PHYSICS

BOOKS - MARVEL PHYSICS (HINGLISH)

ROTATIONAL MOTION

Multiple Choice Question

1. The physical quantity in translational motion, which is analogous to moment of inertia in rotational motion is

A. Velocity

B. Force

C. Energy

D. Mass

Answer: D

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2. Two masses of 500 gram and 600 grams are attached to the 10 cm and 80 cm marks respectively of a light metre scale. The moment of inertia of this system about an axis passing through the centre of the scale will be

A. $0.134\ \text{kg-m}^2$

B. $2\ \text{kg-m}^2$

C. $0.56\ \text{kg-m}^2$

D. $4.5\ \text{kg-m}^2$

Answer: A

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3. A rod 0.5 m long has two masses each of 20 gram stuck at its ends. If the masses are treated as point masses and if the mass of the rod is

neglected, then the moment of inertia of the system about a transverse axis passing through the centre is

A. $1.25 \times 10^{-3} kg - m^2$

B. $2.5 \times 10^{-3} kg - m^2$

C. $4 \times \ \times 10^{-3} kg - m^2$

D. $5 \times 10^{-3} kg - m^2$

Answer: B

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4. A wheel of mass 10 kg and radius of gyration 50 cm is rotating at 300 rpm. Then, the rotational kinetic energy of the wheel is

A. 625J

B. 1000J

C. 1250J

D. 1500J

Answer: C

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5. Four similar point masses (m each) are symmetrically placed on the circumference of a disc of mass M and radius R. Moment of inertia of the system about an axis passing through centre O and perpendicular to the plane of the disc will be

A. $MR^2 + 4mR^2$

B. $\frac{MR^2}{2} + 4mR^2$

C. $MR^2 + mR^2$

D. $\frac{MR^2}{3} + 8mR^2$

Answer: B

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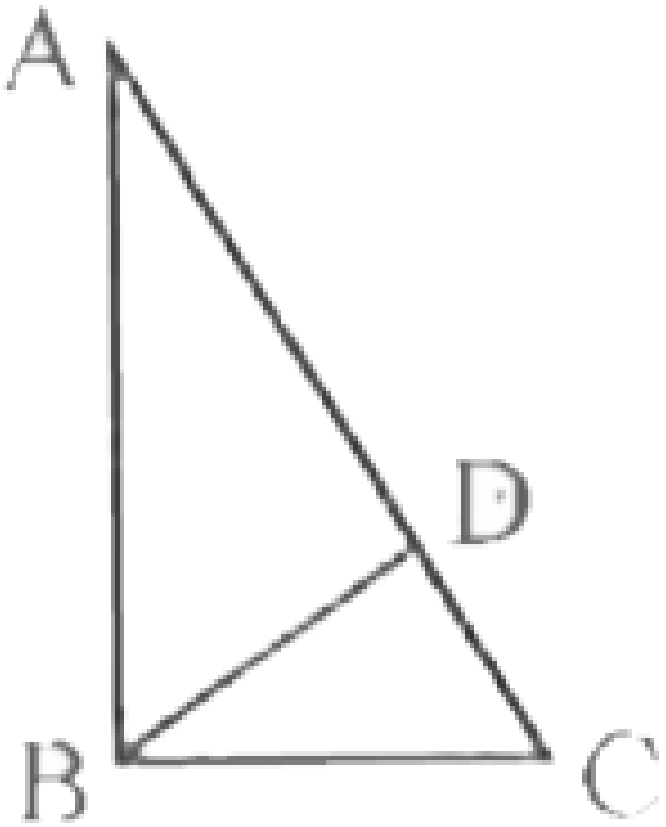
6. About which axis, the moment of inertia in the given triangular lamina is maximum?



A. AB

B. BC

C. CD

D. BD

Answer: B

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7. The angular displacement of a flywheel varies with time as $\theta = at + bt^2 - ct^3$. Then the angular acceleration is given by

A. $a + 2bt - 3ct^2$

B. $2b - 6t$

C. $a + 2b - 6t$

D. $2b - 6ct$

Answer: D

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8. A disc of mass 1 kg and radius 10 cm is rotating about its axis with an anuglar velocity of 2 rad/s. The linear momentum of the disc,

A. 0.2 kg-m/s

B. zero

C. 0.4 kg-m/s

D. 0.02 kg-m/s

Answer: B

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9. Three point masses, each of mass m, are placed at the corners of an equilateral triangle of side L. The moment of inertia of this system about an axis along one side of the triangle is

A. $3mb^2$

B. $2mb^2$

C. $\left(\frac{4}{3}\right)mb^2$

D. $\left(\frac{3}{4}\right)mb^2$

Answer: D

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10. Three thin rods, each of length 2 m and mass 3 kg are placed along x, y and z axes, such that one end of each rod is at the origin. The moment of inertia of this system about the x axis is

A. $2kgm^2$

B. $4kgm^2$

C. $6kgm^2$

D. $8kgm^2$

Answer: D

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11. A circular disc is to be made by using equal masses of aluminium and iron. To get maximum moment of inertia, about its geometrical axis, it should be so prepared that

A. Aluminium is at the interior and the iron surrounding it

B. Iron is at the interior and the aluminium surrounding it

C. Aluminium and iron are used in alternate layers

D. Aluminium and iron discs should be kept one above the other

Answer: A

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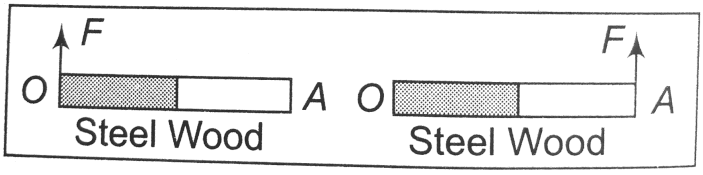
12. In first figure a meter stick, half of which is wood and the other half steel is pivoted at the wooden end at A and a force is applied at the steel and at O. On second figure the stick is pivoted at the steel end at O and the same force is applied at the wooden end at A. The angular

acceleration.



A. smaller in the first case

B. smaller in the second case

C. equal in both the cases

D. larger in the first case

Answer: A

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13. When a rigid body is in motion, few particles of the body remain at rest at all times. What kind of motion is the rigid body having?

A. Translational

B. Rotational

C. Rolling

D. Uniform circular motion

Answer: B

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14. If a horizontal cylindrical tube, partly filled with water is rapidly rotated about a vertical axis passing through its centre, the moment of inertia of the water about its axis will

A. decrease

B. increase

C. not change

D. increase or decrease depending upon clockwise or anticlockwise sense of rotation

Answer: B

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15. A flywheel rotating about a fixed axis has a kinetic energy of 225 J when its angular speed is 30 rad/s. What is the moment of inertia of the flywheel about its axis of rotation?

A. $0.5\ \mathrm{kg\ m^2}$

B. $0.6\ \mathrm{kg\ m^2}$

C. $0.8\ \mathrm{kg\ m^2}$

D. $0.3\ \mathrm{kg\ m^2}$

Answer: A

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16. A whell of mass 4 kg and radius of gyration 0.4 m is making 300 r.p.m. Its moment of inertia is

A. $6.4\ \mathrm{kg\ m^2}$

B. $0.64\ \mathrm{kg\ m^2}$

C. $0.32\ \mathrm{kg\ m^2}$

D. $64\ \mathrm{kg\ m^2}$

Answer: B

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17. A flywheel rotating about a fixed axis has a kinetic energy of $360J$ when its angular speed is 30 radian s^{-1} . The moment of inertia of the wheel about the axis of rotation is

A. $0.6\ \mathrm{kg\ m^2}$

B. $0.4\ \mathrm{kg\ m^2}$

C. $0.8\ \mathrm{kg\ m^2}$

D. $0.55\ \mathrm{kg\ m^2}$

Answer: C

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18. A circular disc of mass 2 kg and radius 0.1 m is rotating at an angular speed of 2 rad/s, about an axis passing through its centre and perpendicular to its plane. What is its rotational kinetic energy?

A. 0.1 J

B. 0.2 J

C. 0.02 J

D. 0.05 J

Answer: C

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19. The K.E. of a body is 3 joule and its moment of inertia is $6\ \mathrm{kg\ m^2}$. Then its angular momentum will be

A. $3\ \mathrm{kg\ m^2}/s$

B. $4\ \mathrm{kg\ m^2}/s$

C. $5\ \mathrm{kg\ m^2}/s$

D. $6\ \mathrm{kg\ m^2}/s$

Answer: D

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20. A ring and a thin hollow cylinder have the same mass and radius. If I_r and I_s represent their moment of inertia about their axes, then

A. $I_R = I_C$

B. $I_R = \frac{1}{2} I_C$

C. $I_R = 2I_C$

D. $I_R = \sqrt{2} I_C$

Answer: A

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21. When the speed of a flywheel is increased from 240 r.p.m. to 360 r.p.m., the energy spent is 1936 J.

What is te moment of inertia of the flywheel?

A. $4.9kg - m^2$

B. $9.8kg - m^2$

C. $2kg - m^2$

D. $15kg - m^2$

Answer: A

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22. A body having M.I of $5kg - m^2$ about its axis of rotation is rotating with angular velocity of 6 rad/s. The kinetic energy of the rotating body is the same as that of a body of mass 5 kg moving with a speed of

A. 2 m/s

B. 4 m/s

C. 6 m/s

D. 8 m/s

Answer: C

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23. A solid disc is rotating at an angular speed of 20 rad/s. It is decelerated at a constant rate of $2\,\mathrm{rad/s^2}$. Through what angle the disc will turn before coming to rest?

A. 100 radian

B. 50 radian

C. 200 radian

D. 300 radian

Answer: A

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24. A wheel is rotating at 900 rpm about its axis. When the power is cut off, it comes to rest in 1 min. The angular retardation (in rad s^{-2}) is

A. π

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

C. $\frac{\pi}{6}$

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

Answer: B

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25. The moment of an inertia about an axis of a body which is rotating with angular velocity $1\mathrm{rad}\,\mathrm{s}^{-1}$ is numerically equal to

A. twice the rottational kinetic enegy

B. one-fourth of its rotational kinetic energy

C. half of the rotational kinetic energy

D. rotational kinetic energy

Answer: A

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26. A thin metal disc of mass 2 kg starts from rest and rolls down a smooth inclined plane. Its rotational K.E. is 4 J at the bottom of the inclined plane. What is its linear velocity at the same point?

A. $3\sqrt{2}m/s$

B. $2\sqrt{3}m/s$

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

D. $2m/s$

Answer: C

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27. A body of moment of inertia about its axis of rotation is $3kgm^2$ and angular velocity 3 rad/s. The kinetic energy of rotating body is same as that of body of mass 27 kg moving with a speed of

A. $1.0\ \text{ms}^{-1}$

B. $0.5\ \text{ms}^{-1}$

C. $1.5\ \text{ms}^{-1}$

D. $2.0\ \text{ms}^{-1}$

Answer: A

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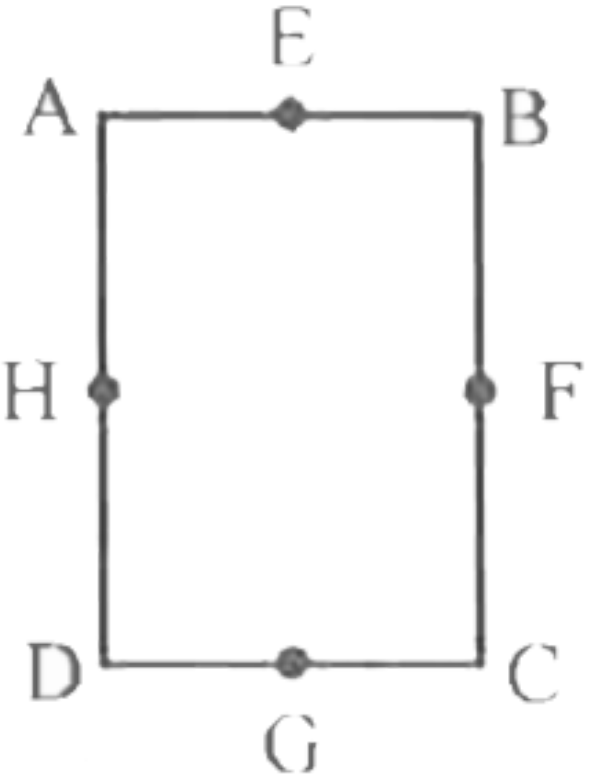
28. In a rectangle $ABCD(BC = 2AB)$. Along which axis the moment of inertia will be the minimum?



A. BC

B. BD

C. HF

D. EG

Answer: D

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29. Of the two eggs which have identical sizes, shapes and weights, one is raw and other is half boiled. The ratio between the moment of inertia of the raw to the half boiled egg about central axis is:

A. one

B. less than one

C. more than one

D. can not be decided

Answer: B

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30. When a disc rotates with uniform angular velocity, which of the following is not true ?

A. The sense of rotation remains same

B. The orientation of the axis of rotation remains same

C. The speed of rotation is non-zero and remains same

D. The angular acceleration is non - zero and remains same

Answer: D

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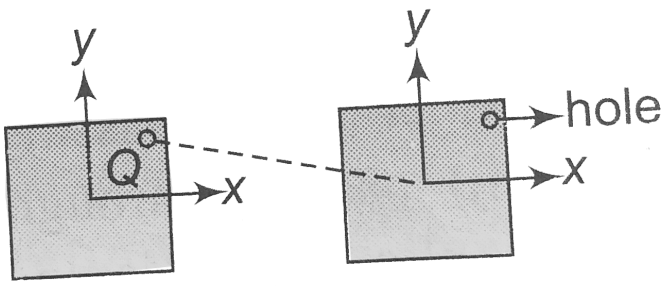
31. A uniform square plate has a small piece Q of an irregular shape removed and guled to the centre of the plate leaving a hole behind in

figure. The moment of inertia about the z-axis is then,



A. increased

B. decreased

C. the same

D. changed in unpredicted manner

Answer: B

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32. A solid sphere of mass M and radius R spins about an axis passing through its centre making 600 r.p.m. What is its kinetic energy of rotation?

A. $\frac{2}{5}\pi M^2 R^2$

B. $80\pi^2 MR^2$

C. $80\pi R$

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

Answer: B

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33. Three mass points $m_1, m_2, m_3$are located at the vertices of an equilateral triangle of length a. What is the moment of 'inertia' of the system about an axis along an axis along the altitude of the triangle passing through m_1?

