KINEMETICS OF ROTATIONAL MOTION

1. Which of the following pairs do not match :-
(1) rotational power-Joule/sec (2) torque-Newton meter
(3) angular displacement-radian (4) angular acceleration-radian/sec

2. All the particles of a rigid rotating body move in a circular path when the axis of rotation:-
(1) passes through any point in the body (2) is situated outside the body
(3) situated any where (4) passes through the centre of mass

3. On account of the earth rotating about its axis :-
(1) the linear velocity of objects at equator is greater than at other places.
(2) the angular velocity of objects at equator is more than that of objects at poles.
(3) the linear velocity of objects at all places at the earth is equal, but angular velocity is different.
(4) at all places the angular velocity and linear velocity are uniform.

4. The quantity not involved directly in rotational motion of the body is
(1) moment of inertia (2) torque
(3) angular velocity (4) mass

MOMENT OF INERTIA

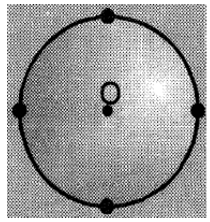
5. The moment of inertia of a body about a given axis of rotation depends upon :-
(1) the distribution of mass
(2) distance of particle of body from .the axis of rotation
(3) shape of the body
(4) all of the above

6. A fly wheel is so constructed that almost whole of its mass is concentrated at its rim, because:-
(1) it increases the moment of inertia of the flywheel
(2) it decreases the moment of inertia of the flywheel
(3) it increases the speed of the fly-wheel
(4) it increases the power of the fly-wheel

7. The moment of inertia of a solid cylinder about its own axis is the same as its moment of inertia about an axis passing through its centre of gravity and perpendicular to its length. The relation between its length L and radius R is
(1) $L = \sqrt{2}\,R$ (2) $L = \sqrt{3}\,R$ (3) L = 3R (4) L = R

8. The wheels of moving vehicles are made hollow in the middle and thick at the periphery, because
(1) it gives minimum moment of inertia to the tyre
(2) its shape is a strong one
(3) this increases the speed
(4) it increases moment of inertia of tyre

9. Four similar point masses (each of mass m) are placed on the circumference of a disc of mass M and radius R. The M. I. of the system about the normal axis through the centre O will be:-



(1) $MR^2 + 4mR^2$ (2) $\frac{1}{2} MR^2 + 4mR^2$ (3) $MR^2 + \frac{8}{5} mR^2$ (4) none of these

10. By the theorem of perpendicular axes, if a body be in X-Z-plane then :-

(1) $I_x - I_y = I_z$ (2) $I_x + I_z = I_y$ (3) $I_x + I_y = I_z$ (4) $I_y + I_z = I_x$

11. The theorem of perpendicular axes is not applicable for determination of moment of inertia along the diameter, for which of the following body :-

(1) sphere (2) disc (3) ring (4) blade

12. The axis X and Z in the plane of a disc are mutually perpendicular and Y-axis is perpendicular to the plane of the disc. If the moment of inertia of the body about X and Y axes is respectively 30 kg m^2 and 40 kg m^2 then M.I. about Z-axis in kg m^2 will be :-

(1) 70 (2) 50 (3) 10 (4) Zero

13. A solid sphere and a hollow sphere of the same mass have the same M.I. about their respective diameters. The ratio of their radii will be :-

(1) 1 : 2 (2) $\sqrt{3}:\sqrt{5}$ (3) $\sqrt{5}:\sqrt{3}$ (4) 5 : 4

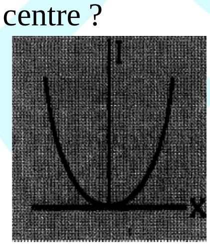
14. The moment of inertia of a square lamina about the perpendicular axis through its centre of mass is 20 kg-m^2. Then, its moment of inertia about an axis touching its side and in the plane of the lamina will be :-

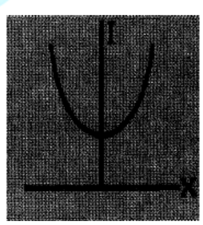
(1) 10 kg-m^2 (2) 30 kg-m^2 (3) 40 kg-m^2 (4) 25 kg-m^2

