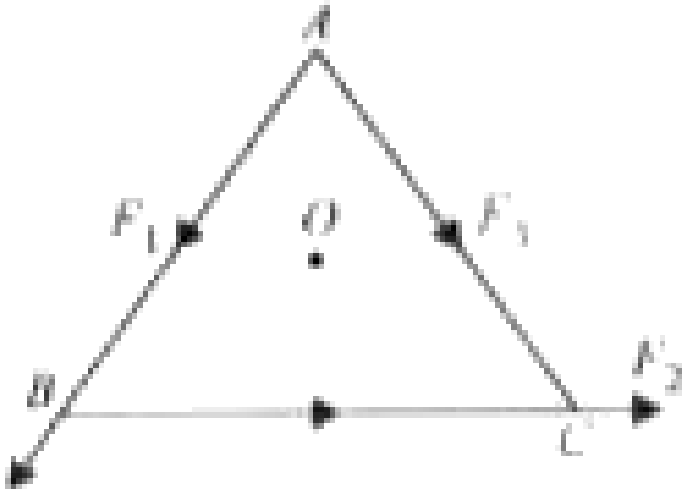
5. O is the centre of an equilateral triangle ABC. F_1, F_2 and F_3 are three forces acting along the sides AB, BC and AC as shown in the figure. What should be the magnitude of F_3,

so that the total torque about O is



A. $(F_1 + F_2)$

B. $2(F_1 + F_2)$

C. $(F_1 + F_2)/2$

D. $(F_1 - F_2)$

Answer: A

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6. A thin circular ring of mass M and radius r is rotating about its axis with a constant angular velocity ω. Two objects each of mass m are attached gently to the opposite ends of a diameter of the ring. The ring will now rotate with an angular velocity

A. $\frac{\omega(M-2m)}{M}$

B. $\frac{\omega M}{M+2m}$

C. $\frac{\omega(M-2M)}{M+2m}$

D. $\frac{\omega M}{M+m}$

Answer: B

View Text Solution

7. Three identical metal balls, each of the radius r are placed touching each other on a horizontal surface such that an equilateral triangle is formed when centres of three balls are joined. The centre ofthe mass of the system is located at

A. line joining centres of any two balls

B. centre of one of the balls

C. horizontal surface

D. horizontal surface

Answer: D

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8. Consider a point P as the contact point of a wheel on ground which rolls on ground without slipping. Value of displacement of

point P when wheel completes half of rotation

(Ifradius of wheel is 1 m)

A. 2m

B. $\sqrt{\pi^2 + 4m}$

C. πm

D. $\sqrt{\pi^2 + 2m}m$

Answer: B

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9. A thin circular ring of mass Mand radius r is rotating about its axis with a constant angular velocity ω. Four objects each of mass m, are kept gently to the opposite ends of two perpendicular diameters of the ring. The angular velocity of the ring will be

A. $\frac{M\omega}{4m}$

B. $\frac{M\omega}{M+4m}$

C. $\frac{(M+4m)\omega}{M}$

D. $\frac{(M-4m)\omega}{M+4m}$

Answer: B

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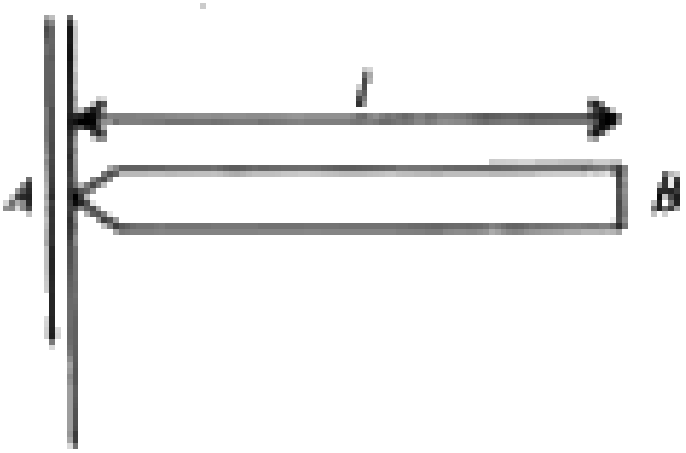
10. A uniform rod AB of length l and mass m is free to rotate about point A. The rod is released from rest in the horizontal position. Given that the moment of inertia of the rod about A is $ml^2/3$, the initial angular

acceleration of the rod will be



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

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

C. $\frac{3g}{2l}$

D. $\frac{2g}{3l}$

Answer: C

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11. A wheel has angular acceleration of 3.0 rad/sec^2 and an initial angular speed of 2.00 rad/sec. In a time of 2 sec it has rotated through an angle (in radian) of

A. 10

B. 12

C. 4

D. 6

Answer: A

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12. Two bodies have their moments of inertia I and 2I respectively about their axis of rotation. If their kinetic energies of rotation are equal, their angular velocity will be in the ratio

A. $2:1$

B. $1:2$

C. $\sqrt{2}:1$

D. $1 : \sqrt{2}$

Answer: C

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13. Force required to move a mass of 1 kg at rest on a horizontal rough plane $(\mu = 0.1$ and $g = 9.8m / s^2)$ is

A. $> 0.98N$

B. $< 0.49N$

C. $= 0.49N$

D. $< 0.98N$

Answer: A

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14. Two point objects of masses 1.5 g and 2.5 g respectively are at a distance of 16 cm apart, the centre of gravity is at a distance x from the object of mass 1. 5 g where x is

A. 10 cm

B. 6 cm

C. 13 cm

D. 3 cm

Answer: A

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15. A boy of mass 40 kg is climbing on a vertical pole at a constant speed. If the coefficient of friction between his palms and

the pole is 0.8 and g = $10m/s^2$, the horizontal force that he is applying on the pole is

