Questions on Rotational Motion, Paper 1

1. 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 **(MHT-CET-2005)**

(a) $\frac{3I}{4}$ (b) $\frac{3I}{2}$

(c) $\frac{5I}{6}$ (d) $\frac{6I}{5}$

2. If radius of solid sphere is doubled by keeping its mass constant, then

(a) $\frac{I_1}{I_2}=\frac{1}{4}$ (b) $\frac{I_1}{I_2}=\frac{4}{1}$

(c) $\frac{I_1}{I_2}=\frac{3}{2}$ (d) $\frac{I_1}{I_2}=\frac{2}{3}$

Answer: (a)

3. Calculate the M.I. of a thin uniform ring about an axis tangent to the ring and in a plane of the ring, if its M.I. about an axis passing through the centre and perpendicular to plane is 4 kg m^2. **(MHT-CET-2006)**

(a) 12 kg m^2 (b) 3 kg m^2

(c) 6 kg m^2 (d) 9 kg m^2

Answer: (c)

4. By keeping moment of inertia of a body constant, if we double the time period, then angular momentum of body **(MHT-CET-2005)**

(a) Remains constant (b) Becomes half

(c) Doubles (d) Quadruples

Answer: (b)

5. $\frac{L^2}{2I}$ represents **(MH-CET 2003)**

(a) Rotational kinetic energy of a particle.

(b) Potential energy of a particle

(c) Torque on a particle

(d) Power

Answer: (a)

6. The M.I. of a disc about an axis passing through its centre and perpendicular to plane is $\frac{MR^2}{2}$, then its M.I. about a tangent parallel to its diameter is [**MH-CET 2002**]

(a) $\frac{MR^2}{2}$ (b) $\frac{4}{5}MR^2$

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

Answer: (c)

7. The M.I. of disc about an axis perpendicular to its plane and passing through its centre is $\frac{MR^2}{2}$. Its M.I. about a tangent perpendicular to its plane will be **(MH-CET 2002)**

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

(c) $\frac{1}{2}MR^2$ (d) Cannot be determined

Answer: (b)

8. The torque acting is 2000Nm with an angular acceleration of 2 rad/s^2. the moment of inertia of body is **(MHT-CET-2004)**

(a) 1200 kgm^2 (b) 900 kgm^2

(c) 1000 kgm^2 (d) Can't say

Answer: (d)

9. Four solid spheres each of mass M and diameter 2r, are placed with their centers on the four corners of a square of side a (> 2r). the moment of inertia of the system about one side of square is **(DEC 92)**

(a) $\frac{2}{5}M\left(5r^2+4a^2\right)$ (b) $\frac{2}{5}M\left(5r^2+2a^2\right)$

(c) $\frac{2}{5}M\left(2r^2+5a^2\right)$ (d) $\frac{2}{5}M\left(4r^2+5a^2\right)$

Answer: (d)

10. For increasing the angular velocity of a object by 10%, the kinetic energy has to be increased by **(MHT-CET-2001)**

(a) 40% (b) 20%

(c) 10% (d) 21%

Answer: (d)

11. M.I. of a thin uniform circular ring about the tangent to the plane of the ring is **(CPMT 92)**

(a) $\frac{MR^2}{2}$ (b) MR^2

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

Answer: (d)

12. A thin uniform ring of mass M and radius R passing through its centre and perpendicular to its plane. Then its M.I. is, **(CPMT 82)**

(a) $\frac{1}{2}MR^2$ (b) MR^2

(c) $2MR^2$ (d) $\frac{3}{2}MR^2$

Answer: (b)

13. Ratio of rotational K.E. to rolling K.E. of a solid sphere is **[MH-CET 2002]**

(a) $\frac{2}{3}$ (b) $\frac{2}{5}$

(c) $\frac{2}{7}$ (d) ∞

Answer: (c)

14. A body of M.I. of 5 kg m^2, rotating with an angular velocity of 6 rad/s, has the same kinetic energy as a mass of 20 kg, moving with a velocity of

(a) 3 m/s (b) 2 m/s

(c) 4 m/s (d) 5 m/s

Answer: (a)

15. A thin uniform circular disc of mass M and radius R is rotating in a horizontal plane about an axis passing through its centre and perpendicular to the plane with angular velocityω. Another disc of same mass but half the radius is gently placed over it coaxially. The angular speed of the composite disc will be **(IIT 86)**

(a) $\frac{5}{4}\omega$ (b) $\frac{4}{5}\omega$

(c) $\frac{2}{5}\omega$ (d) $\frac{5}{2}\omega$

Answer: (b)

16. A wheel having a moment of inertia of 2 kg m^2 about its vertical axis, is rotating at the rate of 60 r.p.m. about this axis. What is the retarding torque required to stop its rotation one minute?

(a) $\frac{\pi}{12}$Nm (b) $\frac{\pi}{15}$Nm

(c) $\frac{\pi}{12}$Nm (d) $\frac{\pi}{18}$Nm

Answer: (b)

17. 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 of

(a) 1:2 (b) 2:1

(c) $\sqrt{2}:1$ (d) $1:\sqrt{2}$

Answer: (d)

18. A particle of mass m is moving with a constant velocity along a line parallel to the +ve direction of the X-axis. The magnitude of its angular momentum w.r.t 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)

19. Torqueses of equal magnitude are applied to a 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)

20. A dancer on ice spins faster when she folds here arms. This is due to **(CPMT. PMT MP 86)**

(a) Increases in energy and increase in angular momentum
(b) Decrease in friction at the skates
(c) Constant angular momentum and increase in kinetic energy
(d) Increase in energy an decreases in angular momentum

Answer: (c)

21. The moment of inertia of a loop of radius R and mass M about any tangent line will be **(CPMT 92)**

(a) $\frac{3}{2}MR^2$ (b) $\frac{MR^2}{2}$ (c) MR^2 (d) $\frac{MR^2}{4}$

Answer: (a)

22. A mass is revolving in a circle which is in the plane of the paper. The direction of angular acceleration is **(CPMT 83)**

(a) Upward to the radius
(b) Towards the radius
(c) Tangential
(d) At right angle to angular velocity

Answer: (c)

23. Angular momentum is **(CBSE 93)**

(a) A scalar
(b) A polar vector
(c) A scalar as well as vector
(d) An axial vector

Answer: (d)

24. Which is the wrong relation from the following? **(MH-CET 99)**

(a) $\tau = I\alpha$ (b) $F = ma$

(c) $L = I\omega$ (d) $I = \tau\alpha$

Answer: (d)

25. Two circular discs A and B have equal masses and uniform thickness but have densities ρ_1 and ρ_2 such that $\rho_1 > \rho_2$. their moment of inertia is **(MHT-CET-2000)**

(a) $I_1 > I_2$ (b) $I_1 >> I_2$

(c) $I_1 < I_2$ (d) $I_1 = I_2$

Answer: (c)