A. $(m_1 + m_2 + m_3)a^2$

B. $\frac{1}{4}(m_2 + m_3)a^2$

C. $\frac{1}{2}(m_2 + m_3)a^2$

D. $(m_2 + m_3)a^2$

Answer: B

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34. A heavy body and a light body have equal K.E. which one of them has hreater momentum?

A. Light body

B. Heavy body

C. Both have equal momentum

D. A body with higher velocity

Answer: B

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35. If the angular velocity of a body increases by 20% then its kinetic energy of rotation will increase by

A. $20\ \%$

B. $30\ \%$

C. $44\ \%$

D. $66\ \%$

Answer: C

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36. The angular velocity of a body is increased from 5 rad/s to 20 rad/s, without applying a torque but by changing its moment of Inertia. What is the relation between the new radius of gyration and the initial radius of gyration?

A. $K_1 = K_2$

B. $K_1 = \frac{K_2}{2}$

C. $K_1 = 2K_2$

D. $K_2 = 3K_1$

Answer: C

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37. A body rolls down a smooth inclined plane. If its rotational kinetic energy is 40% of its translational K.E., then the body must be a

A. cylinder

B. ring

C. solid sphere

D. solid disc

Answer: C

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38. Two solid spheres of the same mass are of steel and aluminium. If I_S and I_A denote their moments of inertia about their diameters, then

A. $I_S = I_A$

B. $I_S > I_A$

C. $I_S < I_A$

D. none of the above

Answer: C

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39. A uniform metre scale of mass 0.2 kg is rotated about an axis passing through its one end and perpendicular to its length, at the rate of 60 revolutions/minute. What is its kinetic energy of rotation? $(\text{use } \pi^2 = 10)$

A. 3/4 J

B. 4/3 J

C. 2.5 J

D. 0.5 J

Answer: B

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40. Two loops P and Q are made from a uniform wire. The radii of P and Q are R_1 and R_2 respectively and their moments of inertia are I_P and I_Q respectively.

If $\frac{I_P}{I_Q} = 8$ then $\frac{R_1}{R_2}$ is

A. 5

B. 4

C. 3

D. 2

Answer: D

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41. The moment of inertia of a circular disc of mass M and radius R about an axis passing thrugh the center of mass is I_0. The moment of inertia of another circular disc of same mass and thickness but half the density about the same axis is

A. $\frac{I_0}{4}$

B. $\frac{I_0}{2}$

C. $2I_0$

D. $4I_0$

Answer: C

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42. A car is moving with a constant speed. The wheels of the car make 120 rotations per minute. The brakes are applied and the car comes to rest in 8 second. How many rotations are completed by the wheels, before the

car is brought to rest? (Assume that the brakes produce a constant retarding force)

A. 4

B. 6

C. 8

D. 10

Answer: C

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43. The ratio of the dimension of Planck's constant and that of moment of inertia is the dimension of

A. frequency

B. angular momentum

C. velocity

D. time

Answer: A

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44. Two circular discs A and B have equal masses and equal thicknesses but have densities d_1 and d_2 such that $d_1 > d_2$. Their moments of inertia are related as

A. $I_1 > I_2$

B. $I_1 < I_2$

C. $I_1 = I_2$

D. $I_1 > > I_2$

Answer: B

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45. A ody is in pure rotation. The linear speed v of a particle, the distance r of the particle from the axis and the angular velocity ω of the body are related as $\omega = \frac{v}{r}$. Thus

A. $\omega \propto \frac{1}{r}$

B. $\omega \propto r$

C. $\omega = 0$

D. ω is independent of r

Answer: D

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46. The moment of inertia of a copper disc, rotating about an axis passing through its centre and perpendicular to its plane

A. increases if its temperature is increased

B. changes if its axis of rotation is changed

C. increases if its angular velocity is increased

D. both (a) and (b) are correct

Answer: D

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47. Four point masses, each of value m, are placed at the corners of a square ABCD, having each side of length L. What is the moment of inertia of this system about an axis passing through A and parallel to the diagonal BD?

A. $3mL^2$

B. $2mL^2$

C. $\sqrt{3}mL^2$

D. mL^2

Answer: A

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48. If ρ is the density of its material, then its rotational K.E. is given by

A. $\frac{AL^3\rho\omega^2}{24}$

B. $\frac{AL^3\rho\omega^2}{6}$

C. $\frac{AL^2\rho\omega^2}{24}$

D. $\frac{AL^3\rho^2\omega}{24}$

Answer: A

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49. The density of a rod AB increases linearly from A to B its midpoint is O and its centre of mass is at C. four axes pass through A, B, O and C, all perpendicular to the length of the rod. The moment of inertial of the rod about these axes are I_A, I_B, I_O and I_C respectively.

A. $I_A > I_B$

B. $I_A < I_B$

C. $I_O < I_B$

D. $I_A < I_C$

Answer: A

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50. The diameter of a disc is increased by 2% without changing its mass. What is the percentage increase in its moment of inertia about its axis of symmetry?

A. 2%

B. 4%

C. 8%

D. 1%

Answer: B

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51. A molecule consists of two atoms each of mass m and separated by a distance d. If K is the average rotational K.E. of the molecule at particular temperature, then its angular frequency is

A. $\frac{2}{d}\sqrt{\frac{K}{m}}$

B. $\frac{d}{2}\sqrt{\frac{K}{m}}$

C. $2d\sqrt{\frac{m}{K}}$

D. $\frac{d}{4}\sqrt{\frac{m}{K}}$

Answer: A

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52. When a ceiling fan is switched off, its angular velocity reduces to 50% while it makes 36 rotations. How many more rotations will it make before coming to rest?(Assume uniform angular retardation)

A. 18

B. 16

C. 12

D. 10

Answer: C

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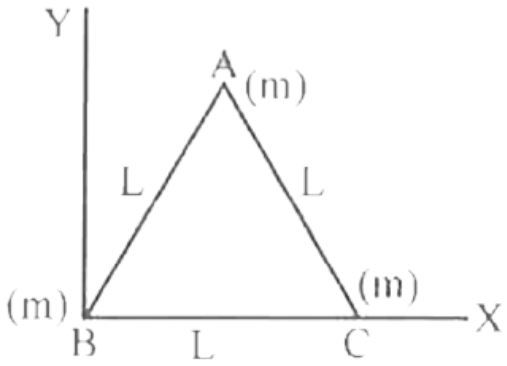
53. Three particles each of mass m gram are situated at the vertices of an equilateral triangle ABC of side L cm as shown in the figure.



The moment of inertia of the system about a line BY perpendicular to BC and in the plane ABC is

A. $\frac{3}{2}\mathrm{mL}^2\mathrm{gram}\text{ - }\mathrm{cm}^2$

B. $\frac{3}{2}\mathrm{mL}^2\mathrm{gram}\text{ - }\mathrm{cm}^2$

C. $\frac{5}{4}\mathrm{mL}^2\mathrm{gram}\text{ - }\mathrm{cm}^2$

D. $2\ \mathrm{mL}^2\mathrm{gram}\text{ - }\mathrm{cm}^2$

Answer: C

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54. Two discs A and B are mounted coaxiallay on a vertical axle. The discs have moments of inertia I and 2 I respectively about the common axis. Disc A is imparted an initial angular velocity 2ω using the entire potential energy of a spring compressed by a distance x_1 Disc B is imparted an angular velocity ω by a spring having the same spring constant and compressed by a distance x_2 Both the discs rotate in the clockwise

direction.

The ratio x_1 / x_2 is

A. 2

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

C. $\sqrt{2}$

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

Answer: C

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55. A hollow spere of mass M and radius R is rotating with angular frequency ω it suddenly stops rotating and 75% of kinetic energy is converted to heat if s is the speicific heat of the material in j / kg k then rise in temperature of the spere is (MI of hollow sphere $= \frac{2}{3}MR^2$

A. $\frac{R\omega}{4S}$

B. $\frac{R^2\omega^2}{4S}$

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

D. $\frac{R^2\omega^2}{2S}$

Answer: B

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56. A disc of moment of inertia $9.8/\pi^2 kgm^2$ is rotating at 600 rpm. If the frequency of rotation changes from 600 rpm to 300 rpm, then what is the work done ?

A. 1370 J

B. 1630 J

C. 1470 J

D. 1570 J

Answer: C

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57. An automobiles engine develops a power of 100 kilowatt, when rotating at a speed of 30 rev/sec. What torque does it deliver?

A. $\frac{1000}{3\pi}N-m$

B. $\frac{2000}{3\pi}N-m$

C. $\frac{5000}{3\pi}N-m$

D. $\frac{4000}{3\pi}N-m$

Answer: C

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58. The fly wheel of a motor has a moment of inertia of 90 $kg-m^2$. If the motor produces a constant torque of 270 N-m, then the angular acceleration produced in the fly wheel.

A. $3\ \mathrm{rad/s}^2$

B. $6\ \mathrm{rad/s^2}$

C. $9\ \mathrm{rad/s^2}$

D. $12\ \mathrm{rad/s^2}$

Answer: A

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59. If there a change in the angular momentum of a body from $5\ \mathrm{kg\text{-}m^2/s}$ to $8\ \mathrm{kg\text{-}m^2/s}$ in 4 seconds, then the torque acting on the body is

A. $1N - m$

B. $\frac{3}{4}N - m$

C. $\frac{1}{2}N - m$

D. $2N - m$

Answer: B

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60. A torque of magnitude 500 Nm acts on a body of mass 16 kg and produces and angular acceleration of $20\ \mathrm{rad/s^2}$. The radius of gyration of the body is

A. $\frac{5}{4}m$

B. $\frac{4}{5}m$

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

D. $\frac{3}{2}m$

Answer: A

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61. A constant torque of 31.4 Nm is applied to a pivoted wheel. If the angular acceleration of the wheel is $2\pi\ \mathrm{rad/s^2}$, then its moment of inertia is

A. $5\ \mathrm{kg\ m^2}$

B. $2.5\ \mathrm{kg\ m^2}$

C. $10\ \mathrm{kg\ m^2}$

D. $1.25\ \mathrm{kg\ m^2}$

Answer: A

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62. Under a constant torque, the angular momentum of a body changes from 2x to 5x in 8 sec. The torque acting on the body is

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

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

C. $\frac{3x}{8}$

D. $\frac{3x}{16}$

Answer: C

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63. A wheel has a moment of inertia of $5 \times 10^{-3} kgm^2$ and is making $20\,\mathrm{rev/s}$. What is the magnitude of the torque required to stop it in 10 s?

A. $1.5\pi \times 10^{-2} N.m$

B. $2\pi \times 10^{-2} N - m$

C. $3\pi \times 10^{-2} N - m$

D. $3.5\pi \times 10^{-2} N - m$

Answer: B

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64. A wheel having moment of inertia $2kgm^2$ about its vertical axis, rotates at the rate of $60r \pm$ about this axis. The torque which can stop the wheel's rotation in one minute would be

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

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

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

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

Answer: B

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65. A constant torque of $31.4N - m$ id exterted on a pivoted wheel. If the angular acceleration of the wheel is $4\pi rad/s^2$, then the moment of inertia will be.

A. $1.5\ \text{kg-m}^2$

B. $2.5\ \text{kg-m}^2$

C. $3.5\ \text{kg-m}^2$

D. $4.5\ \text{kg-m}^2$

Answer: B

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66. Torques of equal magnitude are applied to a thin hollow cylinder and a solid sphere, both having the same mass and radius. Both of them are free to rotate about their axis of symmetry. If α_c and α_s are the angular accelerations of the cylinder and the sphere respectively, then the ratio $\frac{\alpha_c}{\alpha_s}$ will be

A. $\frac{5}{2}$

B. $\frac{2}{5}$

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

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

Answer: B

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67. A torque of 100 N-m acting on a wheel at rest, rotates it through 200 radian in 10 s. What is the moment of inertia of the wheel?

A. $10\ \text{kg-m}^2$

B. $15\ \text{kg-m}^2$

C. $20\ \text{kg-m}^2$

D. $25\ \text{kg-m}^2$

Answer: D

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68. A toraue of magnitude 4000 N-m, acts on a body of mass 2 kg. If the angular acceleration produced in the body is $20\ \text{rad/s}^2$, then the radius of gyration of the body is

A. 5 m

B. 10 m

C. 15 m

D. 20 m

Answer: B

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69. A rope of negligible mass is wound around a hollow cylinder of mass 4 kg and radius 40 cm. What is the angular acceleration of the cylinder, if the rope is pulled with a force of 4N? Assume that there is no splipping.

A. $2\ \mathrm{rad/s^2}$

B. $1.5\ \mathrm{rad/s^2}$

C. $2.5\ \mathrm{rad/s^2}$

D. $3\ \mathrm{rad/s^2}$

Answer: C

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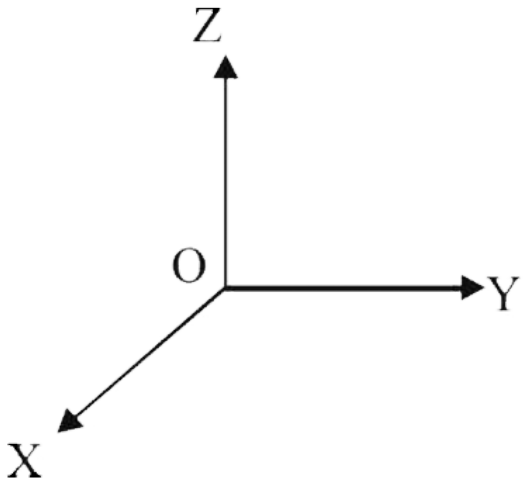
70. A force of $-F\hat{k}$ acts on O, the origin of the coodinate system. The torque about the point (1,-1) is



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

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

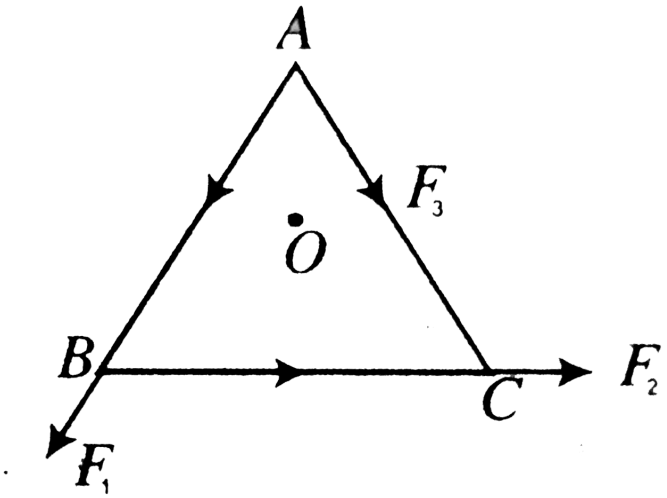
C. $F\left(\hat{i}+\hat{j}\right)$

D. $-F\left(\hat{i}+\hat{j}\right)$

Answer: C

Watch Video Solution

71. O is the centre of an equilateral triangle ABC. F_1, F_2 and F_3 are the three forces acting along the sides AB, BC and AC respectively. What should be the value of F_3 so that the total torque about O is zero?