A. 300 N

B. 400 N

C. 500 N

D. 600 N

Answer: C

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16. A box of mass 2 kg is placed on the roof of a car. The box would remain stationary untill the car attains a maximum acceleration. Coefficient of static friction between the box and the roof of the car is 0.2 and g = $10ms^{-2}$. This maximum acceleration of the car, for the box to remain stationary, is

A. $8ms^{-2}$

B. $6ms^{-2}$

C. $4ms^{-2}$

D. $2ms^{-2}$

Answer: D

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17. A wheel having moment of inertia 2 kg m^2 about its vertical axis, rotates at the rate of 60 rpm about this axis. The torque which can stop the wheel's rotation in one minute would be

A. $\frac{2\pi}{15}Nm$

B. $\frac{\pi}{12} Nm$

C. $\frac{\pi}{15} Nm$

D. $\frac{\pi}{18} Nm$

Answer: C

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18. The moment of inertia of a uniform circular disc of radius R and mass M about an axis passing from the edge of the disc and normal to the disc is

A. MR^2

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

C. $\frac{3}{2}MR^2$

D. $\frac{7}{2}MR^2$

Answer: C

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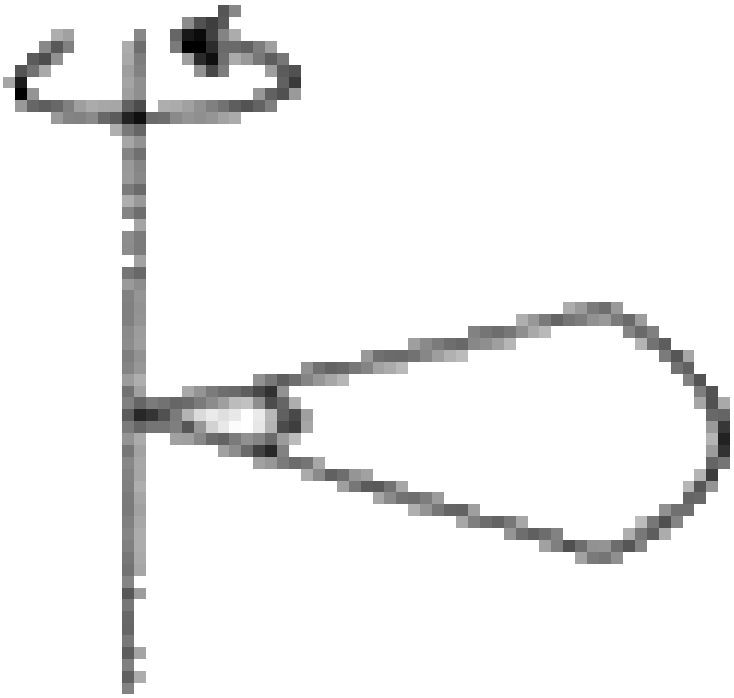
19. One quarter sector is cut from a uniform circular disc ofradius R. This sector has mass M. It is made to rotate about a line

perpendicular to its plane and passing through the centre of the original disc. Its moment of inertia about the axis of rotation is



A. $\frac{1}{2}MR^2$

B. $\frac{1}{4}MR^2$

C. $\frac{1}{8}MR^2$

D. $\sqrt{2}MR^2$

Answer: A

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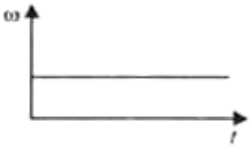
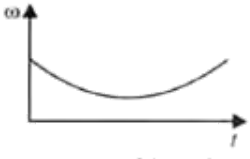
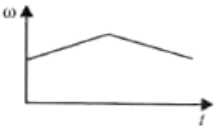
20. A circular platform is free to rotate in a horizontal plane about a vertical axis passing through its center. A tortoise is sitting at the edge of the platform. Now, the platform is given an angular velocity c.o0. When the

tortoise moves along the diameter of the platform with a constant velocity (with respect to the platform), the angular velocity of the platform $\omega(t)$ will vary with time t as

A. 

B. 

C. 

D. 

Answer: B

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21. The moment of inertia of a solid sphere of density p and radius R about its diameter is

A. $\frac{176\pi R^3}{105}$

B. $\frac{176pR^5}{105}$

C. $\frac{105pR^3}{176}$

D. $\frac{105pR^5}{176}$

Answer: B

View Text Solution

22. A stone of mass m tied to a string of length l rotates along circumference of a circle with constant speed v. The torque on the stone is

A. zero

B. $mv^2 \times l$

C. $\frac{m^2 v}{l}$

D. $\frac{mv^2}{l}$

Answer: A

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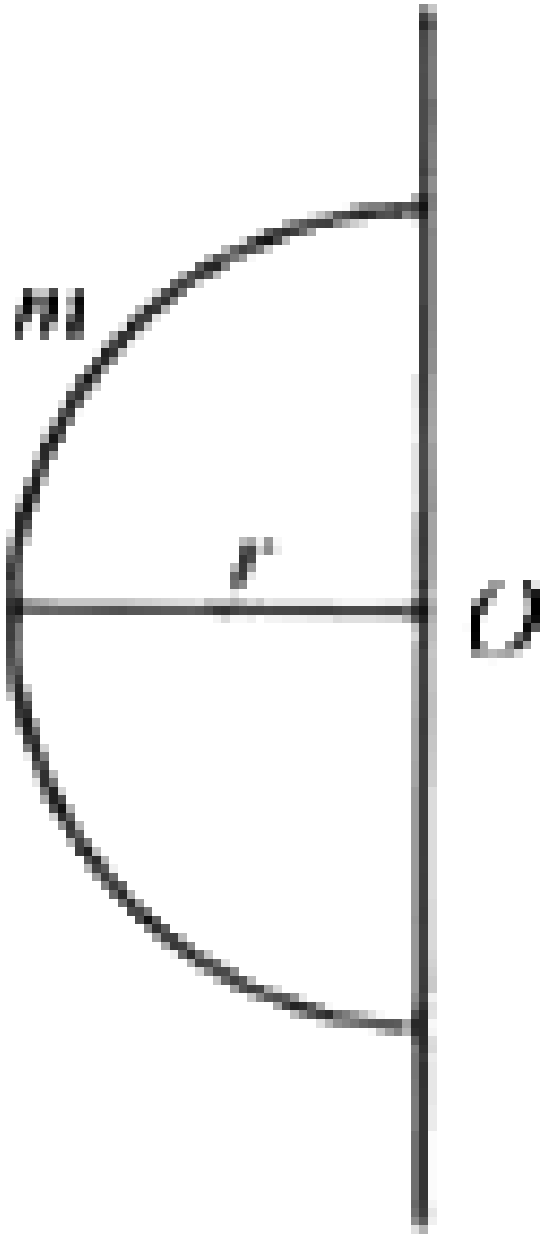
23. A thin wire of length l and mass m is turned into the form of a semicircle. Its moment of inertia about an axis joining its