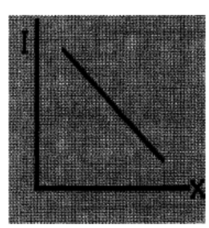
15. The M.I. of a thin rod of length λ about the perpendicular axis through its centre is I. The M.I. of the square structure made by four such rods about a perpendicular axis to the plane and through the centre will be :-

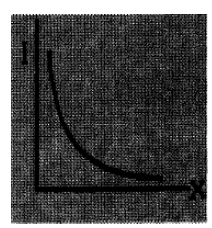
(1) 4I (2) 8I (3) 12I (4) 16I

16. The curve for the moment of inertia of a sphere of constant mass M versus distance of axis from Its centre ?

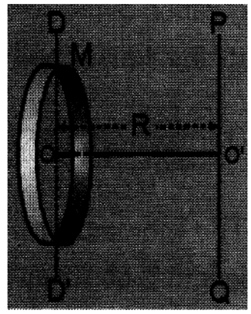
(1) 

(2) 

(3) 

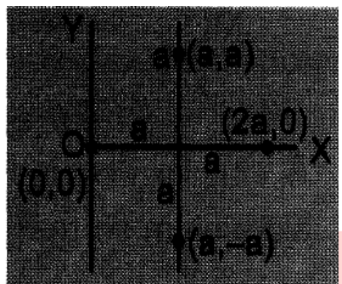
(4) 

17. The moment of Inertia of a ring of mass M and radius R about PQ axis will be :-



(1) MR^2 (2) $\frac{MR^2}{2}$ (3) $\frac{3}{2}MR^2$ (4) $2\ MR^2$

18. Four point masses (each of mass m) are arranged it the X-Y plane the moment of inertia of this array of masses about Y-axls is



(1) ma^2 (2) $2\ ma^2$ (3) $4\ ma^2$ (4) $6\ ma^2$

19. Which of the following has the highest moment of inertia when each of them has the same mass and the same radius ?

(1) a hollow sphere about one of its diameters
(2) a solid sphere about one of its diameters
(3) a disc about its central axis perpendicular to the plane of the disc
(4) a ring about its central axis perpendicular to the plane of the ring.

20. If the radius of gyration of a solid disc of mass 10 kg about an axis is 0.40 m, then the moment of inertia of the disc about that axis is

(1) 1.6 kg m^2 (2) 3.2 kg m^2 (3) 6.4 kg m^2 (4) 9.5 kg m^2

21. If I_1, I_2 and I_3 are moments of Inertia of solid sphere, hollow sphere and a ring of same mass and radius about geometrical axis, which of the following statement holds good ?

(1) $I_1 > I_2 > I_3$ (2) $I_3 > I_2 > I_1$ (3) $I_2 > I_1 > I_3$ (4) $I_2 > I_3 > I_1$

22. Three thin uniform rods each of mass M and length L are placed along the three axis of a cartesian coordinate system with one end of each rod at the origin. The M.I. of the system about z-axis is

(1) $\frac{ML^2}{3}$ (2) $\frac{2ML^2}{3}$ (3) $\frac{ML^2}{6}$ (4) ML^2

23. Four particles each of mass m are placed at the corners of a square of side length λ. The radius of gyration of the system about an axis perpendicular to the square and passing through centre is:-

(1) $\frac{l}{\sqrt{2}}$ (2) $\frac{l}{2}$ (3) λ (4) $l\sqrt{2}$

24. The moment of inertia of a rod of mass M and length L about an axis passing through one edge and perpendicular to its length will be :-

(1) $\frac{ML^2}{12}$ (2) $\frac{ML^2}{6}$ (3) $\frac{ML^2}{3}$ (4) ML^2

25. A circular disc is to be made by using iron and aluminium so that it acquired maximum moment of inertia about geometrical axis. It is possible with:

(1) aluminium at interior and in;:m surrounded to it.
(2) iron at interior and aluminium surrounded to it.
(3) using iron and aluminium layers in alternate order.
(4) sheet of iron is used at both external surface and aluminium sheet as internal layer.