A. $(F_1 - F_2)$

B. $(F_1 + F_2)$

C. $2(F_1 + F_2)$

D. $\frac{(F_1 + F_2)}{2}$

Answer: B

Watch Video Solution

72. Which one of the following relations is wrong?

A. Angular momentum $= M.I. \times$ Angular velocity

B. $\text{Force} = \text{Mass} \times \text{Acceleration}$

C. $\text{Moment of Inertia} = \text{Torque} \times \text{Angular acceleration}$

D. $\text{Torque} = \text{M.I} \times \text{Angular acceleration}$

Answer: C

Watch Video Solution

73. A toruque τ produces an angular acceleration in a body rotating about an axis of rotation. The moment of inertia of the body is increased by 50% by redistributing the masses, about the axis of rotation. To maintain the same angular acceleration, the torque is changed to τ'. What is the relation between τ and τ'?

A. $\tau' = \tau$

B. $\tau' = \frac{2}{3}\tau$

C. $\tau' = \frac{3}{2}\tau$

D. $\tau' = \frac{\tau}{2}$

Answer: C

Watch Video Solution

74. A costant torque of 400 N turns a flywheel at rest and of $\mathrm{M.I.}\ 100\ \mathrm{kgm}^2$ about an axis through its centre. What is the change in its angular velocity in 4 s?

A. 8 rad/s

B. 12 rad/s

C. 16 rad/s

D. 20 rad/s

Answer: C

Watch Video Solution

75. What is the power of an engine, if it applies a toque of 180 Nm, to rotate a rotor at a uniform angular speed of 100 rad/s?

A. 36 kW

B. 18 kW

C. 27 kW

D. 50 kW

Answer: B

Watch Video Solution

76. A rope is wound round a hollow cylinder of mass 5 kg and radius 0.5m. What is the angular acceleration of the cylinder if the rope is pulled with

a force of 20 Ngt

A. $4\ \mathrm{rad/s^2}$

B. $5\ \mathrm{rad/s^2}$

C. $6\ \mathrm{rad/s^2}$

D. $8\ \mathrm{rad/s^2}$

Answer: D

Watch Video Solution

77. The angular velocity of a body is given by

$\vec{\omega} = 3\hat{i} + 2\hat{j} + 3\hat{k}$

A torque $\vec{\tau} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ acts on it. Then the rotational power will be

A. 12 watt

B. 24 watt

C. 16 watt

D. 8 watt

Answer: B

Watch Video Solution

78. A ring and a disc of different masses are rotating with the same kinetic energy. If a retarding torque (τ) is applied to the ring, the ring stops after completing n rotations. If the same retarding torque is applied to the disc, how many rotations would it complete before coming to rest?

A. 2n

B. 4n

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

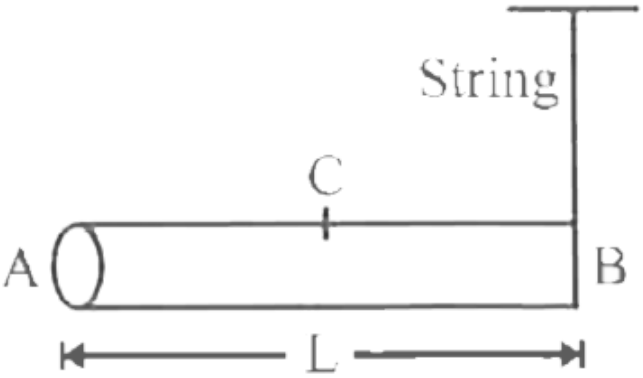
D. n

Answer: D

Watch Video Solution

79. A uniform rod AB of length L and and weight Mg is hinged at one end A. The rod is kept in the horizontal position by a massless string. If the string is cut, then the angular acceleration of the rod will be

$\left[\text{M.I. of the rod about A is } \frac{ML^2}{3}\right]$



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

B. $\frac{2g}{L}$

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

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

Answer: A

Watch Video Solution

80. Let $\vec{F}$ be the force acting on a particle having position vector $\vec{r}$ and $\vec{\tau}$ be the torque of this force about the origin. Then

A. $\vec{r} . \vec{\tau} \neq 0$ and $\vec{F} . \vec{\tau} \neq 0$

B. $\vec{r} . \vec{\tau} = \neq 0$ and $\vec{F} . \vec{\tau} = 0$

C. $\vec{r} . \vec{\tau} = \neq 0$ and $\vec{F} . \vec{\tau} \neq 0$

D. $\vec{r} . \vec{\tau} = 0$ and $\vec{F} . \vec{\tau} = 0$

Answer: D

View Text Solution

81. A rope is wound round a hollow cylinder of mass M and radius R. If the rope is pulled with a force F newton, then the angular acceleration of the cylinder will be

A. MRF

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

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

D. $\frac{F}{MR}$

Answer: D

Watch Video Solution

82. A wheel is at rest in the horizontal position. Its moment of inertia about a vertical axis passing through its centre is $15\,\mathrm{kgm}^2$. A constant torque of 300 N-m is now applied to it for 5 second. What is the change in its kinetic energy?

A. $3 \times 10^4 J$

B. $6.5 \times 10^4 J$

C. $7 \times 10^3 J$

D. $7.5 \times 10^4 J$

Answer: D

Watch Video Solution

83. A uniform disc of mass 500 kg and radius 2 metres is rotating at the rate of 600 rpm. What is the torque required to rotate the disc in the opposite direction with the same speed in a time of 100 seconds?

A. $600\pi Nm$

B. $500\pi Nm$

C. $400\pi Nm$

D. $300\pi Nm$

Answer: C

Watch Video Solution

84. A cord is wound round the circumference of wheel of radius r. The axis of the wheel is horizontal and fixed and moment of inertia about it is I. A weight mg is attached to the end of the cord and falls from rest. After falling through a distance h, the angular velocity of the wheel will be.

A. $[mgh]^{1/2}$

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

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

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

Answer: C

Watch Video Solution

85. A solid cylinder of mass $50kg$ and radius $0.5m$ is free to rotate about the horizontal axis. A massless string is wound round the cylinder with

one end attached to it and other end hanging freely. Tension in the string required to produce an angular acceleration of 2 revolution s^{-2} is

A. 78.5 N

B. 157 N

C. 25 N

D. 50 N

Answer: C

Watch Video Solution

86. A torque of 75 Nm acts on a body at rest for 4 s. What is the change in its angular momentum?

A. increases by $100\ \mathrm{kg\ m^2}/s$

B. decreases by $200\ \mathrm{kg\ m^2}/s$

C. increases by $200\ \mathrm{kg\ m^2}/s$

D. increases by $300\ \mathrm{kg\ m^2}/s$

Answer: D

Watch Video Solution

87. A ring of mass 10 kg and radius 0.2 m is rotating about its geometrical axis at 20 rev/sec. Its moment of inertia is

A. $0.2\ \mathrm{kg\text{-}m^2}$

B. $3.0\ \mathrm{kg\text{-}m^2}$

C. $0.4\ \mathrm{kg\text{-}m^2}$

D. $5.0\ \mathrm{kg\text{-}m^2}$

Answer: C

Watch Video Solution

88. A rod of length 2 m, has a mass of 0.12 kg. Its moment of inertia about an axis passing through its one end and perpendicular to the length of the rod is

A. $0.16\ \mathrm{kg}$ - m^2

B. $0.12\ \mathrm{kg}$ - m^2

C. $0.32\ \mathrm{kg}$ - m^2

D. $0.08\ \mathrm{kg}$ - m^2

Answer: A

Watch Video Solution

89. A uniform disc of mass 5 kg has a radius of 0.5 m. Its moment of inertia about an axis passing through a point on its circumference and perpendicular to its plane is

A. $1.25\ \mathrm{kg}$ - m^2

B. $0.5\ \text{kg - m}^2$

C. $4\ \text{kg - m}^2$

D. $1.875\ \text{kg - m}^2$

Answer: D

Watch Video Solution

90. A rod of length 2 m has a mass of 0.24 kg. Its moment of inerita about an axis passing through its centre and perpendicular to the length of the rod is

A. $0.04\ \text{kg - m}^2$

B. $0.08\ \text{kg - m}^2$

C. $0.12\ \text{kg - m}^2$

D. $0.02\ \text{kg - m}^2$

Answer: B

Watch Video Solution

91. A disc of mass 2 kg is rolling on a horizontal surface without slipping with a velocity of 0.1 m/s. What is its rotational kinetic energy?

A. $5 \times 10^{-3} J$

B. $2.5 \times 10^{-3} J$

C. $15 \times 10^{-3} J$

D. $8 \times 10^{-3} J$

Answer: A

Watch Video Solution

92. The moment of inertia of a circular disc about an axis passing through its centre and normal to its plane is $50\,\mathrm{kg}\text{-}\,\mathrm{m}^2$. Then its moment of inertia about a diameter is

A. $100\ \mathrm{kg}\text{-}\ \mathrm{m}^2$

B. $25\ \mathrm{kg}\text{-}\ \mathrm{m}^2$

C. $200\ \mathrm{kg}\text{-}\ \mathrm{m}^2$

D. $10\ \mathrm{kg}\text{-}\ \mathrm{m}^2$

Answer: B

Watch Video Solution

93. A solid sphere of mass 1 kg and radius 10 cm rolls without slipping on a horizontal surface, with a velocity of 20 cm/s. The total kinetic energy of the sphere is

A. 0.014 J

B. 0.028 J

C. 14 J

D. 28 J

Answer: B

Watch Video Solution

94. Two rings have their M.I. in the ratio 2:1. If their diameters are in the ratio of 2:1, then the ratio of their masses will be

A. $2:1$

B. $1:1$

C. $1:2$

D. $1:4$

Answer: C

Watch Video Solution

95. Two circular discs are of same thickness. The diameter of A is twice that of B. The moment of inertia of A as compared to that of B is

A. 4

B. 16

C. 8

D. 2

Answer: B

Watch Video Solution

96. The diameter of a thin circular disc of mass 2 kg is 0.2 m. Its moment of inertia about an axis passing through the edge and perpendicular to the plane of the disc is

A. $0.01\ \mathrm{kg}\text{-}\ \mathrm{m}^2$

B. $0.02\ \mathrm{kg}\text{-}\ \mathrm{m}^2$

C. $0.03\ \mathrm{kg}\text{-}\ \mathrm{m}^2$

D. $0.04\ \mathrm{kg}\text{-}\ \mathrm{m}^2$

Answer: C

Watch Video Solution

97. The radius of gyration of a disc of mass 100 g and radius 5 cm about an axis passing through its centre of gravity and perpendicular to the plane is

A. 0.5 cm

B. 2.5 cm

C. 3.54 cm

D. 6.45 cm

Answer: C

Watch Video Solution

98. The moment of inertia of a ring of mass 5 gram and radius 1 cm about and axis passing through its edge and parallel to its natural axis is

A. $5g - cm^2$

B. $2.5\ \mathrm{g}$ - cm^2

C. $20\ \mathrm{g}$ - cm^2

D. $10\ \mathrm{g}$ - cm^2

Answer: D

Watch Video Solution

99. The M.I. of a ring about an axis passing through its centre and perpendicular to its plane is $2\ \mathrm{kg}$ - m^2, then its M.I. about any diameter is

A. $3\ \mathrm{kg}$ - m^2

B. $1\ \mathrm{kg}$ - m^2

C. $4\ \mathrm{kg}$ - m^2

D. $2\ \mathrm{kg}\text{-}\ \mathrm{m}^2$

Answer: B

Watch Video Solution

100. M.I. of a thin uniform rod about the axis passing through its centre and perpendicular to its length is $ML^2/12$. The rod is cut transversely into two halves, which are then riveted end to end.M.I. of the composite rod about the axis passing through its centre and perpendicular to its length will be

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

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

C. $\frac{Ml^2}{48}$

D. $\frac{Ml^2}{24}$

Answer: C

Watch Video Solution

101. Find the moment of inertia of a solid cylinder of mass M and radius R about a line parallel to the axis of the cylinder and on the surface of the cylinder.

A. $\frac{2}{5}MR^2$

B. $\frac{3}{5}MR^2$

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

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

Answer: C

Watch Video Solution

102. The moment of inertia of a uniform thin rod of length L and mass M about an axis passing through a point at a distance of $L/3$ from one of its ends and perpendicular to the rod is

A. $\frac{ML^2}{9}$

B. $\frac{ML^2}{12}$

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

D. $\frac{ML^2}{5}$

Answer: A

Watch Video Solution

103. The moment of inertia of a metre scale of mass 0.6 kg about an axis perpendicular to the scale and passing through 30 cm position on the scale is given by (Breadth of'the scale is negligible)

A. $0.104\ \text{kg - m}^2$

B. $0.208\ \text{kg - m}^2$

C. $0.070\ \text{kg - m}^2$

D. $0.148\ \text{kg - m}^2$

Answer: A

Watch Video Solution

104. Two discs cone of density 7200 kg/m^3 and another of density $9000km/m^3$ have the same mass and thickness. What is the ratio of their moments of inertia?