free ends will be



A. $m\pi l^2$

B. ml^2/π^2

C. $\frac{ml^2}{2\pi}$

D. $\frac{ml^2}{2\pi^2}$

Answer: D

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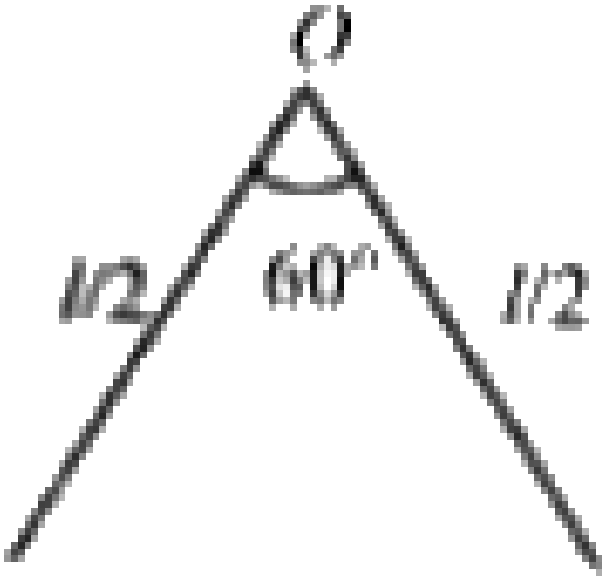
24. A thin rod of length l and mass m is turned at mid-point O at angle of 60°. The moment of inertia of the rod about an axis passing

through O and perpendicular to the plane of the rod will be



A. $ml^2/3$

B. $\frac{ml^2}{6}$

C. $\frac{ml^2}{8}$

D. $\frac{ml^2}{12}$

Answer: D

View Text Solution

25. A thin hollow cylinder open at both ends

(i) Slides without rotating

(ii) Rolls without slipping, with the same speed.

The ratio of kinetic energies in the two cases is

A. $1:1$

B. $4:1$

C. $1:2$

D. $2:1$

Answer: C

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26. A uniform rod of length l is placed with one end in contact with the horizontal and is then inclined at an angle a to the horizontal and allowed to fall, without slipping at contact

point. When it becomes horizontal, its angular velocity will be

A. $\omega = \sqrt{\frac{3g\sin\alpha}{l}}$

B. $\omega = \sqrt{\frac{2l}{3g\sin\alpha}}$

C. $\omega = \sqrt{\frac{6g\sin\alpha}{l}}$

D. $\omega = \sqrt{\frac{l}{g\sin\alpha}}$

Answer: A

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27. If a sphere is rolling, the ratio of the translational energy to total kinetic energy is given by

A. $7:10$

B. $2:5$

C. $10:7$

D. $5:7$

Answer: D

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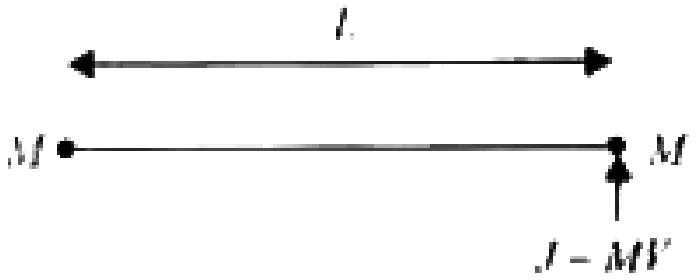
28. Consider a body, shown in figure, consisting of two identical balls, each of mass M connected by a light rigid rod. If an impulse J = MV is imparted to the body at one of its ends, what would be its angular velocity?



A. V / L

B. $2V / L$

C. $V / 3L$

D. $V/4L$

Answer: A

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29. The moment of inertia of a unifmm rod of mass M and length L about an axis through centre and perpendicular to length L is given by $(ML^2)/12$. Now consider one such rod pivoted at its centre free to rotate in a vertical plane. The rod is at rest in the vertical

position. A bullet of mass M moving horizontally at a speed V strikes and gets embedded in one end of the rod. The angular velocity CD of the rod after collision will be

A. V / L

B. $2V / L$

C. $3V / 2L$

D. $6V / L$

Answer: C

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30. If the earth were to suddenly contract to $\frac{1}{n}th$ of its present size without any change in its mass, the duration of the new day will be nearly

A. 24/n hours

B. 24 n hours

C. $24/n^2$ hours

D. $24n^2$ hours

Answer: C

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Wb Jee Workout Category 2 Single Option Correct Type 2 Marks

1. The moment of inertia of a body about a given axis is 1.2 kg m^2. · Initially, the body is at rest. In order to produce a rotational kinetic energy of 1500 J, an angular acceleration of 25 rad/s^2 must be applied about that axis for a duration of

