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Time-1hrs. **Class-XI** **Subject- Physics** **M.M- 63**

For each correct answer +3 and for incorrect answer -1 marks

1. A wheel of mass 10 kg has a moment of inertia of 160 kg–m^2 about its own axis, the radius of gyration will be

(a) 10 m (b) 8 m (c) 6 m

2. 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

3. A thin uniform circular disc of mass M and radius R is rotating in a horizontal plane about an axis passing [1] through its centre and perpendicular to its plane with an angular velocity ω. Another disc of same dimension but of mass M/4 is placed gently on the first disc coaxially. The angular velocity of the system now is

(a) $2\omega/5$ (b) $2\omega/\sqrt{5}$ (c) $4\omega/5$ (d) $4\omega/\sqrt{5}$

4. A smooth sphere A is moving on a frictionless horizontal plane with angular speed ω and center of mass with velocity υ. It collides elastically and head-on with an identical sphere B at rest. Neglect friction everywhere. After the collision, their angular speeds are ω_A and ω_B respectively. Then

(a) $\omega_A < \omega_B$ (b) $\omega_A = \omega_B$ (c) $\omega_A = \omega$ (d) $\omega = \omega_B$

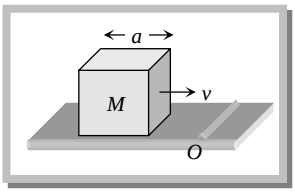
5. A cubical block of side a is moving with velocity v on a horizontal smooth plane as shown. It hits a ridge at point O. The angular speed of the block after it hits O is

(a) 3v/4a

(b) 3v/2a

(c) $\frac{\sqrt{3}v}{\sqrt{2}a}$

(d) Zero



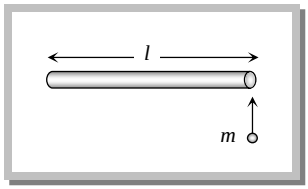
6. A stick of length l and mass M lies on a frictionless horizontal surface on which it is free to move in any way. A ball of mass m moving with speed v collides elastically with the stick as shown in the figure. If after the collision ball comes to rest, then what should be the mass of the ball

(a) $m = 2M$

(b) $m = M$

(c) $m = M/2$

(d) $m = M/4$



7. In a playground there is a merry-go-round of mass 120 kg and radius 4 m. The radius of gyration is 3m. A child of mass 30 kg runs at a speed of 5 m/sec tangent to the rim of the merry-go-round when it is at rest and then jumps on it. Neglect friction and find the angular velocity of the merry-go-round and child

(a) 0.2 rad/sec (b) 0.1 rad/sec (c) 0.4 rad/sec (d) 0.8 rad/sec

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

(a) $\frac{K^2}{R^2}$ (b) $\frac{K^2}{K^2+R^2}$ (c) $\frac{R^2}{K^2+R^2}$ (d) $\frac{K^2+R^2}{R^2}$

9. In a bicycle the radius of rear wheel is twice the radius of front wheel. If r_F and r_r are the radii, v_F and v_r are speeds of top most points of wheel, then

(a) $v_r = 2\,v_F$ (b) $v_F = 2\,v_r$ (c) $v_F = v_r$ (d) $v_F > v_r$

10. The total kinetic energy of a body of mass 10 kg and radius 0.5 m moving with a velocity of 2 m/s without slipping is 32.8 joule. The radius of gyration of the body is

(a) 0.25 m (b) 0.2 m (c) 0.5 m (d) 0.4 m

11. The moment of inertia of a body about a given axis is 2.4 kg–m^2. To produce a rotational kinetic energy of 750 J, an angular acceleration of 5 rad/s^2 must be applied about that axis for

(a) 6 sec (b) 5 sec (c) 4 sec (d) 3 sec

12. A solid sphere of mass 500 gm and radius 10 cm rolls without slipping with the velocity 20cm/s. The total kinetic energy of the sphere will be **[Pb. PMT 2002]**

(a) 0.014 J (b) 0.028 J (c) 280 J (d) 140 J

13. The ratio of rotational and translatory kinetic energies of a sphere is

(a) $\frac{2}{9}$ (b) $\frac{2}{7}$ (c) $\frac{2}{5}$ (d) $\frac{7}{2}$

14. A thin hollow cylinder open at both ends:

(i) Slides without rotating

(ii) Rolls without slipping, with the same speed.

The ratio of kinetic energy in the two cases is

(a) 1 : 1 (b) 4 : 1 (c) 1 : 2 (d) 2 : 1

15. Four particle of masses m, 2m, 3m and 4m are arranged at the corners of a parallelogram with each side equal to a and one of the angle between two adjacent sides is 60^o. The parallelogram lies in the x-y plane with mass m at the origin and 4m on the x-axis. The centre of mass of the arrangement will be located at

(a) $\left(\frac{\sqrt{3}}{2}a,\ 0.95a\right)$ (b) $\left(0.95a,\ \frac{\sqrt{3}}{4}a\right)$ (c) $\left(\frac{3a}{4},\ \frac{a}{2}\right)$ (d) $\left(\frac{a}{2},\ \frac{3a}{4}\right)$

16. A system consists of 3 particles each of mass m and located at (1, 1) (2, 2) (3, 3). The co-ordinate of the centre of mass are

(a) (6, 6) (b) (3, 3) (c) (2, 2) (d) (1, 1)

17. Four identical spheres each of mass m are placed at the corners of square of side 2metre. Taking the point of intersection of the diagonals as the origin, the co-ordinates of the centre of mass are

(a) (0, 0) (b) (1, 1) (c) (– 1, 1) (d) (1, – 1)

18. A circular disc of radius R and thickness $\frac{R}{6}$ has moment of inertia I about an axis passing through its centre and perpendicular to its plane. It is melted and recasted into a solid sphere. The moment of inertia of the sphere about its diameter as axis of rotation is

(a) I (b) $\frac{2I}{8}$ (c) $\frac{I}{5}$ (d) $\frac{I}{10}$

19. The moment of inertia of a meter scale of mass 0.6 kg about an axis perpendicular to the scale and located at the 20 cm position on the scale in kg m^2 is (Breadth of the scale is negligible)

(a) 0.074 (b) 0.104 (c) 0.148 (d) 0.208

20. Two discs of the same material and thickness have radii 0.2 m and 0.6 m. Their moments of inertia about their axes will be in the ratio

21. A circular disc is to be made by using iron and aluminium, so that it acquires maximum moment of inertia about its geometrical axis. It is possible with

(a) Iron and aluminium layers in alternate order (b)Aluminium at interior and iron surrounding it