26. The moment of inertia in rotational motion is equivalent to :-

(1) angular velocity of linear motion (2) mass of linear motion
(3) frequency of linear motion (4) current

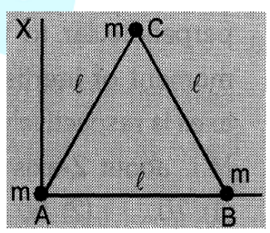
27. Two rods each of mass m and length λ are joined at the centre to form a cross. The moment of inertia of this cross about an axis passing through the common centre of the rods and perpendicular to the plane formed by them, is :-

(1) $\frac{ml^2}{12}$ (2) $\frac{ml^2}{6}$ (3) $\frac{ml^2}{3}$ (4) $\frac{ml^2}{2}$

28. The ratio of the radii of gyration of a circular disc about a tangential axis in the plane of the disc and of a circular ring of the same radius about a tangential axis in the. plane of the ring is :-

(1) 2 : 1 (2) $\sqrt{5}:\sqrt{6}$ (3) 2 : 3 (4) 1 : $\sqrt{2}$

29. Three particles, each of mass mare situated at the vertices of an equilateral triangle ABC of side λ (as shown in the figure).
The moment of inertia of the system about a line AX perpendicular to AB and in the plane of ABC, will be :-



(1) 2 $m\lambda^2$ (2) $\frac{5}{4}$ $m\lambda^2$ (3) $\frac{3}{2}$ $m\lambda^2$ (4) $\frac{3}{4}$ $m\lambda^2$

30. A solid cylinder of mass 20kg has length 1m and radius 0.2 m. Then its moment of inertia (in kg-m^2) about its geometrical axis is :-

(1) 0.8 kg-m^2 (2) 0.4 kg-m^2 (3) 0.2 kg-m^2 (4) 20.2 kg-m^2

31. Moment of inertia :-

(1) is a vector quantity (2) is a scalar quantity
(3) is a tensor quantity (4) can not be calculate

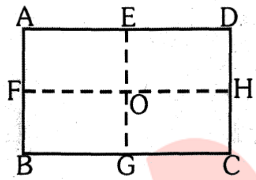
32. The moment of inertia of a circular ring (radius R, mass M) about an axis which passes through tangentially and perpendicular to its plane will be:-

(1) $\frac{MR^2}{2}$ (2) MR^2 (3) $\frac{3}{2}MR^2$ (4) $2MR^2$

33. What is the moment of inertia of ring about its diameter ?

(1) MR^2 (2) $\frac{MR^2}{2}$ (3) $\frac{3}{4}MR^2$ (4) $\frac{5}{4}MR^2$

34. In the rectangular lamina shown in the figure, AB = BC/2. The moment of inertia of the lamina is minimum along the axis passing through :-



(1) AB (2) BC (3) EG (4) FH

35. Which of the following bodies of same mass and same radius has minimum moment of inertia?

(1) Ring (2) Disc (3) Hollow sphere (4) Solid sphere

TORQUE, EQUILIBRIUM OF RIGID BODIES AND TOPPING

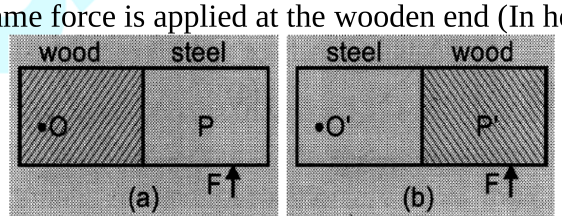
36. A ring and a solid sphere of same mass and radius are rotating with the same angular velocity about their diametric axes then :-

(1) it is easier to stop the ring
(2) it is easier to stop the solid sphere
(3) it is equally difficult to stop both of them
(4) it is not possible to stop a rotating body

37. For rotational motion, the Newton's second law of motion is indicated by :-

(1) $\omega_2^2 = \omega_1^2 + 2\alpha\theta$ (2) $\vec{F} = \frac{d\vec{p}}{dt}$ (3) $\vec{\tau} = \frac{d\vec{L}}{dt}$ (4) $\vec{F}_{12} = \vec{F}_{21}$

38. In the fig. (a) half of the meter scale is made of wood while the other half of steel. The wooden part is pivoted at O. A force F is applied at the end of steel part. In figure (b) the. steel part is pivoted at O' and the same force is applied at the wooden end (In horizontal plane) :-



(1) more angular acceleration will be produced in (a)
(2) more angular acceleration will be produced in (b)
(3) same angular acceleration will be produced in both conditions
(4) information is incomplete

39. The moment of inertia of a disc of radius 0.5 m about its geometric axis is 2 kg-m^2. If a string is tied to its circumference and a force of 10 Newton is applied, the value of torque with respect to this axis will be :-