A. 4s

B. 2s

C. 8s

D. 10s

Answer: B

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2. A thin and circular disc of mass m and radius R is rotating in a horizontal plane about an axis passing through its centre and perpendicular to its plane with an angular

velocity ω . If another disc of same dimension but mass ml4 is placed gently on the first disc co-axially, then the new angular velocity of the system is

A. $5\omega/4$

B. $2\omega/3$

C. $4\omega/5$

D. $3\omega/2$

Answer: C

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3. A circular disc is to be made by using iron and aluminium so that it acquires maximwn moment of inertia about geometrical axis. It is possible with

A. aluminium at interior and iron surrounding it

B. iron at interior and aluminium surrounding it

C. using iron and aluminium layers in alternate order

D. sheet of iron is used at both external surface and aluminium sheet as internal layers.

Answer: A

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4. A disc is rotating with angular speed CD. If a child sits on it, what is conserved

A. linear momentum

B. angular momentum

C. kinetic energy

D. potential energy

Answer: B

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5. A solid cylinder of mass M and radius R rolls without slipping down an inclined plane of length L and height h. What is the speed of its centre of mass when the cylinder reaches its bottom ?

A. $\sqrt{2gh}$

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

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

D. $\sqrt{4gh}$

Answer: C

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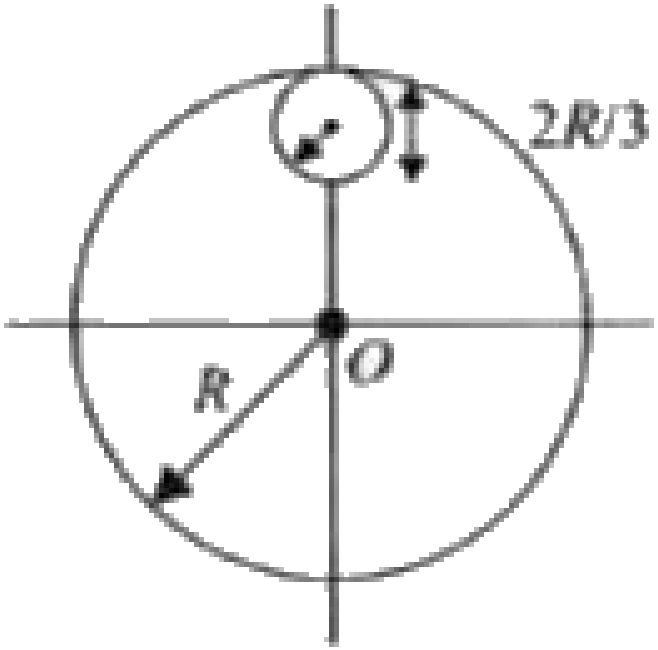
6. From a circular disc of radius R and mass 9M, a small disc of radius R/3 is removed from the disc. The moment of inertia of the remaining disc about an axis perpendicular to

the plane of the disc and passing through O is



A. $4M^2$

B. $\frac{40}{9}MR^2$

C. $10MR^2$

D. $\frac{37}{9}MR^2$

Answer: A

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7. A solid sphere of mass M, radius R and having moment of inertia about an axis passing through the centre of mass as J, is recast into a disc of thickness t, whose moment of inertia about an axis passing through its edge and perpendicular to its plane remains J. Then, radius of the disc will be

A. $\frac{2R}{\sqrt{15}}$

B. $R\sqrt{\frac{2}{15}}$

C. $\frac{4R}{\sqrt{15}}$

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

Answer: A

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8. A cord is wound round the circumference of a wheel of radius r. The axis of the wheel is horizontal and its moment of inertia about

this axis is I. A weight mg is attached to the end of the cord and is allowed to fall from rest. The angular velocity of the wheel, when the weight has fallen through a distance h, is

A. $\left[\frac{2gh}{l+mr}\right]^{1/2}$

B. $\left[\frac{2mgh}{I+mr^2}\right]^{1/2}$

C. $\left[\frac{2mgh}{1+2mr^2}\right]^{1/2}$

D. $(2gh)^{1/2}$

Answer: B

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9. A tube of length L is filled completely with an incompressible liquid of mass M and closed at both the ends. The tube is then rotated in a horizontal plane about one of its ends with a uniform angular velocity ω. The force exerted by the liquid at the other end is

A. $\frac{M\omega^2 L}{2}$

B. $M\omega^2 L$

C. $\frac{M\omega^2 L}{4}$

D. $\frac{M\omega^2 L^2}{2}$

Answer: A

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10. A body takes twice the time to slides down a rough inclined plane at 45^{o} to an identical smooth inclined plane. What is the coefficient of friction of rough plane?

A. 0.75

B. 0.5

C. 0.25

D. 0.15

Answer: A

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11. Two discs of moments of inertia l_1 and l_2 and angular speeds ω_1 and ω_2 are rotating along collinear axes pass through their centre of mass and perpendicular to their plane. If the two are made to rotate jointly along the same axis, the rotational K.E. of system will be