A. $\frac{4}{5}$

B. $\frac{5}{4}$

C. $\frac{5}{9}$

D. $\frac{1}{9 \times 7.2}$

Answer: B

Watch Video Solution

105. A solid cylinder of mass 20 kg, has length 1 metre and radius 0.5 m. Then its moment of inertia in kgm^2 ? about its geometrical axis is

A. 2.5

B. 5

C. 1.5

D. 3

Answer: A

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106. Moment of inertia of a solid sphere of radius R and density p about its diameter is

A. $\frac{8}{3}\pi R^3\rho$

B. $\frac{8}{15}\pi R^4\rho$

C. $\frac{8}{15}\pi R^5\rho$

D. $\frac{15}{8}\pi R^3\rho^2$

Answer: C

Watch Video Solution

107. The moment of inertia of two spheres of equal masses about their diameters are equal. If one of them is solid and the other is hollow, then the ratio of their radii is

[M.I. of hollow sphere = $\frac{2}{3}MR_h^2$]

A. $5:3$

B. $3:5$

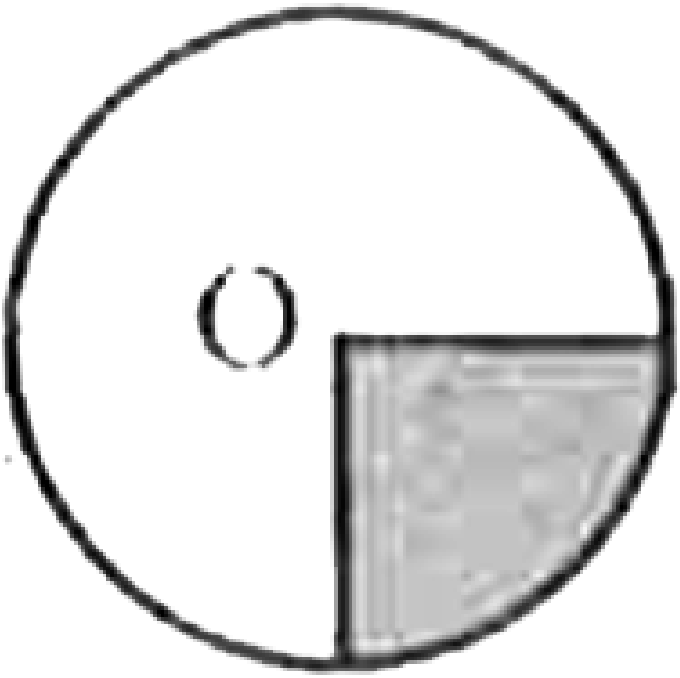
C. $\sqrt{5}:\sqrt{3}$

D. $\sqrt{3}:\sqrt{5}$

Answer: C

Watch Video Solution

108. The M.I. of a disc of mass M and radius R, about an axis passing through the centre O and perpendicular to the plane of the disc is $\frac{MR^2}{2}$. If one quarter of the disc is removed, the new moment of inertia of the disc will be



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

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

C. $\frac{3}{8}MR^2$

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

Answer: C

Watch Video Solution

109. A wire of mass m and length l is bent in the form of circular ring. The moment of inertia of the ring about its axis is

A. $4\pi^2 ML^2$

B. $\frac{ML^2}{8\pi^2}$

C. $8\pi^2 ML^2$

D. $\frac{ML^2}{4\pi^2}$

Answer: D

Watch Video Solution

110. Two solid spheres are made of the same material. The ratio of their diameters is 2: 1. The ratio of their moments of inertia about their respective diameters is

A. $1:4$

B. $8:1$

C. $32:1$

D. $16:1$

Answer: C

Watch Video Solution

111. The ratio of the radii of gyration of a circular disc and a circular ring of the same radii about a tangential axis perpendicular to plane of disc or ring is

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

B. $2:3$

C. $1:2$

D. $\sqrt{5}:\sqrt{6}$

Answer: A

Watch Video Solution

112. Two identical concentric rings each of mass m and radius R are placed perpendicularly. What is the moment of inertia of the system about the axis of one of the rings ?

A. $3MR^2$

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

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

D. $2MR^2$

Answer: B

Watch Video Solution

113. The M.I. of a solid sphere about its diameter is I. It is then casted into 8 small identical spheres. What is the M.I. of each small sphere about its diameter?

A. $\frac{1}{8}$

B. $\frac{1}{24}$

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

D. $\frac{1}{32}$

Answer: D

Watch Video Solution

114. Moment of inertia of a rod of mass M and length L about an axis passing through a point midway between centre and end is

A. $\frac{7ML^2}{12}$

B. $\frac{ML^2}{44}$

C. $\frac{7ML^2}{48}$

D. $\frac{7ML^2}{44}$

Answer: C

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115. The M.I. of a uniform disc about a diameter is I. Its M.I. about an axis perpendiçular to its plane and passing through a point on its rim is

A. 51

B. 61

C. I

D. 4I

Answer: B

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116. Moment of inertia of a ring of mass m = 3 gm and radius r = 1 cm about an axis passing through its edge and parallel to its natural axis is

A. $10\ \text{gram cm}^2$

B. $100\ \text{gram cm}^2$

C. $6\ \text{gram cm}^2$

D. $1\ \text{gram cm}^2$

Answer: C

Watch Video Solution

117. One quarter sector is cut from a uniform disc of radius 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. What is its moment of inertia about the axis of rotation ?

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

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

C. $\frac{MR^2}{4}$

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

Answer: D

Watch Video Solution

118. One solid sphere A and another hollow sphere B are of same mass and same outer radii. Their moment of inertia about their diameters are respectively I_A and I_B such that.

A. $I_A < I_B$

B. $\frac{I_A}{I_B} = \frac{d_A}{d_B}$

C. $I_A = I_B$

D. $I_A > I_B$

Answer: A

Watch Video Solution

119. Moment of inertia of a circular wire of mass M and radius R about its diameter is

A. MR^2

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

C. $\frac{MR^2}{4}$

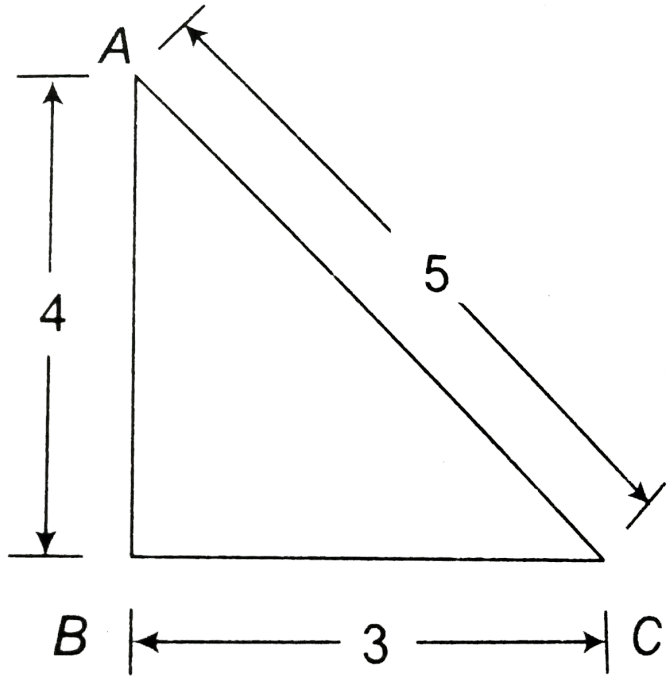
D. $2MR^2$

Answer: B

Watch Video Solution

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

the plate about AB, BC and CA repectively. Which one of the following relations is correct?



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

B. I_{CA} is maximum

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

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

Answer: D

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121. A solid cylinder has mass M radius R and length / its moment of inertia about an axis passing through its centre and perpendicular to its own axis is

A. $\frac{2MR^2}{3}+\frac{Ml^2}{12}$

B. $\frac{MR^2}{3}+\frac{Ml^2}{12}$

C. $\frac{3MR^2}{4}+\frac{Ml^2}{12}$

D. $\frac{MR^2}{4}+\frac{Ml^2}{12}$

Answer: D

Watch Video Solution

122. What is the moment of inertia of a solid of density ρ and radius R about its diameter ?

A. $\frac{176}{105}R^5\rho$

B. $\frac{176}{105}R^2\rho$

C. $\frac{105}{176}R^5\rho$

D. $\frac{105}{176}R^2\rho$

Answer: A

Watch Video Solution

123. The moment of inertia of a thin circular disc of mass M and radius R about any diameter is

A. $\frac{MR^2}{4}$

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

C. MR^2

D. $2MR^2$

Answer: A

Watch Video Solution

124. A circular disc of mass M and radius R is suspended from a nail in the wall. The nail is fixed very near to the rim of the disc. The moment of inertia of the disc about an axis along the nail is

A. MR^2

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

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

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

Answer: C

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125. The radius of gyration of a body about an axis at a distance of 6 cm from the centre of mass is 10 cm. What is its radius of gyration about a parallel axis through its centre of mass?

A. K = 4 cm

B. K = 6 cm

C. K =10 cm

D. K = 8 cm

Answer: D

Watch Video Solution

126. The ratio of the radii of gyration of a circular disc and a circular ring of the same radii about a tangential axis perpendicular to plane of disc or ring is

A. $1:2$

B. $2:3$

C. $3:4$

D. $\sqrt{5}:\sqrt{6}$

Answer: D

Watch Video Solution

127. Two rings have the same mass (m) and radius (r). They are placed in such away that their centres are at a common point and their planes are perpendicular to each other. What is the moment of inertia of the system about an axis passing through their centre and perpendicular to the plane of one of the ring ?

A. mr^2

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

C. $2mr^2$

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

Answer: B

Watch Video Solution

128. The M.I. of a uniform semicircular disc of mass M and radius R about a line perpendicular to the plane of the disc and passing through the centre is

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

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

C. MR^2

D. $\frac{3}{4}MR^2$

Answer: A

Watch Video Solution

129. The M.I. of a uniform rod about a perpendicular axis passing through one of its ends is I_1 . The same rod is bent into a ring and its moment of inertia about a diameter is I_2. Then $\frac{I_1}{I_2}$ is

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

B. $\frac{4\pi^2}{3}$

C. $\frac{8\pi^2}{3}$

D. $\frac{16\pi^2}{3}$

Answer: C

Watch Video Solution

130. Two spheres of equal masses, one of which is a thin spheical shelll and the other a solid, have the same moment of inertia about their respective diameters. The ratio of their radii well be

A. $3:5$

B. $\sqrt{3}:\sqrt{5}$

C. $\sqrt{3}:\sqrt{7}$

D. $5:7$

Answer: B

Watch Video Solution

131. Two circular rings A and B of radii nR and R are made from the same wire. The Ml of A about an axis passing through the centre and perpendicular to the plane of A is 27 times that of the smaller loop B. What is the value of n if the length of A = n (length of B) ?

A. 2

B. 3

C. 4

D. 5

Answer: B

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132. Bodies of regular geometrical shape were allowed to roll on a horizontal surface. It was found that for one rolling body, die

translational KE was equal to rotational KE, the body must be

A. a solid sphere

B. a hollow sphere

C. a disc

D. a thin ring

Answer: D

Watch Video Solution

133. A circular disc of radius R and thickness $R/6$ has moment of inertia I about an axis passing through its centre and perpendicular to its plane. It is melted and recast into a solid sphere. The $M.I$ of the sphere about its diameter as axis of rotation is

A. $\frac{I}{100}$

B. $\frac{2I}{8}$

C. I

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

Answer: D

Watch Video Solution

134. Ler I be the moment of inertia of a uniform square plate about an axis AB that passes through its centre and is parallel to two of its sides. CD is a line in the plane of the plate that passes through the centre of the plate and makes an angle θ with AB. The moment of inertia of the plate about the axis CD is then equal to

A. $I\cos^2\theta$

B. I

C. $I\cos^2\left(\frac{\theta}{2}\right)$

D. $I\sin^2\theta$

Answer: B

Watch Video Solution

135. A thin rod of length L and mass M is bent at its midpoint into two halves so that the angle between them is 90°. The moment of inertia of the bent rod about an axis passing through the bending point and perpendicular to the plane defined by the two halves of the rod is.

A. $\frac{ML^2}{6}$

B. $\frac{\sqrt{2}ML^2}{24}$

C. $\frac{ML^2}{24}$

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

Answer: D

Watch Video Solution

136. Consider a uniform square plate of side 'a' and mass 'm' The moment of inertia of heis plate about an axis perpendiucalar to its plane and passing through one of its corners is

A. $\frac{7}{12}ma^2$

B. $\frac{1}{12}ma^2$

C. $\frac{5}{6}ma^2$

D. $\frac{2}{3}ma^2$

Answer: D

Watch Video Solution

137. A thin uniform rod of length l and mass m is swinging freely about a horizontal axis passing through its end. Its maximum angular speed is ω. Its centre of mass rises to a maximum height of -

A. $\frac{1}{3}\frac{l^2\omega^2}{g}$

B. $\frac{1}{6}\frac{l\omega}{g}$

C. $\frac{1}{2}\frac{l^2\omega^2}{g}$

D. $\frac{1}{6}\frac{l^2\omega^2}{g}$

Answer: D

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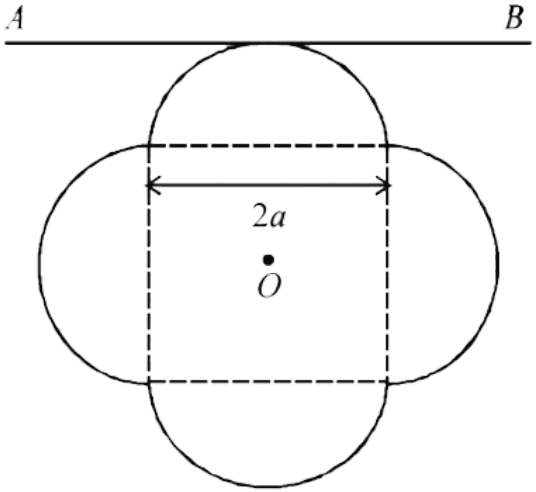
138. A symmetric lamina of mass M consists of a square shape with a semicircular section over of the edge of the square as shown in fig. p-10. The side of the square is 2a. The moment of inertia of the lamina about an axis through its centre of mass and perpendicular to the plane is $1.6Ma^2$. The moment of inertia of the lamina is .....