(1) 2.5 N-m (2) 5 N-m (3) 10 N-m (4) 20 N-m

40. In the above question, if the disc executes rotator motion, its angular acceleration will be :-

(1) 2.5 rad/sec^2 (2) 5 rad/sec^2 (3) 10 rad/sec^2 (4) 20 rad/sec^2

41. In the above question, the value of its angular velocity after 2 seconds will be :-

(1) 2.5 rad/sec (2) 5 rad/sec (3) 10 rad/sec (4) 20 rad/sec

42. In the above question, the change in angular momentum of disc in first 2 seconds (in Nm second) will be-

(1) 2.5 (2) 5 (3) 10 (4) 20

43. In the above question, angular displacement of the disc, in first two second will be (in radian) :-

(1) 2.5 (2) 5 (3) 10 (4) 20

44. A particle of mass m and radius of gyration K is rotating with an angular acceleration α. The torque acting on the particle is

(1) $\frac{1}{2}$ $mK^2\alpha$ (2) $mK^2\alpha$ (3) mK^2/α (4) $\frac{1}{4}mK^2\alpha$

45. The grinding stone of a flour mill is rotating at 600 rad/sec. for this power of 1.2 k watt is used the effective torque on stone in N-m will be

(1) 1 (2) 2 (3) 3 (4) 4

46. A rigid body is rotating about an axis. To stop the rotation, we have to apply :-

(1) pressure (2) force (3) momentum (4) torque

47. A wheel has moment of inertia 5×10^{-3} kg m^2 and is making 20 rev/sec. The torque needed to stop it in 10 sec is . . . . $\times 10^{-2}$ N-m :-

(1) 2π (2) 2.5π (3) 4π (4) 4.5π

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

(1) $\frac{\pi}{12}$ N-m (2) $\frac{\pi}{15}$ N-m (3) $\frac{\pi}{18}$ N-m (4) $\frac{2\pi}{15}$ N-m

49. A constant torque acting on a uniform circular wheel changes its angular momentum from A_0 to 4 A_0 in 4 seconds. The magnitude of this torque is :-

(1) $\frac{3A_0}{4}$ (2) A_0 (3) 4 A_0 (4) 12 A_0

50. The torque of force $\vec{F} = 2\hat{i} - 3\hat{j} + 4\hat{k}$ newton acting at a point $\vec{r} = 3\hat{i} + 2\hat{j} + 3\hat{k}$ meter about origin is:

(1) $6\hat{i} - 6\hat{j} + 12\hat{k}$ N – m (2) $-6\hat{i} + 6\hat{j} - 12\hat{k}$ N – m

(3) $17\hat{i}+6\hat{j}+13\hat{k}\ \text{N}-\text{m}$ (4) $-17\hat{i}+6\hat{j}+13\hat{k}\ \text{N}-\text{m}$

51. When constant torque is acting on a body then :-
(1) body maintain its state or moves in straight line with same velocity
(2) acquire linear acceleration
(3) acquire angular acceleration
(4) rotates with a constant angular velocity

52. If torque on a body is zero, then which is conserved:
(1) force (2) linear momentum
(3) angular momentum (4) angular impulse

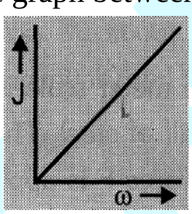
53. If I = 50 kg-m^2, then how much torque will be applied to stop it in 10 sec. Its initial angular speed is 20 rad/sec. :-
(1) 100 N-m (2) 150 N-m (3) 200 N-m (4) 250 N-m

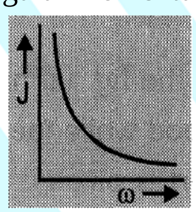
54. A force $\vec{F}=2\hat{i}-3\hat{k}$ acts on a particle at $\vec{r}=0.5\hat{j}-2\hat{k}$. The torque $\vec{\tau}$ acting on the particle relative to a point with co-ordinates (20. M, 0, –3.0 m) is :-
(1) $(-3.0\hat{i}-4.5\hat{k})\text{N}-\text{m}$ (2) $(3\hat{i}+6\hat{j}-\hat{k})\text{N}-\text{m}$
(3) $(-20\hat{i}+4.0\hat{j}-\hat{k})\text{N}-\text{m}$ (4) $(-1.5\hat{i}-4.0\hat{j}-\hat{k})\text{N}-\text{m}$