A. $\frac{(l_1\omega_1 + l_2\omega_2)^2}{2(l_1 + l_2)}$

B. $\frac{(l_1 + l_2)(\omega_1 + \omega_2)}{2}$

C. $\frac{(l_1 + l_2)(\omega_1 + \omega_2)}{2}$

D. None of these

Answer: A

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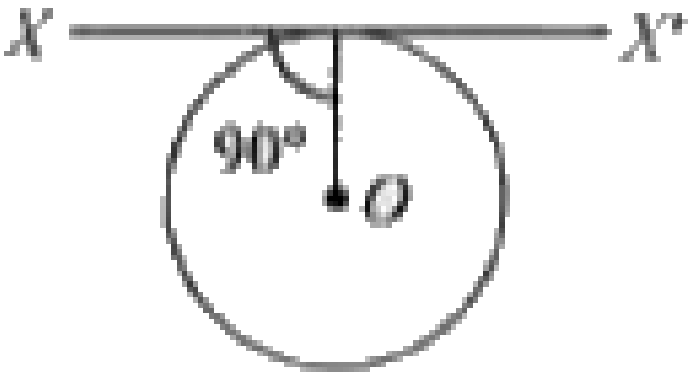
12. A thin wire of length L and uniform linear mass density p is bent into a circular loop with centre at O as shown. The moment of inertia

of the loop about the axis XX' is



A. $\frac{pL^3}{8\pi^2}$

B. $\frac{pL^3}{16\pi^2}$

C. $\frac{5pL^3}{16\pi^2}$

D. $\frac{3pL^3}{8\pi^2}$

Answer: D

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13. A particle of mass m = 5 units is moving with a uniform speed $v = 3\sqrt{2}$ units in the XOY plane along the line Y = X + 4. The magnitude of the angular momentum of the particle about the origin is

A. 60 units

B. $40\sqrt{2}$ units

C. zero

D. 7.5 units

Answer: A

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14. Four spheres each having mass m and radius r are placed with their centres on the four comers of a square of side a. Then the moment of inertia of the system about an axis along one of the sides of the square, is

A. $\frac{8}{5}mr^2$

B. $\frac{8}{5}mr^2 + 2ma^2$

C. $\frac{4}{5}mr^2 + 2ma^2$

D. $\frac{4}{5}mr^2 + 4ma^2$

Answer: B

View Text Solution

15. A circular disc rolls down on an inclined plane without slipping. What fraction of its total energy to translational?

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

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

C. $\frac{5}{7}$

D. $\frac{7}{5}$

Answer: A

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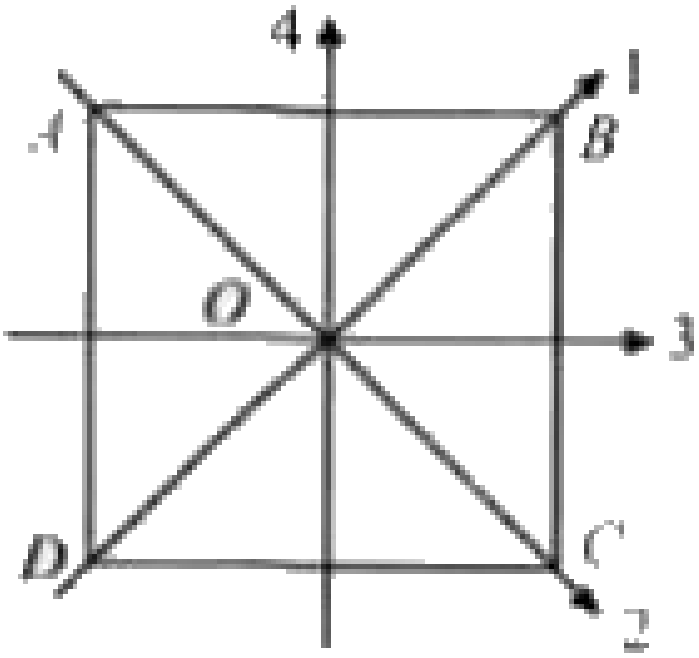
16. The moment of inertia of a thin square plate ABCD, as shown A in the figure, of uniform thickness about an axis passing through the centre O and perpendicular to

the plane of



A. $l_1 + l_2$

B. $l_3 + l_4$

C. $l_1 + l_3$

D. $l_1 + l_2 + l_3 + l_4$ ltbRgt where l_1, l_2, l_3 and l_4 are respectively the moments of inertia about axis 1, 2, 3 and 4 which are in the plane of the plate.

Answer: A::B::C

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17. 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 about the point of projection, when the particle is at its maximum height h, is

A. zero

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

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

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

Answer: B::D

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18. A man stands at the centre of a circular table with his two hands outstretched. The table is set into rotation with an angular speed of 40 rev/min. What is the angular speed when the man folds his hands back and thereby reduces his moment of inertia 2/5 times the initial value? Assume that the table rotates without friction.

A. A) 100 rpm

B. B) 150 rpm

C. C) 50 rpm

D. D) 75 rpm

Answer: A

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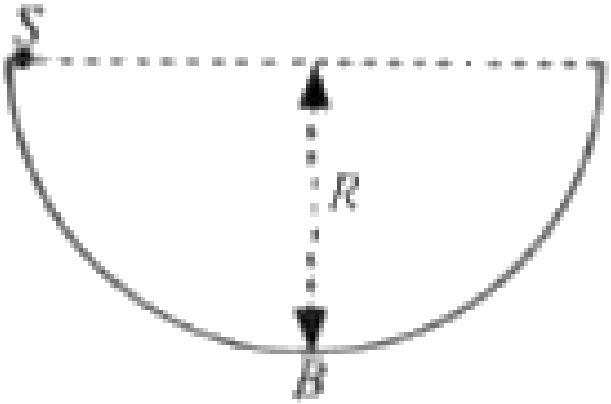
19. A small sphere S of radius ,r and mass m rolls without slipping, inside a large hemispherical bowl B of radius R as shown in figure. S starts from rest at the top point of

the hemisphere



A. The fraction of translational kinetic energy at the sphere is 5/7.

B. The fraction of rotational kinetic energy of the sphere is 2/7.

C. The fraction of rotational kinetic energy of the sphere is $\frac{2}{7}mv^2$.

D. The total kinetic energy of the sphere at the bottom of the bowl is $\frac{2}{7}mv^2$

Answer: A::B::C

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20. The torque $\vec{\tau}$ on a body about a given point is found to be equal to $\vec{A}$ and $\vec{L}$ where $\vec{A}$ is a constant vector, and $\vec{L}$ is the angular momentum of the body about that point. From this it follows that