A. $2.4Ma^2$

B. $3.6Ma^2$

C. $4.8Ma^2$

D. $6.00Ma^2$

Answer: C

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139. The moment of inertia of a hollow sphere of mass M having internal and external radii R and $2R$ about an axis passing through its centre and perpendicular to its plane is

A. $\frac{13}{32}MR^2$

B. $\frac{31}{35}MR^2$

C. $\frac{62}{35}MR^2$

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

Answer: C

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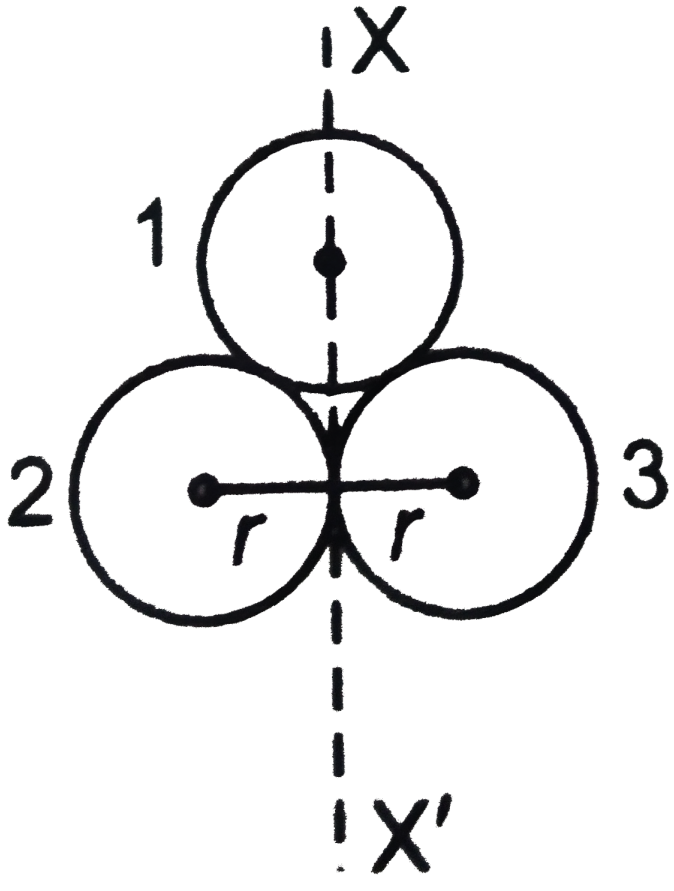
140. Three idential spherical shells each of mass m and radius r are placed as shown in Fig. Consider an axis XX' which is touching the two shells and passing through diameter of third shell. Moment of Inertia of the system consisting of these three spherical shells about XX' as axis is :



A. $3mr^2$

B. $\frac{16}{5}mr^2$

C. $4mr^2$

D. $\frac{11}{5}mr^2$

Answer: C

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141. A solid sphere of mass M and radius R having tmoment of inertia I about its diameter is recast into a solid dise of radius r and thickness t. The moment of inertia of the disc about an axis passing the edge and perpendicular to the plane remains I. Then R and r are related as

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

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

C. $r = \sqrt{\frac{2}{15}}R$

D. $r = \frac{2}{15}R$

Answer: B

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142. Moment of inertia of a disc about an axis which is tangent and parallel to its plane is I . Then the moment of inertia of disc about a tangent, but perpendicular to its plane will be

A. $\frac{5}{6}I$

B. $\frac{6}{5}I$

C. $\frac{3}{4}I$

D. $\frac{3}{2}I$

Answer: B

Watch Video Solution

143. The moment of inertia of a solid sphere about an axis passing through its centre of gravity is $\frac{2}{5}MR^2$. What is its radius of gyration about a parallel axis at a distance 2R from the first axis ?

A. $\frac{5}{2}R$

B. $5R$

C. $\sqrt{\frac{12}{5}}R$

D. $\sqrt{\frac{22}{5}}R$

Answer: D

Watch Video Solution

144. Two uniform circular discs A and B of radii R and 4R with thicknesses x and x/4 respectively, rotate about their axes passing through their centres and perpendicular to their planes. If the M.I. of the first disc is I_A and that of the second disc is I_B then

A. $I_A = I_B$

B. $I_A > I_B$

C. $I_B > I_A$

D. Data is insufficient

Answer: C

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145. The moment of inertia of a uniform rod about a perpendicular axis passing through one end is I_1. The same rod is bent into a ring and its moment of inertia about a diameter is I_2. Then I_1 / I_2 is

A. $\frac{5\pi}{3}$

B. $\frac{8\pi^2}{3}$

C. $\frac{5\pi}{3}$

D. $\frac{8\pi^2}{5}$

Answer: B

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146. When a torque acting on a system is increased, then which óne of the following quantities will increase? (a) linear momentum (b) Angular momentum (c) force (d) Displacement

A. linear momentum

B. Angular momentum

C. force

D. Displacement

Answer: B

Watch Video Solution

147. If L is the angular momentum and I is the moment of inertia of a rotating body, then $\frac{L_2}{21}$ represents

A. rotational potential energy

B. total energy

C. rotational kinetic energy

D. translational kinetic energy

Answer: C

Watch Video Solution

148. A disc of mass 4 kg and radius 0.2 m, makes 20 rev/s, about an axis passing through its centre and perpendicular to the plane of the disc. The angular momentum of the disc is approximately equal to

A. $10\ \text{kg-m}^2/\text{sec}$

B. $5\ \text{kg-m}^2/\text{sec}$

C. $15\ \text{kg-m}^2/\text{sec}$

D. $20\ \text{kg-m}^2/\text{sec}$

Answer: A

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149. A disc of mass M and radius r is rotating with an angular velocity ω. If gently, two masses m each are placed at a distance $r/2$ on either side of the axis of rotation, what will be the new angular velocity ?

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

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

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

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

Answer: C

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150. A particle of mass 0.75 kg is moving in the XY plane parallel to Y-axis, with a uniform speed of 4 m/s. It crosses the X-axis at 3 m from the origin. What is the angular momentum of the particle about the origin?

A. $3\ \mathrm{kg\ m^2}/s$

B. $9\ \mathrm{kg\ m^2}/s$

C. $6\ \mathrm{kg\ m^2}/s$

D. $1.5\ \mathrm{kg\ m^2}/s$

Answer: B

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151. A body of mass 2 kg is rotating on a circular path of radius 0.5 m, with an angular velocity of 20 rad/s. If the radius of the path is doubled, then the new angular velocity will be

A. 5 rad/sec

B. 2.5 rad/sec

C. 10 rad/sec

D. 8 rad/sec

Answer: A

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152. A circular disc rotates about an axis passing through its centre with a certain angular velocity. Suddenly a small piece of the disc is broken from the edge and falls down. Then

A. Its M.I will increase and angular velocity will decrease

B. Its M.I will decrease and the angular velocity will increase

C. Both the M.I. and the angular velocity will increase

D. Both the M.I and the angular velocity will decrease

Answer: B

Watch Video Solution

153. A body of mass m and radius of gyration K has an angular momentum L. Then its angular velocity is

A. $\frac{mK^2}{L}$

B. $\frac{L}{mK^2}$

C. mK^2K

D. $\frac{K^2}{mL}$

Answer: B

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154. A man standing on a rotating horizontal circular table, suddenly sits down. What is conserved in this process ?

A. kinetic energy

B. angular speed

C. angular momentum

D. linear momentum

Answer: C

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155. A particle performs a uniform circular motion with angular momentum L. If its angular frequency is halved and the rotational kinetic energy is doubled, then the new angular momentum will be

A. $2L$

B. $3L$

C. $4L$

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

Answer: C

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156. A thin circular ring of mass M and radius R is rotating in a horizontal plane about an axis vertical to its plane with a constant angular velocity ω. If two objects each of mass m be attached gently to the opposite ends of a diameter of the ring, the ring will then rotate with an angular velocity

A. $\frac{M+2m}{M\omega_1}$

B. $\frac{M\omega_1}{M+2m}$

C. $\frac{\omega_1(M+2m)}{M}$

D. $\frac{\omega_1(m+2M)}{2m}$

Answer: B

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157. A round disc of moment of inertia I_2 about its axis perpendicular to its plane and passing through its centre is placed over another disc of moment of inertia I_1 rotating with an angular velocity ω about the same axis. The final angular velocity of the combination of discs is.

A. $\frac{(I_1 + I_2)\omega_1}{I_1}$

B. $\frac{I_1\omega_1}{I_1 + I_2}$

C. ω_1

D. $\frac{I_2\omega_1}{I_1 + I_2}$

Answer: B

Watch Video Solution

158. If the earth were to suddenly contract to $1/n^{th}$ of its present radius without any change in its mass, the duration of the new day will be nearly

A. $24n^2\text{hour}$

B. $\frac{24}{n^2}$ hour

C. 24 n hour

D. $\frac{24}{n}$ hour

Answer: B

Watch Video Solution

159. A car of mass 1200 kg is travelling around a circular path of radius 250 m with a steady speed of 72 km/hour. What is its angular momentum ?

A. $3 \times 10^6 \ \text{kg m}^2/s$

B. $4 \times 10^6 \ \text{kg m}^2/s$

C. $5 \times 10^6 \ \text{kg m}^2/s$

D. $6 \times 10^6 kgm^2/s$

Answer: D

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160. The moment of inertia of a disc rotating about an axis passing through its centre and perpendicular to its axis is $20kgm^2$. If its rotational K.E. is 10 J, then its angular momentum will be

A. $10\ \mathrm{kg\ m^2}/s$

B. $15\ \mathrm{kg\ m^2}/s$

C. $20\ \mathrm{kg\ m^2}/s$

D. $25\ \mathrm{kg\ m^2}/s$

Answer: C

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161. A solid cylinder of moment of inertia $0.625kgm^2$, rotates about its axis with an angular speed of 200 rad/s. What is the magnitude of angular momentum of the cylinder about its axis ?

A. $25\ \mathrm{kg\ m^2/s}$

B. $12.5\ \mathrm{kg\ m^2/s}$

C. $62.5\ \mathrm{kg\ m^2/s}$

D. $125\ \mathrm{kg\ m^2/s}$

Answer: D

Watch Video Solution

162. A man standing at the centre of a rotating table, with his hands stretched outwards. The table is rotating at the rate of 30 rev/minute. If the man brings his hands towards his chest and thereby reduces his moment of inertia to $\frac{3}{5}$ times of its original moment of inertia, then the number of revolutions performed by the rotating table per minute will be

A. 25

B. 30

C. 40

D. 50

Answer: D

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163. If the mass of the earth remains constant but the duration of the day reduces from 24 hours to 6 hours, then the relation between its new and original radii (R_2 and (R_1) is given by

A. $R_2 = 2R_1$

B. $R_2 = \frac{R_1}{2}$

C. $R_2 = \frac{R_1}{3}$

D. $R_2 = 3R_1$

Answer: B

Watch Video Solution

164. A uniform metre scale of mass 0.2 kg is rotated about an axis passing through its one end and perpendicular to its length at the rate of 60 revolutions/minute. What is its angular momentum?

A. $\frac{2\pi}{15}\ \text{kg m}^2/s$

B. $\frac{4\pi}{15}\ \text{kg m}^2/s$

C. $\frac{\pi}{15}\ \text{kg m}^2/s$

D. $1\ \text{kg m}^2/s$

Answer: A

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165. A swimmer while jumping into water from a height easily forms a loop in air, if

A. he keeps himself straight

B. he spreads his arms and legs

C. he pulls his arms and legs in

D. he juinps, making an angle of 45° with the horizontal

Answer: C

Watch Video Solution

166. A ballet dancer revolved at 24 r.p.m. with her hands folded. If she stretches her hands so that her M.I. increases by 20%, then the new frequency of rotation will be

A. 18 r.p.m.

B. 20 r.p.m.

C. 22 r.p.m.

D. 24 r.p.m.

Answer: B

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167. An electron revolves around the nucleus of an atom in a circular orbit of radius 4 Å with a speed of $5 \times 10^6 m/s$. What is the angular momentum of the electron ? $[m_e = 9 \times 10^{-31} kg]$.

A. 2×10^{-33} $\mathrm{kg\,m^2/s}$

B. 1.8×10^{-33} $\mathrm{kg\,m^2/s}$

C. 3×10^{-32} $\mathrm{kg\,m^2/s}$

D. 0.8×10^{-34} $\mathrm{kg\,m^2/s}$

Answer: B

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168. The moments of inertia of two rotating bodies A and B are I_A and I_B. $(I_A > I_B)$ and their angular momenta are equal. Which one has greater $K.E.$?

A. $K_1 = K_2$

B. $K_1 < K_2$

C. $K_1 > K_2$

D. $K_1 = \frac{1}{2}K$

Answer: B

Watch Video Solution

169. 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 momenta will be in the ratio.

A. $2:1$

B. $1:2$

C. $\sqrt{2}:1$

D. $1:\sqrt{2}$

Answer: D

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170. A particle is moving in a circular orbit of radius r_1 with an angular velocity ω_1 It jumps to another circular orbit of radius r_2 and attains an angular velocity ω_2 . If $r_2 = 0.5r_1$, and if no external torque is applied to the system, then the new angular velocity ω_2 is given by

A. $\omega_2 = \omega_1$

B. $\omega_2 = 2\omega_1$

C. $\omega_2 = 3\omega_1$

D. $\omega_2 = 4\omega_1$

Answer: D

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171. A solid sphere is rotating in a free space. If the radius of the sphere is increased, keeping the mass same, which one of the following will not be

affected ?

A. Angular velocity

B. Moment of inertia

C. Angular momentum

D. Rotational kinetic energy

Answer: C

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172. The angular speed of a body changes from ω_1 to ω_2 without applying a torque but due to change in its moment of inertia. The ratio of radii of gyration in the two cases is :-

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

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

C. $\omega_2 : \omega_1$

D. $\omega_1 : \omega_2$

Answer: A

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173. A solid sphere is rotating about a diameter at an angular velocity ω. If it cools so that its radius reduces to $1/n$ of its original value, its angular velocity becomes

A. $n^2\omega$

B. $n\omega$

C. $\frac{\omega}{n^2}$

D. $\frac{\omega}{n}$

Answer: A

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174. A person with outstretched arms, is spinning on a rotating stool. He suddenly brings his arms down to his sides. Which of the following is true about his kinetic energy K and angualr momentum L?

A. K remains constant, L increases

B. K increases but L remains constant

C. Both K and L remain unchanged

D. Both K and L increase

Answer: B

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175. r denotes the distance between the sun and the earth. Assume that the earth moves around the sun in a circular orbit of radius r. The angular momentum of the earth around the sun is proportional to

A. r

B. r^3

C. $\sqrt{r}$

D. r^2

Answer: C

Watch Video Solution

176. A body of moment of inertia `2kg-m^(2) has a rotational kinetic energy of 4 J. What is the angular momentum of the body ?

A. $\sqrt{2}\ \ \mathrm{kg\,m^2/s}$

B. $2\ \ \mathrm{kg\,m^2/s}$

C. $4\ \ \mathrm{kg\,m^2/s}$

D. $8\ \ \mathrm{kg\,m^2/s}$

Answer: C

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177. A thin horizontal circular disc is rotating about a vertical axis passing through its centre. An insect is at rest at a point near the rim of the disc. The insect now moves along a diameter of the disc to reach other end. During the journey of the insect, the angular speed of the disc

A. remains unchanged

B. continuously decreases

C. continuously increases

D. first increases and then decreases

Answer: D

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178. A particle undergoes uniform circular motion. About which point on the plane of the circle, will the angular momentum of the particle remain conserved?