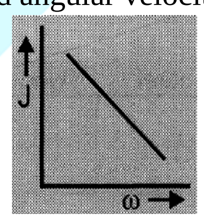
55. If a ladder is. not in balance against a smooth vertical wall, then it can be made in balance by :-
(1) Decreasing the length of ladder (2) Increasing the length of ladder
(3) Increasing the angle of inclination (4) Decreasing the angle of inclination

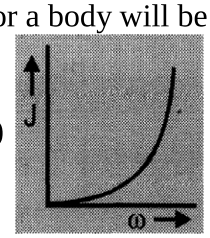
ANGULAR MOMENTUM

56. The graph between the angular momentum J and angular velocity ω for a body will be :-

(1) 

(2) 

(3) 

(4) 

57. When a mass is rotating in a plane about a fixed point, Its angular momentum is directed along
(1) the radius
(2) the tangent to orbit
(3) line at an angle of 45° to the plane of rotation
(4) the axis of rotation

58. A ring of mass 10 kg and diameter 0.4 meter is rotating about its geometrical axis at 1200 rotations per minute. Its moment of inertia and angular momentum will be respectively :-
(1) 0.4 kg-m^2 and 50.28 J-s (2) 0.4 kg-m^2 and 0.4 J-s
(3) 50.28 kg-m^2 and 0.4 J-s (4) 0.4 kg-m^2 and zero

59. The rotational kinetic energy of two bodies is moments of inertia 9 kg-m^2 and 1 kg-m^2 are same. The ratio of their angular momentum is :-

(1) 3 : 1 (2) 1 : 3 (3) 9 : 1 (4) 1 : 9

60. A fan of moment of inertia 0.6 kg-m^2 is to run upto a working speed of 0.5 revolution per second. Indicate the correct value of the angular momentum of the fan

(1) $0.6\pi\ \text{kg} \times \frac{\text{meter}^2}{\text{sec}}$ (2) $6\pi\ \text{kg} \times \frac{\text{meter}^2}{\text{sec}}$

(3) $3\pi\ \text{kg} \times \frac{\text{meter}^2}{\text{sec}}$ (4) $\frac{\pi}{6}\text{kg} \times \frac{\text{meter}^2}{\text{sec}}$

61. A body of mass m is moving with constant velocity parallel to x-axis. The angular momentum with respect to origin :-

(1) increases with time (2) decreases with time

(3)does not change (4) none of above

62. In an orbital motion, the angular momentum vector is :-

(1) along the radius vector (2) parallel to the linear momentum

(3) in the orbital plane (4) perpendicular to the orbital plane

63. 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 momentum will be in the ratio :-

(1) 1 : 2 (2) $\sqrt{2} : 1$ (3) $1 : \sqrt{2}$ (4) 2 : 1

64. The rotational kinetic energy of a body is K_{rot} and its moment of inertia is I. The angular momentum of body is:-

(1) IK_{rot} (2) $2\sqrt{IK_{rot}}$ (3) $\sqrt{2IK_{rot}}$ (4) $2IK_{rot}$

65. A body of mass 10 kg and radius of gyration 0.1 m is rotating about an axis. If angular speed is 10 rad/s, then angular momentum will be:-

(1) 1 kg m^2/s (2) 0.1 kg m^2/s (3) 100 kg m^2/s (4) 10 kg m^2/s

66. A particle of mass 1.0 kg is rotating on a circular path of diameter 2.0 m at the rate of 10 rotations in 31.4s. The angular momentum of the body, (in kgm^2/s) is :-

(1) 1.0 (2) 1.5 (3) 2.0 (4) 4.0

67. A particle of mass m is rotating in a plane in a circular path of radius r. Its angular momentum is L. The centripetal force acting on the particle is

(1) $\frac{L^2}{mr}$ (2) $\frac{L^2 m}{r}$ (3) $\frac{L^2}{mr^2}$ (4) $\frac{L^2}{mr^3}$

CONSERVATION OF ANGULAR MOMENTUM

68. A stone attached to one end of string is revolved around a stick so that the string winds upon the stick and gets shortened. What is conserved ?

