JEE MAIN : CHAPTER WISE TEST PAPER-8

SUBJECT :- PHYSICS **DATE.....**
CLASS :- 11th **NAME.....**
CHAPTER :- ROTATIONAL MOTION **SECTION.....**

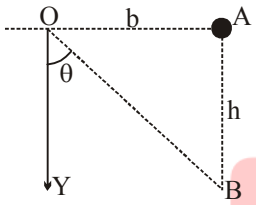
(SECTION-A)

1. If the radius of earth shrinks to ηR ($\eta < 1$), where R is the radius of earth, then the time period of rotation of earth about its axis will become

(A) $24\eta^2$ hour (B) $\frac{24}{\eta}$ hour

(C) 24η hour (D) $\frac{24}{\eta^2}$ hour

2. A particle of mass m is released from rest at point A in the figure falling freely under gravity parallel to the vertical Y axis. The magnitude of angular momentum of particle about point O when it reaches B is :
(Where OA = b and AB = h)



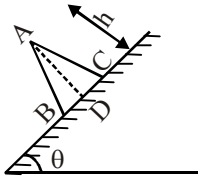
(A) mh/(bg) (B) $mb\sqrt{2gh}$

(C) $mh\sqrt{2gh}$ (D) None of these

3. A sphere is released on a smooth inclined plane from the top. When it moves down its angular momentum is:

(A) conserved about every point
(B) conserved about the point of contact only
(C) conserved about the centre of the sphere only
(D) conserved about any point on a fixed line parallel to the inclined plane and passing through the centre of the ball.

4. A right solid cone of height h and base radius r rests on an inclined plane as shown in figure. The coefficient of friction between the plane and the cone is μ. If the angle of inclination of the plane is slowly increased the cone is just at the point of toppling over at the moment when it is just about to slide down, find the relation between μ, r and h.



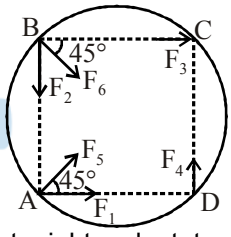
(A) 2r = μh (B) 4r = μh
(C) 6r = μh (D) 3r = μh

5. A generator's flywheel, which is a homogeneous cylinder of radius R and mass M, rotates about its longitudinal axis. The linear velocity of a point on the rim (side) of the flywheel is v. What is the kinetic energy of the flywheel ?

(A) K = $\frac{1}{2}Mv^2$ (B) K = $\frac{1}{4}Mv^2$

(C) K = $\frac{1}{2}Mv^2/R$ (D) K = $\frac{1}{2}Mv^2R$

6. The figure shows a ring in which a square is inscribed. Four equal forces $\vec{F}_1, \vec{F}_2, \vec{F}_3, \vec{F}_4$ of magnitude 10 N each act at A, B, C, D. Two force F_5 and F_6 of magnitude $10\sqrt{2}$ N each act at A and B. The ring will

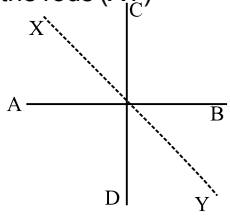


(A) move to right and rotate anticlockwise
(B) move downwards and rotate clockwise
(C) move to right and rotate clockwise
(D) will not move but rotate clockwise

7. If a circular concentric hole is made in a disk then about its axis
(A) Moment of inertia remains same
(B) Moment of inertia increases
(C) Radius of gyration increases
(D) Radius of gyration decreases

8. The moment of inertia of a uniform circular disc about a diameter is I. Its moment of inertia about an axis perpendicular to its plane and passing through a point on its rim is
(A) 3 I (B) 4 I (C) 5 I (D) 6 I

9. AB and CD are two identical rods each of length L and mass M joined to form a cross. Find the M.I. of the system about a bisector of the angle between the rods (XY)



(A) $\frac{ML^2}{12}$ (B) $\frac{ML^2}{6}$ (C) $\frac{ML^2}{3}$ (D) $\frac{4ML^2}{3}$