A. centre of the circle

B. on the circumference of the circle

C. inside the circle

D. outside the circle

Answer: A

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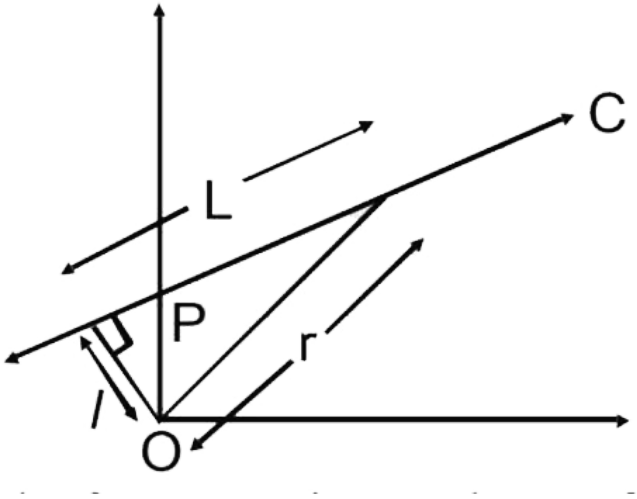
179. A particle of mass m moves along line PC with velocity v as shown. What is the angular momentum of the particle about P?



A. mvl

B. mvr

C. zero

D. mvl

Answer: C

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180. A thin circular ring of mass M and radius R is rotating about its axis with a constant angular velocity omega. 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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181. A uniform metallic rod rotates about its perpendicular bisector with constant angualr speed. If it is heated uniformly to raise its temperature slightly, then

A. its speed of rotation increases

B. its speed of rotation decreases

C. its speed of rotation remains same

D. its speed increases because its moment of inertia increases

Answer: B

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182. By keeping moment of inertia of a body constant, if we double the time period, then angular momentum of body

A. doubles

B. quadruples

C. remains constant

D. becomes half

Answer: D

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183. Two rotating bodies A and B have the same angular momentum. But M.I. (I_1) of A is more than the M.I. (I_2) of B. Which body has higher kinetic energy of rotation?

A. Body A

B. Body B

C. Both will have the same kinetic energy

D. Not possible to decide because the data is not sufficient

Answer: B

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184. If the radius of the earth contracts to half of its present value without change in its mass, what will be the new duration of the day?

A. 3 hour

B. 12 hour

C. 6 hour

D. 48 hour

Answer: C

Watch Video Solution

185. A particle is made to move in circular path with decreasing speed. Which of the following is correct ?

A. Its acceleration $\vec{a}$ is towards the centre

B. It moves in a spiral path with decreasing radius

C. Only the direction of its angular momentum remains constant

D. Its angular momentum (L) about the centre is conserved

Answer: C

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186. A horizontal platform is rotating with uniform angular velcity around the vertical axis passing through its centre. At some instant of time a viscous fluid of mass m is dropped at the centre and is allowed to spread out and finally fall. The angular velocity during this period :

A. decreases continuously

B. increases continuously

C. does not change

D. decreases initially and increases again at the end

Answer: D

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187. A solid cylinder of mass 10 kg and radius 20 cm is free to rotate about its axis. It receives an angular impulse of $4kgm^2rad/s$. What is the angular speed of the cylinder if the cylinder is initially at rest ?

A. 20 rad/s

B. 15 rad/s

C. 10 rad/s

D. 5 rad/s

Answer: A

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188. A circular disc of mass M and radius R is rotating with angular velocity ω . If two small spheres each of mass m are gently attached to two diametrically opposite points on the edge of the disc, then the new angular velocity of the disc will be

A. $\left(\frac{M+4m}{M}\right)\omega$

B. $\left(\frac{M}{M+4m}\right)\omega$

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

D. $\left(\frac{M}{M+2m}\right)\omega$

Answer: B

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189. A particle of mass m is moving in a plane along a circular path of radius r. Its angular momentum about the axis of rotation is L. The

centripetal force acting on the particle is.

A. $\frac{L^2}{mr}$

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

C. $\frac{L^2}{mr^3}$

D. $\frac{L^2 m}{r^3}$

Answer: C

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190. A particle with the position vector r has linear momentum p. Which of the following statements is true is respect of its angular momentum L about the origin ?

A. $\vec{L}$ acts along $\vec{r}$

B. $\vec{L}$ acts along $\vec{P}$

C. L is maximum when $\vec{P}$ and $\vec{r}$ are parallel

D. L is maximum when $\overrightarrow{P}$ is perpendicular to $\overrightarrow{r}$

Answer: D

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191. A unit mass has $\overrightarrow{r} = 8\hat{i} - 4\hat{j}$ and $\overrightarrow{v} = 8\hat{i} + 4\hat{j}$ What is its angular momentum ?

A. $64\hat{k}$ unit

B. $64\hat{j}$ unit

C. $64\hat{i}$ unit

D. $32\hat{k}$ unit

Answer: A

Watch Video Solution

192. The moments of inertia of two rotating bodies A and are I_A and $I_B(I_A > I_B)$. If their angular momenta are equal then.

A. $K_A = K_B$

B. $K_A > K_B$

C. $K_A < K_B$

D. $K_A = \frac{K_B}{2}$

Answer: B

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193. Angular momentum of the particle rotating with a central force is constant due to

A. zero torque

B. constant force

C. constant force

D. constant linear momentum

Answer: A

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194. A particle is moving in the xy-plane with a constant velocity along a line parallel to the X-axis away from the origin. The magnitude of its angular momentum about the origin.

A. is zero

B. goes on increasing as x is increased

C. goes on decreasing as x is increased

D. remains constant for all positions of the particle

Answer: D

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195. If all the ice on the polar caps of the earth melts, due to global warming then the duration of the day will be

A. 24 hour

B. more than 24 hour

C. less than 24 hour

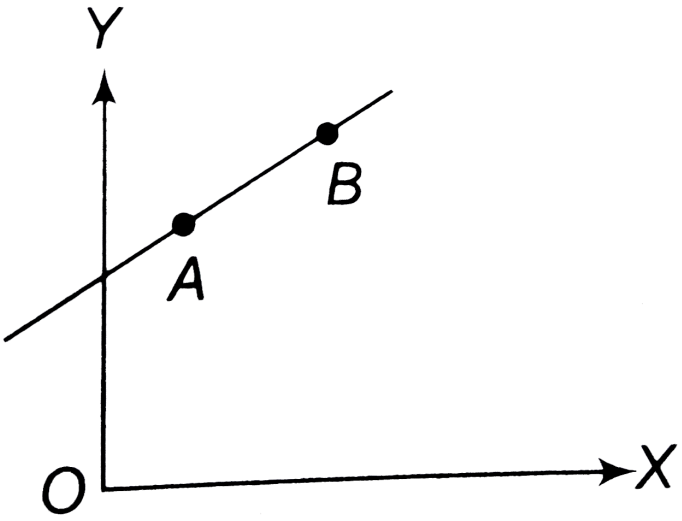
D. 12 hour

Answer: B

Watch Video Solution

196. A particle of mass m moves in the XY plane with a velocity v along the straight line AB. If the angular momentum of the particle with

respect to origin O is L_A when it is at A and L_B when it is at B, then



A. $L_A > L_B$

B. $L_A = L_B$

C. the relationship between L_A and L_B depends upon the slope of the line AB

D. $L_A < L_B$

Answer: B

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197. The position of a particle is given by $\vec{r} = \left(\hat{i} + 2\hat{j} - \hat{k}\right)$ and momentum $\vec{p} = \left(3\hat{i} + 4\hat{j} - 2\hat{k}\right)$. The angular momentum is perpendicular to the

A. X-axis

B. Y-axis (c)

C. Z-axis

D. Any one of these axes

Answer: A

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198. A one kg stone attached to the end of a 60 cm chain is revolving at the rate of 3 revolutions/second. It is found that after 30 second, it makes only one revolution per second. What is the mean torque ?

A. 0.35 N-m

B. 0.15 N-m

C. 0.25 N-m

D. 0.45 N-m

Answer: B

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199. If the earth suddenly contracts to one third of its present size without any change in its mass, the ratio of the kinetic energies of the earth after and before contraction will be

A. 9

B. 8

C. 7

D. 3

Answer: A

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200. If the mass of the earth is kept constant and its radius is made half, then the duration of the day will be

where T is the present duration of the day.

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

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

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

D. $\frac{3T}{4}$

Answer: C

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201. The angular momentum (L) of the earth revolving round the sun uis proportional to r^n, where r is the orbital radius of the earth. The value of n is (assume the orbit to be circular)

A. 1

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

C. 2

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

Answer: D

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202. A stone of mass m tied to the end of a string, is whirled around in a horizontal circle. (Neglect the force due to gravity). The length of the string is reduced gradually keeping the angular momentum of the stone about the centre of the circle constant. Then, the tension in the string is

given by $T = Ar^n$ where A is a constant, r is the instantaneous radius of the circle and n=....

A. -2

B. -1

C. 1

D. -3

Answer: D

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203. A uniform horizontal circular platform of mass $200kg$ is rotating at 10 rpm about a vertical axis passing through its center. A boy of mass $50kg$ is standing at its edge. If the boy moves to the center of the platform, the frequency of rotation would become

A. 12.5 rpm

B. 7.5 rpm

C. 20 rpm

D. 15 rpm

Answer: D

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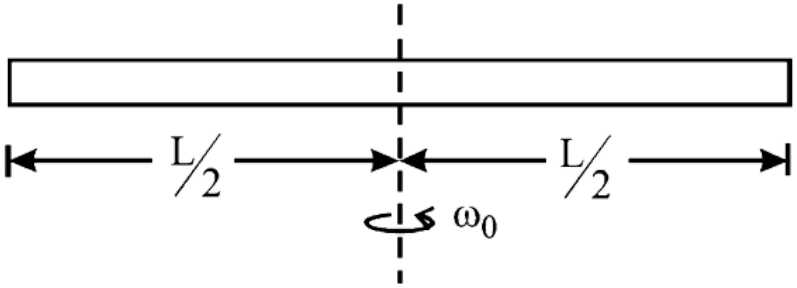
204. A smooth uniform rod of length L and mass M has two identical beads of negligible size each of mass m which can slide freely along the rod. Initially the two beads are at the centre of the rod and the system is rotating with an angular velocity ω_0 about an axis perpendicular to the rod and passing through the midpoint of the rod. There are no external forces. When the beads reach the ends of the rod, the angular velocity of

the system is .....



A. $\left(\frac{M}{M+m}\right)\omega_0$

B. $\left(\frac{M}{M+6m}\right)\omega_0$

C. $\left(\frac{M+m}{M}\right)\omega_0$

D. $\left(\frac{M+6m}{2M}\right)\omega_0$

Answer: B

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205. A child is standing with folded hands at the center of a platform rotating about its central axis. The kinetic energy of the system is K. The child now stretches his arms so that the moment of inertia of the system doubles. The kinetic energy of the system now is

A. K

B. 2K

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

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

Answer: C

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206. A diatomic molecule has moment of inertia I. By applying Bohr's quantisation condition, its rotational energy in the nth level (n = 0 is not allowed) is

A. $\frac{1}{n^2}\left(\frac{h^2}{8\pi^2 I}\right)$

B. $\frac{1}{n}\left(\frac{h^2}{8\pi^2 I}\right)$

C. $n\left(\frac{h^2}{8\pi^2 I}\right)$

D. $n^2\left(\frac{h^2}{8\pi^2 I}\right)$

Answer: D

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207. The position of a particle is given by $\vec{r} = \hat{i} + 2\hat{j} - \hat{k}$ and its momentum is $\vec{p} = 3\hat{i} + 4\hat{j} - 2\hat{k}$. The angular momentum is perpendicular to

A. y-axis

B. z-axis

C. yz plane

D. x-axis

Answer: D

Watch Video Solution

208. Two rigid bodies A and B rotate with rotational kinetic energies E_A and E_B respectively. The moments of inertia of A and B about the axis of rotation are I_A and I_B respectively. If $I_A = I_B/4$ and E_(A)= 100 E_(B), the ratio of angular momentum (L_(A)) of A to the angular momentum (L_(B)) of B is

A. 5

B. 25

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

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

Answer: A

Watch Video Solution

209. A solid sphere rolls down a smooth inclined plane of height h. If it stats from rest then the speed of the sphere when it reaches the bottom is given by

A. $\sqrt{gh}$

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

C. $\sqrt{\frac{4}{7}gh}$

D. $\sqrt{\frac{5}{4}gh}$

Answer: B

Watch Video Solution

210. A sphere of moment of inertia I rolls down a smooth inclined plane. The ratio of its translation K.E. to the total energy is

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

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

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

D. $\frac{3}{5}$

Answer: C

Watch Video Solution

211. A solid cylinder rolls down a smooth inclined plane 4.8 m high without slipping. What is its linear speed at the foot of the plane, if it starts rolling from the top of the plane? (use $g = 10m/s^2$)

A. 4 m/s

B. 2 m/s

C. 10m/s

D. 8 m/s

Answer: D

Watch Video Solution

212. A disc at rest, gets an angular velocity of 40 rad/s, in 5 second, under constant angular acceleration. Through what angle the disc is turned during this time?

A. 50 radian

B. 75 radian

C. 100 radian

D. 25 radian

Answer: C

Watch Video Solution

213. If P is the power supplied to a rotating body, having moment of inertia I and angular acceleration α , then its instantaneous angular velocity is given by

A. $\omega = \frac{PI}{\alpha}$

B. $\omega = \frac{P}{I\alpha}$

C. $\omega = \Pi\alpha$

D. $\omega = \frac{I}{P\alpha}$

Answer: B

Watch Video Solution

214. A solid cylinder of mass 1 kg and radius 0.02 m, is rolling on a smooth horizontal surface with a uniform velocity of 0.1 m/s. Its total energy is

A. $7.5 \times 10^{-3} J$

B. $7.5 \times 10^{-2} J$

C. $7.5 \times 10^{-4} J$

D. $7.5 \times 10^{-6} J$

Answer: A

Watch Video Solution

215. A sphere is rolling on a horizontal surface without slipping. The ratio of the rotational K.E. to the total kinetic energy of the sphere is

A. $\frac{2}{5}$

B. $\frac{2}{7}$

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

D. $\frac{3}{7}$

Answer: B

Watch Video Solution

216. A solid sphere of mass 1 kg and radius 10 cm rolls without slipping on a horizontal surface, with a velocity of 20 cm/s. The total kinetic energy of the sphere is

A. 0.014 J

B. 0.028 J

C. 14 J

D. 28 J

Answer: B

Watch Video Solution

217. A solid cylinder and a solid sphere, both having the same mass and radius, are released from a rough inclined plane of inclination θ one by one. They roll on the inclined plane without slipping. The force of friction that acts

A. on the two bodies is the same

B. on the sphere is less than that for a cylinder

C. on the sphere is more than that for a cylinder

D. on the two bodies is independent of their sizes and shapes

Answer: B

Watch Video Solution

218. A ball rolls without slipping. The radius of gyration of the ball about an axis passing through its centre of mass is k. If radius of the ball be R, then the fraction of total energy associated with its rotation will be.