(1) angular momentum (2) linear momentum

(3) kinetic energy (4) none of the above

69. A rotating table completes one rotation in 10 sec. and its moment of inertia is 100 kg-m^2. A person of 50 kg. mass stands at the centre of the rotating table. If the person moves 2 m from the centre, the angular velocity of the rotating table (in rad/sec). will be:

(1) $\frac{2\pi}{30}$ (2) $\frac{20\pi}{30}$ (3) $\frac{2\pi}{3}$ (4) 2π

70. On melting of ice on the pole of the earth, its moment of inertia will :-

(1) increase (2) decrease
(3) remain unchanged (4) none of these

71. If the earth loses its atmosphere suddenly, then the duration of day will :-

(1) increase (2) decrease
(3) remain unchanged (4) nothing cart be definitely said

72. A wheel is rotating about its axis at a constant angular velocity. If suddenly an object sticks to it on the rim, then its M.I. will :-

(1) increase (2) decrease
(3) remain unchanged (4) nothing can be said

73. In the above question, the angular velocity will:

(1) increase (2) decrease
(3) not change (4) nothing can be said

74. An ant is sitting at the edge of a rotating disc. If the ant reaches the other end, after moving along the diameter, the angular velocity of the disc will :-

(l) remain constant (2) first decreases and then increases
(3) first increases, then decrease (4) Increase continuously

75. The angular momentum of body remains conserve if :-

(1) applied force on body is zero. (2) applied torque on body is zero.
(3) applied force on body is constant. (4) applied torque on body is constant.

76. A person is standing on' the edge of a circular platform, which is moving with constant angular speed about an .axis passing through its centre and perpendicular to the plane of platform. If person is moving along any radius toward$ axis of rotation then the angular velocity will :-

(1) decrease (2) remain unchanged
(3) increase (4) data is insufficient

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

(1) $\frac{M\omega}{4m}$ (2) $\frac{M\omega}{M+4m}$ (3) $\frac{(M+4m)\omega}{M}$ (4) $\frac{(M+4m)\omega}{M+4m}$

78. 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 :-

(1) ω (2) $\frac{I_1\omega}{I_1+I_2}$ (3) $\frac{(I_1+I_2)\omega}{I_1}$ (4) $\frac{I_2\omega}{I_1+I_2}$

79. Rate of change of angular momentum with respect to time is proportional to :-
(1) angular velocity (2) angular acceleration
(3) moment of inertia (4) torque

80. A small steel sphere of mass m is tied to a string of length r and is whirled in a horizontal circle with a uniform angular velocity 2ω. The string is suddenly pulled, so that radius of the circle is halved. The new angular velocity will be
(1) 2ω (2) 4ω (3) 6ω (4) 8ω

81. If the earth were to suddenly contract to half its present size, without any change in its mass, the duration of the new day will be
(1) 18 hours (2) 30 hours (3) 6 hours (4) 12 hours

82. A stone is attached to the end of a string and whirled in horizontal circle, then :-
(1) its linear and angular momentum are constant
(2) only linear momentum is constant
(3) its angular momentum is constant but linear momentum is variable
(4) both are variable

PURE ROLLING AND KINETIC ENERGY

83. A thin rod of length L is suspended from one end and rotated with n rotations per second. The rotational kinetic energy of the rod will be :
(1) $2mL^2\pi^2n^2$ (2) $\frac{1}{2}mL^2\pi^2n^2$ (3) $\frac{2}{3}mL^2\pi^2n^2$ (4) $\frac{1}{6}mL^2\pi^2n^2$

84. The rotational kinetic energy of a body is E. In the absence of external torque, if mass of the body is halved and radius of gyration doubled, then its rotational kinetic energy will be :-
(1) 0.5E (2) 0.25E (3) E (4) 2E

85. A particle of mass m is describing a circular path of radius r with uniform speed. If L is the angular momentum of the particle (about the axis of the circle), then the kinetic energy of the particle is
(1) $\frac{L^2}{mr^2}$ (2) mr^2L (3) $\frac{L^2}{2mr^2}$ (4) $\frac{L^2r^2}{m}$

86. A particle performs uniform circular motion with an angular momentum L. If the frequency of particle's motion is doubled and its kinetic energy halved, the angular momentum becomes
(1) 2L (2) 4L (3) $\frac{L}{2}$ (4) $\frac{L}{4}$

87. A flywheel is making $\frac{3000}{\pi}$ revolutions per minute about its axis. If the moment of inertia of the flywheel about that axis is 400 kgm^2, its rotational kinetic energy is
(1) 2×10^6 J (2) 3×10^3 J (3) $500\pi^2$ J (4) 12×10^3 J