A. $\frac{d\vec{L}}{dt}$ is perpendicular to $\vec{L}$ at all instants of time

B. the component of $\vec{L}$ in the direction of A does not change with time.

C. the magnitude of $\vec{L}$ does not change with time.

D. $\vec{L}$ does not change with time.

Answer: A::B::C

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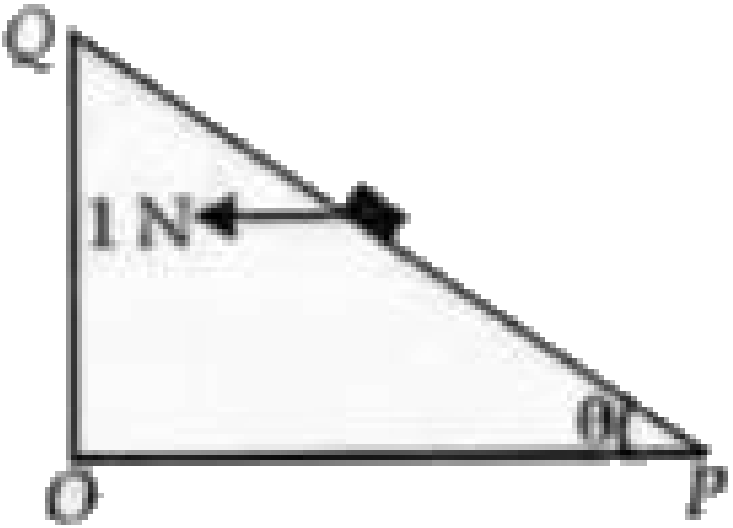
21. A small block of mass of 0.1 kg lies on a fixed inclined plane PQ which makes an angle θ with the horizontal. A horizontal force of 1 N acts on the block through its center of mass as shown in the figure. The block remains stationary if (take g = 10 m/s^2)



A. $\theta = 45^\circ$

B. $\theta > 45^\circ$ and a frictional force acts on the block towardsP.

C. $\theta > 45^\circ$ and a frictional force acts on the block P towards Q.

D. $\theta < 45^\circ$ and a frictional force acts on the block towards Q.

Answer: A::C

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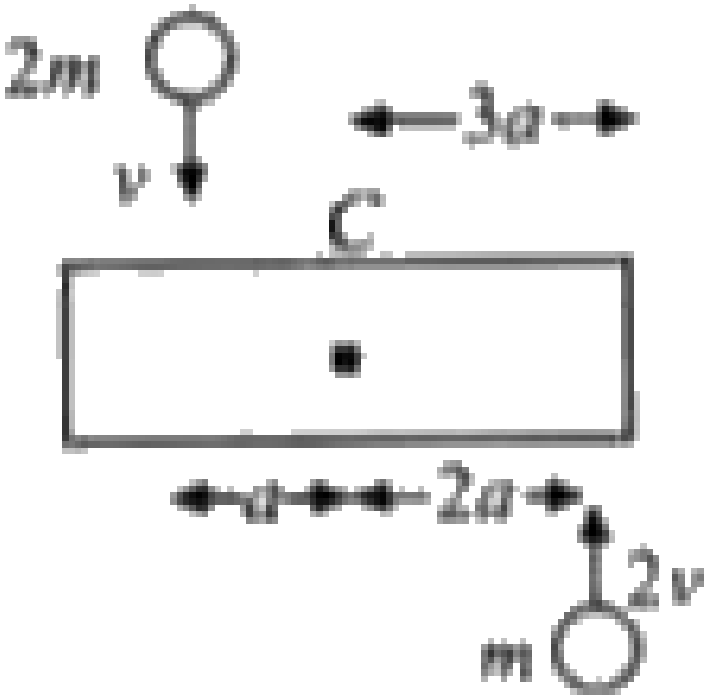
22. A uniform bar of length 6a and mass 8m lies on a smooth horizontal table. Two point masses m and 2m moving with the same horizontal speed 2v and v respectively, strike the bar as shown in the figure and stick to the bar after collision. Denoting angular velocity (about the centre of mass), total energy, and centre of mass velocity after collision by ω, E

and v_C respectively, we have after collision



A. $v_C = 0$

B. $\omega = \dfrac{3v}{5a}$

C. $\omega = \dfrac{v}{5a}$

D. $E = \dfrac{3mv^2}{5}$

Answer: A::C::D

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23. A fly wheel having a moment of inertia of $10^7 gcm^2$ and revolving at the rate of 120 rpm is stopped by a brake in course of 5 seconds. Find the controlling torque.

A. 2.51×10^7 dyne-cm

B. 5.21×10^7 dyne-cm

C. 1.25×10^7 dyne-cm

D. 2.15×10^5 dyne-cm

Answer: A

View Text Solution

24. A bucket of water of mass 21 kg is suspended by a rope wrapped around a solid cylinder 0.2 m in diameter. The mass of the solid cylinder is 21 kg. The bucket is released from rest. Which of the following statement(s) is/are correct?