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

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

C. $K^2 + R^2$

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

Answer: A

Watch Video Solution

219. Two bodies of different masses $2kg$ and $4kg$ are moving with velocities $2m/s$ and $10m/s$ towards each other due to mutual gravitational attraction. Then the velocity of the centre of mass is

A. 6 m/s

B. Zero

C. 5 m/s

D. 8 m/s

Answer: B

Watch Video Solution

220. The center of mass of a system of two particles divides the distance between them.

Watch Video Solution

221. A disc of mass 4.8 kg and radius 1 m is rolling on a horizontal surface without sliding with angular velocity of 600 rotations/min. What is the total kinetic energy of the disc ?

A. $1440\pi^2 J$

B. $360J$

C. $600\pi^2 J$

D. $4000\pi^2 J$

Answer: A

Watch Video Solution

222. Four particles, each of mass $1kg$ are placed at the corners of a square $OABC$ of side $1m$. O is at the origin of the coordinate system. OA and OC are aligned along positive X-axis and positive Y-axis respectively. The position vector of the centre of mass is (in m)

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

B. $\hat{i}+\hat{j}$

C. $\frac{1}{2}\left(\hat{i}-\hat{j}\right)$

D. $\frac{1}{2}\left(\hat{i}+\hat{j}\right)$

Answer: D

Watch Video Solution

223. A metre scale of mass M is standing vertically on a horizontal table on one of its ends. It now falls on the table without slipping. The velocity with which the free end of the metre scale strikes the table is

[Given : $I=\frac{ML^2}{3}$ and $g=10m/s^2$]

A. $\sqrt{20}m/s$

B. $\sqrt{15}m/s$

C. $\sqrt{30}m/s$

D. $\sqrt{10}m/s$

Answer: C

Watch Video Solution

224. The total energy of rolling ring of mass m and radius R is

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

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

C. mv^2

D. $\frac{5}{2}mv^2$

Answer: C

Watch Video Solution

225. If a body is rolling on a surface without slipping such that its kinetic energy of translation is equal to kinetic energy of rotation then it is a

A. disc

B. sphere

C. cylinder

D. ring

Answer: D

Watch Video Solution

226. What is the ratio of the rolling kinetic energy and rotational kinetic energy in the motion of a disc ?

A. $1:1$

B. $2:7$

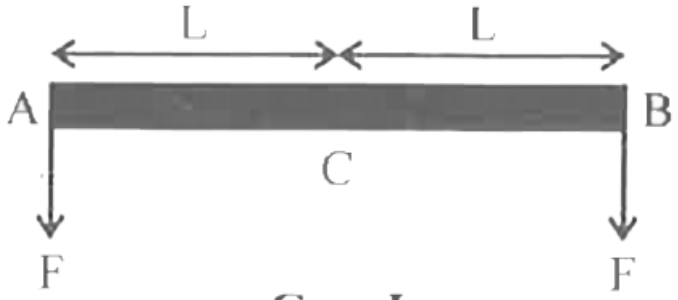
C. $1:2$

D. $3:1$

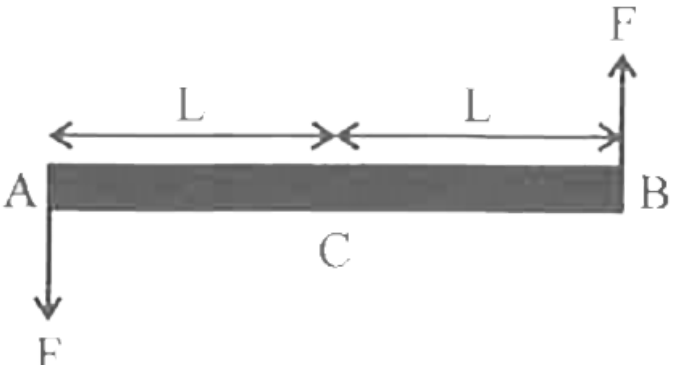
Answer: D

Watch Video Solution

227. A light rod AB of length 2L is acted upon by two forces at their ends as shown in the following figures. These two forces have the same magnitude. In which case the rod is in rotational equilibrium ?



Case I



A. II only

B. Both I and II

C. Neither nor II

D. I only

Answer: A

View Text Solution

228. Two paricle A and B initially at rest, move towards each other under 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 of the system is

A. Zero

B. v

C. 1.5 v

D. 3 v

Answer: A

Watch Video Solution

229. Two blocks of masses 10 kg and 4 kg are connected by a spring of negligible mass and placed on a frictionless horizontal surface. An impulse gives a velocity of $14m/s$ to the heavier block in the direction of the lighter block. The velocity of the centre of mass is

A. 5 m/s

B. 10 m/s

C. 20 m/s

D. 30 m/s

Answer: B

Watch Video Solution

230. 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. zero

B. data is insufficient

C. twice that of the centre of mass

D. equal to that of the centre of mass

Answer: D

Watch Video Solution

231. Three identicle particle each of mass $1kg$ are placed with their centres on a straight line. Their centres are marked A, B and C respectively. The distance of centre of mass of the system from A is.

A. $\frac{AB + AC}{2}$

B. $\frac{AB + BC}{2}$

C. $\frac{AC - AB}{3}$

D. $\frac{AB + AC}{3}$

Answer: D

Watch Video Solution

232. A thin uniform circular ring is rolling down an inclined plane of inclination 30° without slipping. Its linear acceleration along the inclined plane is :

A. g

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

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

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

Answer: D

Watch Video Solution

233. A solid sphere, a hollow sphere and a dise are released from the top of a frictionless inclined plane so that they slide down the inclined plane (without rolling). The maximum acceleration down the plane is

A. for the solid sphere

B. for the hollow sphere

C. for the disc

D. the same for all bodies

Answer: D

Watch Video Solution

234. A thin rod of mass m and length l is hinged at the lower end to a level floor and stands vertically. Then its upper end will strike the floor with a velocity given by:

A. $\sqrt{mgL}$

B. $\sqrt{2gl}$

C. $\sqrt{3gl}$

D. $\sqrt{5gl}$

Answer: C

Watch Video Solution

235. A solid sphere, resting at the top of a smooth inclined plane of inclination 30° with the horizontal, rolls down the plane and reaches the bottom, which is at 15.75 m from the top. How much time it will take to reach the bottom ?

A. 2 s

B. 2.5 s

C. 3 s

D. 4 s

Answer: C

Watch Video Solution

236. Four point masses P, Q, R and S with respective masses 1 kg, 1 kg, 2 kg and 2 kg form the corners of a square of side a. The centre of mass of the system will be farthest from

A. R and S

B. R only

C. P and Q

D. P and R

Answer: C

Watch Video Solution

237. Two wheels of radii 10 cm and 30 cm are connected to each other by a belt. What is the ratio of the moment of inertia of the larger wheel to that of the smaller wheel, when both of them have the same angular momentum?

A. 2

B. 3

C. 4

D. 5

Answer: B

Watch Video Solution

238. Two masses M and m are attached to a vertical axis by weightless threads of combined length l . They are set in rotational motion in a horizontal plane about this axis with constant angular velocity ω . If the

tensions in the threads are the same during motion, the distance of M from the axis is

A. $\left(\frac{M+m}{m}\right)l$

B. $\left(\frac{M+m}{M}\right)l$

C. $\left(\frac{M}{M_m}\right)l$

D. $\left(\frac{M}{M+m}\right)l$

Answer: D

Watch Video Solution

239. A metre scale is standing vertically on a horizontal table on one of its end. It now falls on the table without slipping. The velocity with which the free end of the metre scale strikes the table is

$\left[\text{Given } I = \frac{mL^2}{3}\right]$

A. 9.8 m/s

B. 1 m/s

C. 4.5 m/s

D. 5.4 m/s

Answer: D

Watch Video Solution

240. A solid cylinder of mass M and radius R rolls down an inclined plane of height h without slipping. The speed of its centre when it reaches the bottom is.

A. $\sqrt{2gh}$

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

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

D. $\sqrt{\frac{4g}{h}}$

Answer: B

Watch Video Solution

241. A wheel of bicycle is rolling without slipping on a level road. The velocity of the centre of mass is v_{CM}, then true statement is

A. The velocity of point A is $2v_{cm}$ and velocity of point B is zero

B. The velocity of point A is zero ánd velocity of point B is $2v_{cm}$

C. The velocity of point A is $2v_{cm}$ and velocity of point B is $-v_{cm}$

D. The velocities of both A and B are v_{cm}

Answer: A

Watch Video Solution

242. A solid sphere of radius R is placed on a smooth horizontal surface. A horizontal force F is applied at height h from the lowest point. For the maximum acceleration of the centre of mass

A. h = R

B. h = 2R

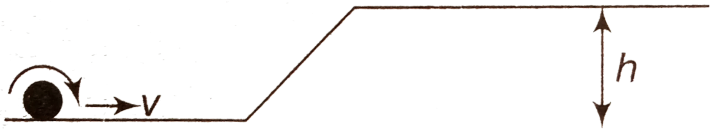
C. h = 0

D. h may be anywhere, as accelertion does not depend upon h

Answer: D

Watch Video Solution

243. A solid sphere is rolling on a frictionless surface, shown in figure with a translational velocity vm/s. If it is to climb the inclined surface then v should be :



A. $2gh$

B. $\frac{10}{7}gh$

C. $> \sqrt{2gh}$

D. $\geq \sqrt{\frac{10}{7}gh}$

Answer: D

Watch Video Solution

244. Two spheres of unequal masses but of the same radii are released from the top of a smooth inclined plane. They roll down the plane without slipping. Which one will reach the bottom first?

A. Both will reach the bottom at the the same time

B. Heavier sphere

C. Lighter sphere

D. None of the above

Answer: A

Watch Video Solution

245. When a uniform solid sphere and a disc of the same mass and of the same radius roll down an inclined smooth plane from rest to the same distance, then ratio of the time taken by them is

A. $15^2 : 14^2$

B. $15 : 14$

C. $\sqrt{14} : \sqrt{15}$

D. $14 : 15$

Answer: C

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246. A solid cylinder rolls down an inclined plane of height $3m$ and reaches the bottom of plane with angular velocity of $2\sqrt{2} rad / s$. The radius of cylinder must be [take $g = 10m / s^2$]

A. $\sqrt{5}m$

B. $\sqrt{10}cm$

C. 10 cm

D. 0.5 cm

Answer: A

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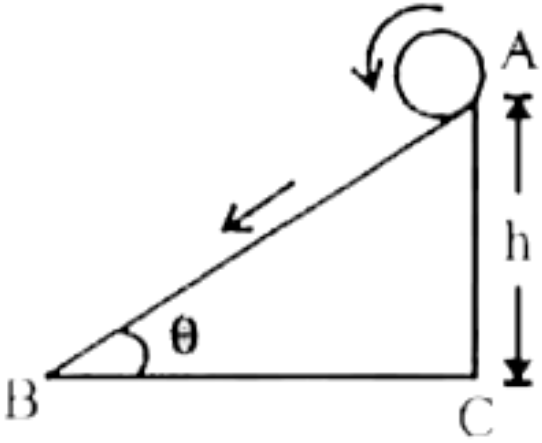
247. A solid sphere of mass M and radius R, rolling down a smooth inclined plane, without slipping, reaches the bottom with a velocity v. What is the height of the inclined plane in terms of the velocity v ?



A. $\frac{2v^2}{5g}$

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

C. $\frac{7v}{10g}$

D. $\frac{7v^2}{10g}$

Answer: D

Watch Video Solution

248. A round uniform body of radius R, mass M and moment of inertia 'I' rolls down (without slipping) and inclined plane making an angle θ with the horizontal. Then its acceleration is.

A. $\frac{g\sin\theta}{1+\frac{MR^2}{I}}$

B. $\frac{g\sin\theta}{1-\frac{1}{MR^2}}$

C. $\frac{g\sin\theta}{1-\frac{MR^2}{I}}$

D. $\frac{g\sin\theta}{1+\frac{1}{MR^2}}$

Answer: D

Watch Video Solution

249. A solid cylinder rolls up an inclined plane of angle of inclination 30°. At the bottom of the inclined plane, the centre of mass of the cylinder has a speed of $5m/s$.

(a) How far will the cylinder go up the plane ? (B) How long will it take to return to the bottom ?

A. $\frac{10}{4}m$

B. $\frac{3}{10}m$

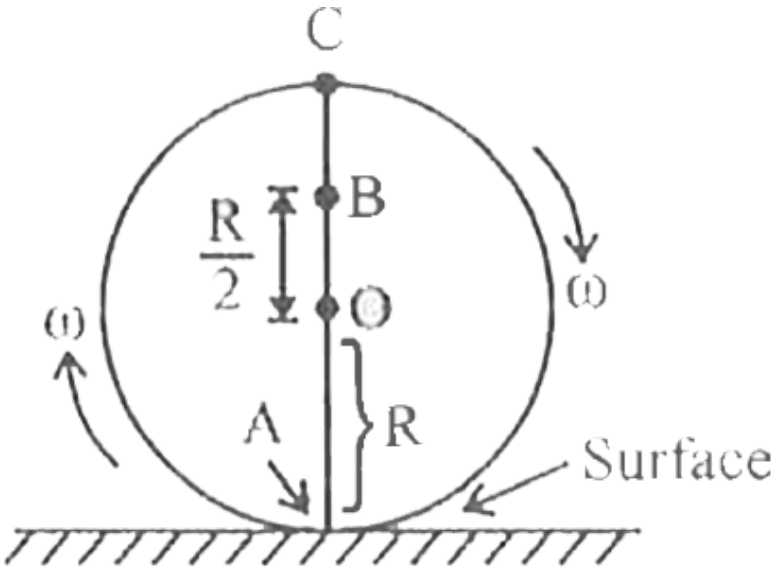
C. $\frac{4}{13}m$

D. $\frac{15}{4}m$

Answer: D

Watch Video Solution

250. A uniform disc of radius R is rolling (without slipping) on a horizontal surface with an angular speed ω as shown in the figure. O is the centre of the disc, points A and C are R. located on its rim and point B is at a distance $\frac{R}{2}$ from O. During rolling, the points A, B and C come on the vertical diameter at a certain instant of time. If $v_A v_B$ and v_C are the linear speeds of points A, Band C respectively at that instant, then



A. $v_A 0, v_C = \frac{4}{3} v_B$

B. $v_A = 0, v_C = 2v_B$

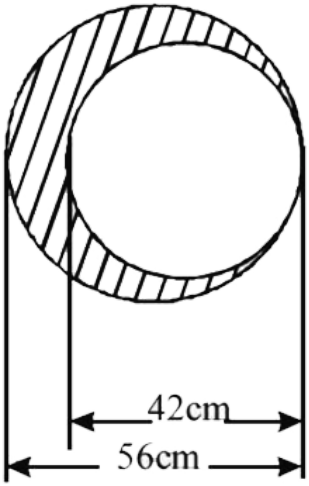
C. $v_A = v_B = v_C$

D. $V_A > v_B > v_C$

Answer: A

View Text Solution

251. A circular plate of uniform thickness has a diameter fo 56cm. A circular portion of diameter 42 cm is removed from one edge of the plate as shown in figure. Find the position of the centre of mass of the remaining portion.