88. A ring is rolling without slipping. Its energy of translation is E. Its total kinetic energy will be :-
(1) E (2) 2E (3) 3E (4) 4E

89. A thin hollow cylinder open at both ends slides without rotating and then rolls without slipping with the same speed. The ratio of the kinetic energies in the two cases is
(1) 1 : 1 (2) 1 : 2 (3) 2 : 1 (4) 1 : 4

90. A solid sphere of mass M and radius R rolls on a horizontal surface without slipping. The ratio of rotational K.E. to total K.E. is :-
(1) $\frac{1}{2}$ (2) $\frac{3}{7}$ (3) $\frac{2}{7}$ (4) $\frac{2}{10}$

91. A disc is rolling on an inclined plane without slipping then what fraction of its total energy will be in form of rotational kinetic energy :-
(1) 1 : 3 (2) 1 : 2 (3) 2 : 7 (4) 2 : 5

92. A wheel is rolling along the ground with a speed of 2 m/s. The magnitude of the linear velocity of the points at the extremities of the, horizontal diameter of the wheel is equal to
(1) $2\sqrt{10}$ m/s (2) $2\sqrt{3}$ m/s (3) $2\sqrt{2}$ m/s (4) 2 m/s

93. A disc is rolling on an inclined plane without slipping then what fraction ·of its total energy will be in form of rotational kinetic energy :-
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93. If rotational kinetic energy is 50% 'of total kinetic energy then the body will be :-
(1) ring (2) cylinder (3) hollow sphere (4) solid sphere

94. 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 rotational energy will be :-
(1) $\frac{K^2+R^2}{R^2}$ (2) $\frac{K^2}{R^2}$ (3) $\frac{K^2}{K^2+R^2}$ (4) $\frac{R^2}{K^2+R^2}$

95. If the angular velocity of a body rotating about an axis is doubled and its moment of inertia halved, the rotational kinetic energy will changed by a factor of :-
(1) 4 (2) 2 (3) 1 (4) 1/2

96. If a sphere is rolling, the ratio of its rotational energy to the total kinetic energy is given by
(1) 7 : 10 (2) 2 : 5 (3) 10 : 5 (4) 2 : 7

97. A person, with outstretched arms, is spinning on a rotating stool. He suddenly bring his arms down to his sides. Which of the following is true about system kinetic energy K and angular momentum L ?
(1) Both K and L increase. (2) Both K and L remain unchanged

(3) K remains constant, L increases. (4) K increases but L remains constant.

98. A uniform thin ring of mass 0.4 kg rolls without slipping on a horizontal surface with a linear velocity of 10 cm/s. The kinetic energy of the ring is :-
(1) 4×10^{-3} J (2) 4×10^{-2} J (3) 2×10^{-3} J (4) 2×10^{-2} J

99. A body is rotating with angular momentum L. If I is its moment of inertia about the axis of rotation, its kinetic energy of rotation is :-
(1) $\frac{1}{2}$ IL^2 (2) $\frac{1}{2}$ IL (3) $\frac{1}{2}(I^2/L)$ (4) $\frac{L^2}{2I}$

ROLLING MOTION ON AN INCLINED PLANE

100. A disc rolls down a plane of length L and inclined at angle θ, without slipping. Its velocity on reaching the bottom will be :-
(1) $\sqrt{\frac{4gL\sin\theta}{3}}$ (2) $\sqrt{\frac{2gL\sin\theta}{3}}$ (3) $\sqrt{\frac{10gL\sin\theta}{7}}$ (4) $\sqrt{4gL\sin\theta}$

101. A spherical shell and a solid cylinder of same radius rolls down an inclined plane. The ratio of their accelerations will be:-
(1) 15 : 14 (2) 9 : 10 (3) 2 : 3 (4) 3 : 5

102. A ring takes time t_1 and t_2 for sliding down and rolling down an inclined plane of length L respectively for reaching the bottom. The ratio of t_1 and t_2 is :-
(1) $\sqrt{2} : 1$ (2) $1 : \sqrt{2}$ (3) 1 : 2 (4) 2 : 1

103. A solid sphere is rolling down on inclined plane from rest and a rectangular block of same mass is also slipping down simultaneously from rest on a similar smooth inclined plane.
(1) both of them will reach the bottom simultaneously
(2) the sphere will reach the bottom first
(3) the rectangular block will reach the bottom first.
(4) depends on density of material.