A. The tension in the rope is 70 N.

B. The acceleration of the bucket is (20/3) m/s^2

C. The acceleration of the bucket is independent of the mass of the bucket.

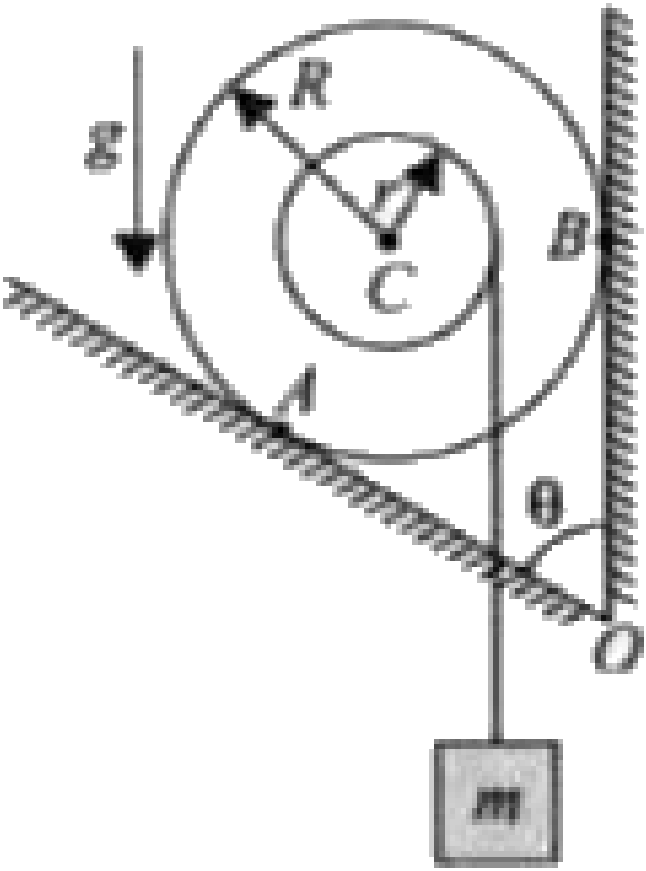
D. The tension in the rope is 50 N.

Answer: A::B::C

View Text Solution

25. A massless spool of inner radius r, outer radius R is placed against vertical wall and tilted split floor as shown. A light inextensible thread is tightly wound around the spool through which a mass m is hanging. There exists no friction at point A, while the coefficient of friction between spool and point

B is μ . The angle between two surface is θ.



A. The magnitude of force on the spool at

B in order to maintain equilibrium is

$$mg\sqrt{\left(\frac{r}{R}\right)^2+\left(1-\frac{r}{R}\right)^2\frac{1}{\tan^2\theta}}$$

B. The magnitude of force on the spool at B in order to maintain equilibrium is mg $\left(1-\frac{r}{R}\right)\frac{1}{\tan\theta}$

C. The minimum value of μ for the system to remain in equilibrium is $\frac{\cot\theta}{(R-r)-1}$

D. The minimum value of μ for the system to remain in equilibrium is $\frac{\tan\theta}{(R-r)-1}$

.

Answer: A::D

View Text Solution

Wb Jee Previous Years Questions

1. Four small objects each of mass m are fixed at the comers of a rectangular wire-frame of negligible mass and of sides a and $b(a > b)$. If the wire frame is now rotated about an axis passing along the side of length b, then the moment of inertia of the system for this axis of rotation is

A. $2ma^2$

B. $4ma^2$

C. $2m\left(a^2+b^2\right)$

D. $2m\left(a^2-b^2\right)$

Answer: A

View Text Solution

2. The velocity of a car travelling on a straight road is 36 km h^{-1} at an instant of time. Now travelling with uniform acceleration for 10s,

the velocity becomes exactly double. If the wheel radius of the car is 25 cm, then which of the following numbers is the closest to the number of revolutions that the wheel makes during this 10 s?

A. 84

B. 95

C. 126

D. 135

Answer: B

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3. A uniform solid spherical ball is rolling down a smooth inclined plane from a height h. The velocity attained by the ball when it reaches the bottom of the inclined plane is v. If the ball is now thrown vertically upwards with the same velocity v, the maximum height to which the ball will rise is

A. 5h/8

B. 3h/5

C. 5h/7

D. 7h/9

Answer: C

View Text Solution

4. A smooth massless string passes over a smooth fixed pulley. Two masses m1 and $m_2(m_1 > m_2)$ are tied at the two ends of the string. The masses are allowed to move under

gravity starting from rest. The total external force acting on the two masses is

A. $(m_1 + m_2)g$

B. $\frac{(m_1 - m_2)^2}{m_1 + m_2}g$

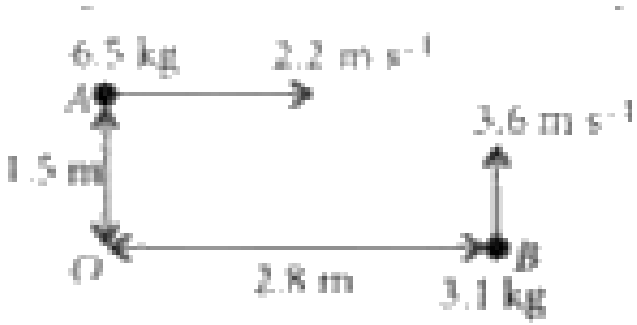
C. $(m_1 - m_2)g$

D. $\frac{(m_1 + m_2)^2}{m_1 - m_2}g$

Answer: B

View Text Solution

5. Two particles A and B are moving as shown in the figure. Their total angular momentum about the point O is



A. $9.8kgm^2/s$

B. zero

C. $52.7kgm^2/s$

D. $37.9kgm^2/s$

Answer: A

View Text Solution

6. A large number of particles are placed around the origin, each at a distance R from the origin. The distance of the center of mass of the system from the origin is