10. A ring of radius R is rolling purely on the outer surface of a pipe of radius 4R. At some instant, the center of the ring has a constant speed = v. Then , the acceleration of the point on the ring which is in contact with the surface of the pipe is

(A) $4v^2/5R$ (B) $3v^2/5R$
(C) $v^2/4R$ (D) zero

11. A solid sphere and a solid cylinder having the same mass and radius roll down the same incline. The ratio of their acceleration is

(A) 14 : 15 (B) 1 : 2
(C) 15 : 14 (D) 2 : 1

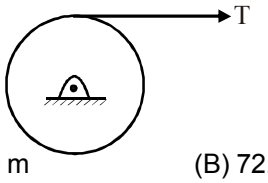
12. A uniform disc is rolling without sliding on a horizontal plane with centre of mass moving with constant velocity v. Number of points on the disc which has speed v at any instant are

(A) 1 (B) 2
(C) 3 (D) none of these

13. A cue ball is hit very near the top so that it starts to move with topspin. As it slides, the force of friction

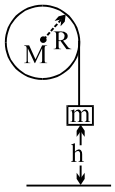
(A) Increases velocity of center of mass and decreases the angular velocity.
(B) Decreases velocity of center of mass and increases the angular velocity.
(C) Increases velocity of center of mass and the angular velocity.
(D) Decreases velocity of center of mass and the angular velocity.

14. A wheel 4 m in diameter rotates about a fixed frictionless horizontal axis, about which its moment of inertia is 10 kg m^2. A constant tension of 40 N is maintained on a rope wrapped around the rim of the wheel. If the wheel starts from rest at t = 0 s, find the length of rope unwounded till t = 3s.



(A) 36.0 m (B) 72.0 m
(C) 18.0 m (D) 720 m

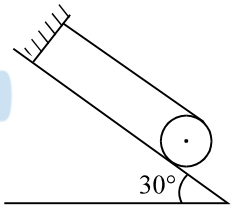
15. A solid uniform cylinder of mass M and radius R is pivoted at its centre free to rotate about horizontal axis.. A massless inextensible string is wrapped around it, and attached to a block of mass m which is initially at a height h above the floor. The acceleration due to gravity is g, directed downward. The block is released from rest. By what total angle $\Delta\theta$ (in radians) has the cylinder turned by the time the block hits the floor if string does not slip over cylinder ?



(A) $\sqrt{1+\frac{2M}{m}}$ (B) $\frac{h}{R}$

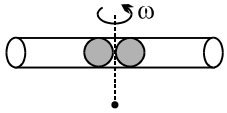
(C) $\sqrt{1+\frac{h}{2R}}$ (D) $\frac{MR}{mh}$

16. A thin hoop of weight 500 N and radius 1 m rests on a rough inclined plane as shown in the figure. The minimum coefficient of friction needed for this configuration is



(A) $\frac{1}{3\sqrt{3}}$ (B) $\frac{1}{\sqrt{3}}$ (C) $\frac{1}{2}$ (D) $\frac{1}{2\sqrt{3}}$

17. A smooth tube of certain mass containing two identical balls is rotated as shown in gravity free space and released. The two balls move towards ends of the tube. Which of the following quantity is not conserved.



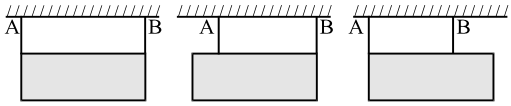
(A) Angular momentum of the whole system
(B) Net linear momentum of the two balls
(C) Kinetic energy of the whole system
(D) Angular speed of the tube

18. A body rolls down without slipping on an inclined plane. The fractional of its total energy associated with rotation will be (radius of gyration is k & radius of body is R)

(A) $\frac{R^2}{R^2+k^2}$ (B) $\frac{k^2}{R^2+k^2}$

(C) $k^2 + R^2$ (D) $\frac{1}{k^2+R^2}$

19. A picture is to be hung from the ceiling by means of two wires. Order the following arrangements of the wires according to the tension in wire B from least to greatest.