104. Calculate the ratio of the times taken by a uniform solid sphere and a disc of the same mass and the same diameter to roll down through the same distance from rest on a inclined plane.
(1) 15 : 14 (2) $\sqrt{15} : \sqrt{14}$ (3) $15^2 : 15^2$ (4) $\sqrt{14} : \sqrt{15}$

105. A body of mass m slides down an incline and reaches the bottom with a velocity v. If the same mass were in the form of a ring which rolls down this incline, the velocity of the ring at the bottom would have been
(1) v (2) $v\sqrt{2}$ (3) $\frac{v}{\sqrt{2}}$ (4) $\left(\sqrt{\frac{2}{5}}\right)v$

106. When a sphere of moment of inertia I rolls down on an inclined plane the percentage of total energy which is, rotational, is approximately
(1) 28 % (2) 72% (3) 100% (4) none of these

107. When a body starts to roll on an inclined plane, its potential energy is converted into

(1) translational kinetic energy only
(2) translational and rotational kinetic energy
(3) rotational energy only
(4) none

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

(1) $\sqrt{2gh}$ (2) $\sqrt{\frac{3}{4}gh}$ (3) $\sqrt{\frac{4}{3}gh}$ (4) $\sqrt{4gh}$

109. Which of the following is true about the angular momentum of a cylinder rolling down a slope without slipping ?
(1) Its magnitude changes but the direction remains same
(2) both magnitude and direction change
(3) only the direction change
(4) neither change

110. A sphere and a disc of same radii and mass are rolling on an inclined plane without slipping. a_s & a_d are acceleration and g is acceleration due to gravity. Then which statement is correct?
(1) $a_s > a_d > g$ (2) $g > a_s > a_d$ (3) $a_s > g > a_d$ (4) $a_d > a_s > g$

ANSWER KEY

EXERCISE-I (Conceptual Questions)

1.	(4)	**2.**	(2)	**3.**	(1)	**4.**	(4)	**5.**	(4)	**6.**	(1)	**7.**	(2)
8.	(4)	**9.**	(2)	**10.**	(2)	**11.**	(1)	**12.**	(3)	**13.**	(3)	**14.**	(3)
15.	(4)	**16.**	(2)	**17.**	(3)	**18.**	(4)	**19.**	(4)	**20.**	(1)	**21.**	(2)
22.	(2)	**23.**	(1)	**24.**	(3)	**25.**	(1)	**26.**	(2)	**27.**	(2)	**28.**	(2)
29.	(2)	**30.**	(2)	**31.**	(3)	**32.**	(4)	**33.**	(2)	**34.**	(4)	**35.**	(4)
36.	(2)	**37.**	(3)	**38.**	(2)	**39.**	(2)	**40.**	(1)	**41.**	(2)	**42.**	(3)
43.	(2)	**44.**	(2)	**45.**	(2)	**46.**	(4)	**47.**	(1)	**48.**	(2)	**49.**	(1)
50.	(3)	**51.**	(3)	**52.**	(3)	**53.**	(1)	**54.**	(4)	**55.**	(3)	**56.**	(1)
57.	(4)	**58.**	(1)	**59.**	(1)	**60.**	(1)	**61.**	(3)	**62.**	(4)	**63.**	(3)
64.	(3)	**65.**	(1)	**66.**	(3)	**67.**	(4)	**68.**	(1)	**69.**	(1)	**70.**	(1)
71.	(2)	**72.**	(1)	**73.**	(2)	**74.**	(3)	**75.**	(2)	**76.**	(3)	**77.**	(2)
78.	(2)	**79.**	(4)	**80.**	(4)	**81.**	(3)	**82.**	(3)	**83.**	(3)	**84.**	(1)
85.	(3)	**86.**	(4)	**87.**	(1)	**88.**	(2)	**89.**	(2)	**90.**	(3)	**91.**	(1)
92.	(3)	**93.**	(1)	**94.**	(3)	**95.**	(2)	**96.**	(4)	**97.**	(4)	**98.**	(1)
99.	(4)	**100.**	(1)	**101.**	(2)	**102.**	(2)	**103.**	(3)	**104.**	(4)	**105.**	(3)
106.	(1)	**107.**	(2)	**108.**	(3)	**109.**	(1)	**110.**	(2)				