A. $= R$

B. $\leq R$

C. $> R$

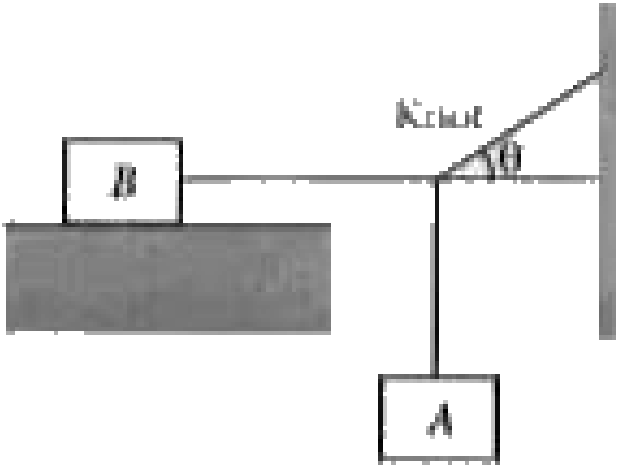
D. $\geq R$

Answer: B

View Text Solution

7. Block B lying on a table weighs W. The coefficient of static friction between the block and the table is μ. Assume that the cord between B and the knot is horizontal. The maximum weight of the block A for which the

system will be stationary is



A. $\frac{W \tan\theta}{\mu}$

B. $\mu W \tan\theta$

C. $\mu W \sqrt{1 + \tan^2\theta}$

D. $\mu W \sin\theta$

Answer: B

View Text Solution

8. Two bodies of masses m_1 and m_2 are separated by a distance R. The distance of the centre of mass of the bodies from the mass m_1 is

A. $\frac{m_2 R}{m_1 + m_2}$

B. $\frac{m_1 R}{m_1 + m_2}$

C. $\frac{m_1 m_2}{m_1 + m_2} R$

D. $\frac{m_1 + m_2}{m_1} R$

Answer: A

View Text Solution

9. Two particles A and B (both initially at rest) start moving towards each other under a mutual force of attraction. At the instant when the speed of A is v and the speed of B is 2v, the speed of the centre of mass is

A. zero

B. v

C. $\frac{3v}{2}$

D. $-\frac{3v}{2}$

Answer: A

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10. A block of mass m_2 is placed on a horizontal table and another block of mass m_1 is placed on top of it. An increasing horizontal force F = at is exerted on the upper block but the lower block never moves as a result. If the

coefficient of friction between the blocks is μ_1 and that between the lower block and the table is μ_2, then what is the maximum possible value of μ_1 / μ_2?

A. $\frac{m_2}{m_1}$

B. $1 + \frac{m_2}{m_1}$

C. $\frac{m_1}{m_2}$

D. $1 + \frac{m_1}{m_2}$

Answer: B

View Text Solution

11. A solid uniform sphere resting on a rough horizontal plane is given a horizontal impulse directed through its centre so that it starts sliding with an initial velocity v_0. When it finally starts rolling without slipping the speed of its centre is

A. $\frac{2}{7}v_0$

B. $\frac{3}{7}v_0$

C. $\frac{5}{7}v_0$

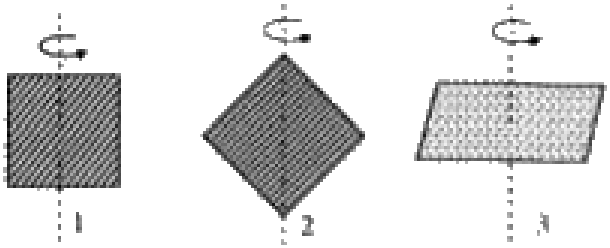
D. $\frac{6}{7}v_0$

Answer: C

View Text Solution

12. Three identical square plates rotate about the axes shown in the figure in such a way that their kinetic energies are equal. Each of the rotation axes passes through the centre of the square. Then the ratio of angular speeds

$\omega_1 : \omega_2 : \omega_3$ is



A. $1:1:1$

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

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

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

Answer: B

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13. A mass of 1 kg is suspended by means of a thread. The system is (i) lifted up with an acceleration of $4.9ms^{-2}$ (ii) lowered with an acceleration of 4.9 ms^{-2}. The ratio of tension in the first and second case is

A. $3:1$

B. $1:2$

C. $1:3$

D. $2:1$

Answer: A

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14. A bullet of mass 4.2×10^{-2} kg, moving at a speed of $300 ms^{-1}$, gets stuck into a block with a mass 9 times that of the bullet. If the block is free to move without any kind of friction, the heat generated in the process will be

A. 45 cal

B. 405 cal

C. 450 cal

D. 1701 cal

Answer: B

View Text Solution

15. A solid spherical ball and a hollow spherical ball of two different materials of densities p_1 and p_2 respectively have same outer radii and same mass. What will be the ratio the moment of inertia (about an axis passing through the

centre) of the hollow sphere to that of the solid sphere?

A. $\frac{p_2}{p_1}\left(1-\frac{p_2}{p_1}\right)^{\frac{5}{3}}$

B. $\frac{p_2}{p_1}\left[1-\left(1-\frac{p_2}{p_1}\right)^{\frac{5}{3}}\right]$

C. $\frac{p_2}{p_1}\left(1-\frac{p_1}{p_2}\right)^{\frac{5}{3}}$

D. $\frac{p_2}{p_1}\left[1-\left(1-\frac{p_1}{p_2}\right)^{\frac{5}{3}}\right]$

Answer: D

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16. A bar of length l canying a small mass m at one of its ends rotates with a uniform angular speed ω in a vertical plane about the mid-point of the bar. During the rotation, at some instant of time when the bar is horizontal, the mass is detached from the bar but the bar continues to rotate with same ω. The mass moves ve1tically up, comes back and reaches the bar at the same point. At that place, the acceleration due to gravity is g.

A. this is possible if the quantity $\frac{\omega^2 l}{2\pi g}$ is an integer

B. the total time of flight of the mass is proportional to ω^2

C. the total distance travelled by the mass in air is proportional to ω^2

D. the total distance travelled by the mass in air and its total time of flight are both independent of its mass.

Answer: A::C::D

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17. A circular disc rolls on a horizontal floor without slipping and the centre of the disc moves with a unifonn velocity v. Which of the following values the velocity at a point on the rim of the disc can have?

A. v

B. $-v$

C. 2v

D. zero

Answer: A::C::D

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