Questions on Rotational Motion, Paper 4

1. Centre of mass of two body system divides the distance between two bodies, is proportional to **(MH-CET 2004)**

   (a) Inverse of square of the mass
   (b) Inverse of mass
   (c) The ratio of the square of mass
   (d) The ratio of mass

   Answer: (b)

2. A thin circular ring of mass M and radius R is rotating about an axis passing through its centre and perpendicular to its plane with a constant angular velocity ω_1. Two small bodies each of mass m are attached gently to the opposite ends of a diameter of ring. The new angular velocity ω_2 of the ring will be

   (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)

3. A solid sphere, a hollow sphere and a disc 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)

4. The kinetic energy of a body is 4 joule and its moment of inertia is 2 kg m^2 then angular momentum is **(MHT-CET-2008)**

   (a) 4 kg m^2/sec (b) 5 kg m^2 /sec
   (c) 6 kg m^2/sec (d) 7 kg m^2/sec

   Answer: (a)

5. Moment of inertia depends on **(MHT-CET-2002)**

   (a) Distribution of particles
   (b) Mass
   (c) Position of axis of rotation
   (d) All of these

   Answer: (d)

6. A disc of moment of inertia $9.8/\pi^2$ kg m^2 is rotating at 600 rpm. If the frequency of rotation charges from 600 rpm to 300 rpm, then what is the work done? **(MHT-CET-2004)**

   (a) 1470 J (b) 1452 J
   (c) 1567 J (d) 1632 J

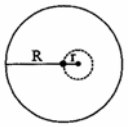
   Answer: (a)

7. A disc of mass 2 kg and diameter 2m is performing rotational motion. Find the work done, if the disc is rotating from 300 rpm to 600 rpm. **(MH-CET 2004)**

   (a) 1479 J (b) 14.79 J
   (c) 147.9 J (d) 1.479

   Answer: (a)

8. What will be distance of centre of mass of the disc (see fig.) from its geometrical centre? **(MHT-CET-2001)**

   (a) $\frac{r}{\left(\frac{R^2}{r^2}-1\right)}$ to left (b) R + r, to left
   (c) $\frac{r}{R+r}$, to left (d) $\frac{r}{(r^2+R^2)}$, to left

   Answer: (a)

9. The moment of inertia of uniform circular disc about an axis passing its centre is 6kgm^2. its M.I. about an axis perpendicular to its plane and just touching the rim will be

   (a) 18 kg m^2 (b) 30 kg m^2
   (c) 15 kg m^2 (d) 3 kg m^2

   Answer: (a)

10. A spherical ball rolls on a table without slipping. Then the fraction of its total energy associated with rotation is **(PMT, 87 MP)**

    (a) $\frac{2}{5}$ (b) $\frac{2}{7}$
    (c) $\frac{3}{5}$ (d) $\frac{3}{7}$

    Answer: (b)

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11. The dimensions of angular momentum are – **(MH-CET 2004)**
(a) $[M^1 L^2 T^{-1}]$ (b) $[M^1 L^1 T^{-1}]$
(c) $[M^1 L^1 T^{-2}]$ (d) $[M^1 L^2 T^{-2}]$
Answer: (a)

12. A cylinder of mass 10 kg and radius 20 cm is free to rotate about its axis. It receives an angular impulse of 4 kg m^2/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)

13. The moment of inertia of an electron in n^{th} orbit will be **(MHT-CET-2001)**
(a) MR_n^2 (b) $\frac{MR_n^2}{2}$
(c) $\frac{1}{2}MR_n^2$ (d) $\frac{2}{3}MR_n^2$
Answer: (a)

14. The M.I. of a body does not depends upon **(CPMT 75)**
(a) Angular velocity of a body
(b) Axis of rotation of the body
(c) The mass of the body
(d) The distribution of the body
Answer: (a)

15. What is the moment of inertia of a solid sphere of radius R and density ρ about its diameter?
(a) $\frac{8}{3}\pi R^3\rho$ (b) $\frac{8}{15}\pi R^4\rho$
(c) $\frac{8}{3}\pi R^5\rho$ (d) $\frac{15}{8}\pi R^3\rho^2$
Answer: (c)

16. 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 **(MHT-CET-2001)**
(a) $\frac{ML^2}{3}$ (b) $\frac{ML^2}{12}$
(c) $\frac{ML^2}{48}$ (d) $\frac{ML^2}{6}$
Answer: (b)

17. The radius of gyration of a disc of mass 100 gm and radius 5 cm about an axis passing through its centre of gravity and perpendicular to the plane is **(MHT-CET-2000)**
(a) 0.5 cm (b) 2.5 cm
(c) 3.54 cm (d) 6.54 cm
Answer: (c)

18. A thin circular ring of mass M and radius r is rotating about its axis passing through its centre and perpendicular to its plane with a constant angular velocity ω two objects each of mass m are attached gently to the opposite ends of a diameter of the ring. The ring will now rotate with an angular velocity of **(I.I.T. 83)**
(a) $\frac{\omega(M-2m)}{(M+2m)}$ (b) $\frac{\omega M}{(M+2m)}$
(c) $\frac{\omega M}{(M+m)}$ (d) $\frac{\omega(M+2m)}{M}$
Answer: (b)

19. A solid cylinder of mass M and radius R rolls down an inclined plane without slipping. The speed of its centre of mass when it reaches the bottom is **(EAMCET 85, PEN 85 MP)**
(a) $\sqrt{2gh}$ (b) $\sqrt{\frac{4gh}{3}}$
(c) $\sqrt{\frac{3gh}{4}}$ (d) $\sqrt{\frac{4g}{h}}$
Answer: (b)

20. The position vector of a particle of mass 10 g, about the origin is $4\hat{i}+3\hat{j}$ m. If it moves with a linear velocity of $4\hat{i}$ m/s, then its angular momentum will be
(a) $12\,\vec{k}$ Js (b) $0.2\,\vec{k}$ Js
(c) $-0.12\,\vec{k}$ Js (d) $-1.2\,\vec{k}$ Js
Answer: (c)

21. Moment of inertia depends upon the **(MH-CET 2002)**
(a) Mass of the body
(b) Distribution of mass of the body
(c) Position of axis of rotation
(d) All of these
Answer: (d)

22. A body of moment of inertia of 3 kgm^2 rotating with an angular velocity of 2rad/s has the same kinetic energy as a mass of 12 kg moving with a velocity of
(MHT-CET-1999)
(a) 1 m/s (b) 2 m/s
(c) 4 m/s (d) 8 m/s
Answer: (a)

23. If a gymnast, sitting on a rotating stool, with his arms outstretched, suddenly lowers his arms
(NCERT 78)
(a) The angular velocity decreases
(b) His moment of inertia decreases
(c) The angular velocity remains constant
(d) The angular momentum increases
Answer: (b)

24. The moment of inertia of a thin circular disc of mass M and radius R about any diameter is
(MHT-CET-1999)
(a) $\frac{MR^2}{4}$ (b) $\frac{MR^2}{2}$
(c) MR^2 (d) $2MR^2$
Answer: (a)

25. A disc of radius R rotating about its axis has a moment of inertia I about that axis. When it is rotating about that axis at a constant angular velocity ω a heavy particle of mass m is placed gently at the rim of the disc. The resulting angular velocity of the system is
(CPMT 91)
(a) ω (b) $I\omega\ (I + mR)$
(c) $(I + mR)/I\omega$ (d) $I\omega/(I + mR^2)$
Answer: (d)