

# Rotational Motion

## 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  $4 \text{ kg m}^2$ . **(MHT-CET-2006)**
- (a)  $12 \text{ kg m}^2$  (b)  $3 \text{ kg m}^2$   
 (c)  $6 \text{ kg m}^2$  (d)  $9 \text{ kg m}^2$
- 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  $2000 \text{ Nm}$  with an angular acceleration of  $2 \text{ rad/s}^2$ . the moment of inertia of body is **(MHT-CET-2004)**
- (a)  $1200 \text{ kgm}^2$  (b)  $900 \text{ kgm}^2$   
 (c)  $1000 \text{ kgm}^2$  (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)  $\frac{2}{5}M(5r^2 + 4a^2)$  (b)  $\frac{2}{5}M(5r^2 + 2a^2)$   
 (c)  $\frac{2}{5}M(2r^2 + 5a^2)$  (d)  $\frac{2}{5}M(4r^2 + 5a^2)$
- 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)

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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)  $\infty$   
 Answer: (c)
14. A body of M.I. of  $5 \text{ kg m}^2$ , rotating with an angular velocity of  $6 \text{ rad/s}$ , has the same kinetic energy as a mass of  $20 \text{ kg}$ , moving with a velocity of
- (a)  $3 \text{ m/s}$  (b)  $2 \text{ m/s}$   
 (c)  $4 \text{ m/s}$  (d)  $5 \text{ m/s}$   
 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 velocity  $\omega$ . 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  $2 \text{ kg m}^2$  about its vertical axis, is rotating at the rate of  $60 \text{ r.p.m.}$  about this axis. What is the retarding torque required to stop its rotation one minute?
- (a)  $\frac{\pi}{12} \text{ Nm}$  (b)  $\frac{\pi}{15} \text{ Nm}$   
 (c)  $\frac{\pi}{12} \text{ Nm}$  (d)  $\frac{\pi}{18} \text{ Nm}$   
 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. Torques 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  $\alpha_c$  and  $\alpha_s$  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 her 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 and decrease 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  $\rho_1$  and  $\rho_2$  such that  $\rho_1 > \rho_2$ . their moment of inertia is **(MHT-CET-2000)**
- (a)  $I_1 > I_2$  (b)  $I_1 \gg I_2$   
 (c)  $I_1 < I_2$  (d)  $I_1 = I_2$   
 Answer: (c)