A. 9 cm

B. 7 cm

C. 5 cm

D. 4 cm

Answer: A

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252. In a CO molecule, the distance between C $(\text{mass} = 12\ \text{a.m.u.})$ and O $(\text{mass} = 16\ \text{a.m.u.})$, where $1\ \text{a.m.u.} = \frac{5}{3} \times 10$

, is close to

(Given : $I_{CO} = 1.87 \times 10^{-46} kgm^2$)

A. $2.4 \times 10^{-10} m$

B. $1.9 \times 10^{-10} m$

C. $1.3 \times 10^{-10} m$

D. $4.4 \times 10^{-11} m$

Answer: C

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253. Two solid cylinders P and Q of same mass and same radius start rolling down a fixed inclined plane from the same height at the same time. Cylinder P has most of its mass concentrated near its surface, while Q has most its mass concentrated near the axis. Which statement(s) is (are) correct?

A. Both cylinders P and Q reach the ground at the same time

B. Cylinder P has larger linear acceleration than cylinder

C. Both cylinders reach the ground with same translational kinetic energy

D. Cylinder Q reaches the ground with larger angular speed

Answer: D

Watch Video Solution

254. A solid sphere, disc and solid cylinder, all of the same mass, are allowed to roll down (from rest) on inclined plane, them

A. disc will reach the bottom first

B. solid sphere reaches the bottom first

C. solid sphere reaches the bottom last

D. all reach the bottom at the same time

Answer: B

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255. 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 center of mass when the cylinder reaches its bottom

A. $\sqrt{4gh}$

B. $\sqrt{2gh}$

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

D. $\sqrt{\frac{4}{2}gh}$

Answer: D

Watch Video Solution

256. The ratio of the accelerations for a solid sphere (mass m, and $radius R$) rolling down an incline of angle θ without slipping, and slipping down the incline without rolling is

A. $2:5$

B. $7:5$

C. $5:7$

D. $2:3$

Answer: C

Watch Video Solution

257. A uniform solid sphere rolls on a horizontal surface at 20 m/s. It, then, rolls up a plane inclined at `

A. 16 m

B. 20 m

C. 28 m

D. 36 m

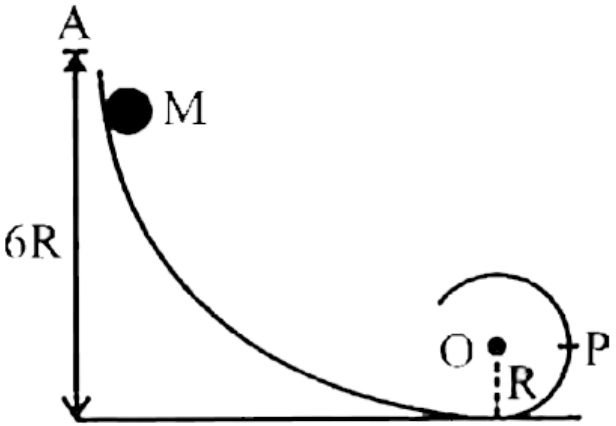
Answer: C

Watch Video Solution

258. Figure shows a loop track whose lower part ends into a circular track of radius R and centre O.

A small solid sphere of mass M rolls without slipping along the loop track from the end A at a height 6R from the bottom of the track. What is the

horizontal force acting on the sphere, when it rises up to the point P in level with the centre O of the circular part ?



A. $\frac{30}{7}Mg$

B. $\frac{40}{7}Mg$

C. $\frac{50}{7}Mg$

D. $\frac{60}{7}Mg$

Answer: C

Watch Video Solution

259. An object of radius R and mass M is rolling horizontally without slipping with speed v . It then rolls up the hill to a maximum height $h = \frac{3v^2}{4g}$. The moment of inertia of the object is (g = acceleration due to gravity)

A. $\frac{2}{5}mR^2$

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

C. mR^2

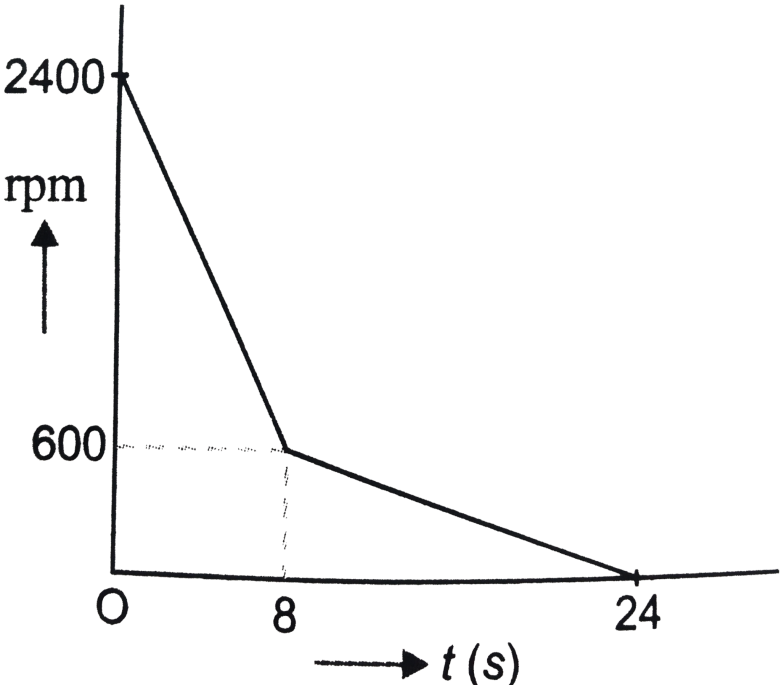
D. $\frac{3}{2}mR^2$

Answer: B

Watch Video Solution

260. A table fan rotating at a speed of 2400 rpm is switched off and the resulting variation of the revolution/minute time is shown in Fig. The

total number of revolutions of the fan before it comes to rest is



A. 190

B. 380

C. 420

D. 280

Answer: D

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261. If L is the angular momentum and I is the moment of inertia of a rotating body, then $\frac{L^2}{2I}$ represents its

A. Rotational K.E.

B. Total energy (c)

C. Rotational P.E.

D. Translational K.E.

Answer: A

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262. A thin wire of length L and uniform linear mass density ρ is bent into a circular loop with centre at O as shown in the figure. What is the moment of inertia of the loop anout the axis XX'?

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

B. $\frac{8\pi^2}{3\rho L^3}$

C. $\frac{3\rho L^3}{8\pi^2}$

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

Answer: C

Watch Video Solution

263. Moment of inertia of a rod of mass M and length L about an axis passing through a point midway between centre and end is

A. $\frac{48}{7}ML^2$

B. $\frac{7}{48}ML^2$

C. $\frac{1}{48}ML^2$

D. $\frac{1}{16}ML^2$

Answer: B

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264. The kinetic energy of a rotating body depends upon

A. distribution of mass only

B. angular specd only

C. distribution of mass and the angular speed

D. angular acceleration only

Answer: C

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265. A whel of M.I. = $1kg - m^2$ is rotating at an angular speed of 40 rad/s. Due to friction on the axis, the wheel comes to rest in 10 minute. What is the angular momentum of the wheel inkgm^2/s two minutes before it comes to rest ?

A. 3

B. 5

C. 6

D. 8

Answer: D

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266. A body of moment of inertia 5 kgm^2 rotating with an angular velocity 6 rad/s has the same kinetic energy as a mass of 20 kg moving with a velocity of .....

A. 5 m/s

B. 4 m/s

C. 3 m/s

D. 2 m/s

Answer: C

Watch Video Solution

267. A ring and a disc roll on the horizontal surface without slipping with same linear velocity. If both have same mass and total kinetic energy of the ring is 4 J then total kinetic energy of the disc is

A. 3 J

B. 4 J

C. 5 J

D. 6 J

Answer: A

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268. A disc of radius 'R' and thickness has moment of $\frac{R}{6}$ has moment of inertia 'I' about an axis passing through its centre and perpendicular to its plane. The disc is melted and recast into a solid sphere. The moment

of inertia of the sphere about its diameter is

A. $\frac{I}{5}$

B. $\frac{I}{6}$

C. $\frac{I}{32}$

D. $\frac{I}{64}$

Answer: A

View Text Solution

269. Let M be the mass and L be the length of a thin uniform rod. In first case, axis of rotation is passing through centre and perpendicular to the length of the rod. In second case, axis of rotation is passing through one end and perpendicular to the length of the rod. The ratio of radius of gyration in first case to second case is

A. 1

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

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

D. $\frac{1}{8}$

Answer: B

Watch Video Solution

270. A wheel of moment of inertia $2kgm^2$ is rotating about an axis passing through centre and perpendicular to its plane at a speed $60rad/s$. Due to friction, it comes to rest in 5 minutes. The angular momentum of the wheel three minutes before it stops rotating is

A. $24\ \mathrm{kg\ m^2/s}$

B. $48\ \mathrm{kg\ m^2/s}$

C. $72\ \mathrm{kg\ m^2/s}$

D. $96\ \mathrm{kg\ m^2/s}$

Answer: C

Watch Video Solution

271. A solid sphere of mass 2 kg is rolling on a frictionless horizontal surface with velocity $6m/s$. It collides on the free and of an ideal spring whose other end is fixed. The maximum compression produced in the spring will be

(Force constant of the spring = 36 N/m)

A. $\sqrt{14}m$

B. $\sqrt{2.8}m$

C. $\sqrt{1.4}m$

D. $\sqrt{0.7}m$

Answer: B

Watch Video Solution

272. A flywheel at rest is to reach an angular velocity of 24 rad/s in 8 second with constant angular acceleration. The total angle turned through during this interval is

A. 24 rad

B. 48 rad

C. 72 rad

D. 96 rad

Answer: D

Watch Video Solution

273. A ceiling fan rotates about its own axis with some angular velocity. When the fan is switched off, the angular velocity becomes $\left(\frac{1}{4}\right)$th of the original in time 't' and 'n' revolutions are made in that time. The number f revolutions made by the fan during the time interval between switch of and rest are (Angular retardation is uniform)

A. $\frac{4n}{15}$

B. $\frac{8n}{15}$

C. $\frac{16n}{15}$

D. $\frac{32n}{15}$

Answer: C

Watch Video Solution

274. A disc of the moment of inertia $'l_1'$ is rotating in horizontal plane about an axis passing through a centre and perpendicular to its plane with constant angular speed $'\omega_1'$. Another disc of moment of inertia $'I_2'$. having zero angular speed is placed discs are rotating disc. Now, both the discs are rotating with constant angular speed $'\omega_2'$. The energy lost by the initial rotating disc is

A. $\frac{1}{\left[\frac{I_1+I_2}{I_1I_2}\right]\omega_1^2}$

B. $\frac{1}{2}\left[\frac{I_1-(2)}{I_1-I_2}\right]\omega_1^2$

C. $\frac{1}{2}\left[\frac{I_1 - I_2}{I_1 I_2}\right]\omega_1^2$

D. $\frac{1}{2}\left[\frac{I_1 I_2}{I_1 + I_2}\right]\omega_1^2$

Answer: D

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Test Your Grasp 3

1. A flywheel of mass 4 kg has a radius of gyration of 0.1 m . If it makes 4 revolutions/sec , then its rotational K.E. is

$(\text{use } \pi^2 = 10)$

A. 8 J

B. 6.4 J

C. 12.8 J

D. 16 J

Answer:

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2. A body of moment of inertia of $3kgm^2$ rotating with an angular velocity or 2rad//s has the same kinetic energy as a mass of 12kg moving with a velocity of

A. 8 m/s

B. 4 m/s

C. 2 m/s

D. 1 m/s

Answer:

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3. Three point masses m_1, m_2 and m_3 are located at the vertices of an equilateral triangle of side α. What is the moment of inertia of the system about an axis along the altitude of the triangle passing through m_1 ?

A. $I = (m_1 + m_2 + m_3)L^2$

B. $I = (m_1 + m_2)\frac{L^2}{2}$

C. $I = (m_2 + m_3)L^2$

D. $I = (m_2 + m_3)\frac{L^2}{4}$

Answer:

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4. A wheel initially at rest, is rotated with a uniform angular acceleration. The wheel rotates through an angleθ_1 in first one second and through an additional angle θ_2 in the next one second. The ratio θ_2 / θ_1 is :

A. $1:2$

B. $1:3$

C. $1:4$

D. $2:5$

Answer:

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5. A thin rod of mass m and length $2L$ is made to rotate about an axis passing through its center and perpendicular to it. If its angular velocity changes from O to ω in time t, the torque acting on it is

A. $\frac{ml^2\omega}{12t}$

B. $\frac{ml^2\omega}{t}$

C. $\frac{ml^2\omega}{3t}$

D. $\left(4ml^2\omega\right)$

Answer:

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6. An iron rod of mass M and length L is cut into n equal parts by cutting it perpendicular to its length. If I is the M.I. of the rod, about an axis passing through its centre and perpendicular to its axis, then the moment of interia of each part about the similar axis

A. $\frac{I}{n}$

B. $\frac{I}{n^2}$

C. $\frac{I}{n^3}$

D. $\frac{1}{n^4}$

Answer:

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7. About which axis would the moment of inertia of a body be minimum ?

A. the central axis

B. any diameter

C. a tangent to the disc in its own place

D. a tangent perpendicular to the plane of the disc

Answer:

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8. If I is the moment of Inertia and E is the kinetic energy of rotation of a body , then its angular momentum is given by

A. $\sqrt{El}$

B. $\sqrt{2El}$

C. $\frac{E}{I}$

D. $2EI$

Answer:

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