(A) I, II, III (B) III, II, I
(C) I and II tie, then III (D) II, I, III

20. A small ball strikes a stationary uniform rod, which is free to rotate, in gravity-free space. The ball does not stick to the rod. Instantaneous axis of rotation will pass through
(A) its centre of mass
(B) the centre of mass of rod plus ball
(C) the point of impact of the ball on the rod
(D) a point which lies between centre and other end of the rod

(SECTION-B)

21. When a person throws a meter stick it is found that the centre of the stick is moving with a speed of 10 m/s vertically upwards & left end of stick with a speed of 20 m/s vertically upwards. Then the angular speed of the stick is:

22. If the positions of two like parallel forces on a light rod are interchanged, their resultant shifts by one–fourth of the distance between them then the ratio of their magnitude is m : n. Find the value (m + n).

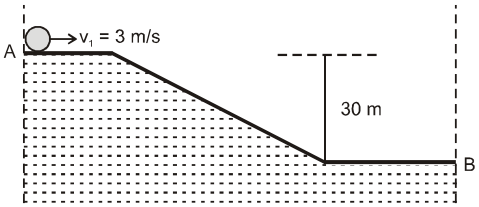
23. A fan is running at 3000 rpm. It is switched off. It comes to rest by uniformly decreasing its angular speed in 10 seconds. The total number of revolution in this period.

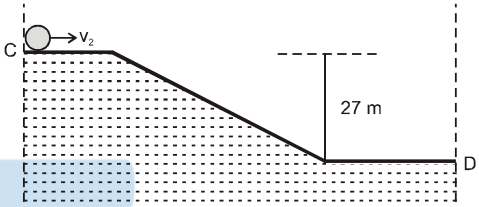
24. A force $\vec{F} = 4\hat{i} - 10\hat{j}$ acts on a body at a point having position vector $-5\hat{i} - 3\hat{j}$ relative to origin of co-ordinates on the axis of rotation . The torque acting on the body is :

25. A uniform metre stick is held vertically with one end on the floor and is allowed to fall. The speed of the other end when it hits the floor is $\sqrt{ng}$ assuming that the end at the floor does not slip. Find the value of n.

26. A circular disc X of radius R is made from an iron plate of thickness t, and another disc Y of radius 4R is made from an iron plate thickness t/4. Then the relation between the moment of inertia I_X and I_Y is $I_Y = K I_X$. Find the value of K.

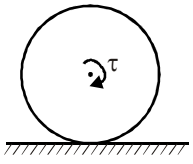
27. Two identical uniform discs roll without slipping on two different surfaces AB and CD (see figure) starting at A and C with linear speeds v_1 and v_2, respectively, and always remain in contact with ths surfaces. If they reach B and D with the same linear speed and $v_1 = 3$ m/s, then v_2 in m/s is ($g = 10$ m/s^2)





28. The dinsities of two solid spheres A and B of the same radii R vary with radial distance r as $\rho_A(r) = k\left(\frac{r}{R}\right)$ and $\rho_B(r) = k\left(\frac{r}{R}\right)^5$, respectively, where k is a contant. The moments of inertia of the individual spheres about axes passing through their centres are I_A and I_B, respectively, If $\frac{I_B}{I_A} = \frac{n}{10}$, the value of n is :

29. A wheel of mass m can be assumed to be a ring. Its radius is R. It is on a level ground. An external couple is applied to it about its axis. $\tau = \frac{mgR}{2}$. If it rolls purely, what is the friction force exerted by the ground.
(Take mass = 8kg)



30. A solid sphere radius R = $\frac{10}{\pi}$ cm is placed on a smooth horizontal surface. It is pulled by a horizontal force acting tangentially at the top most point. What is distance (in cm) traveled by the sphere during the time it makes a full rotation.