Regn. No. 0920
SKD New Standard Coaching Institute
ESTD. 1985
35 YEARS OF TEACHING EXCELLENCE
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Physics Quiz -(Rotational Motion)

01. If I_1 is the moment of inertia of a thin rod about an axis perpendicular to its length and passing through its centre of mass, and I_2 is the moment of inertia (about central axis) of the ring formed by bending the rod, then the ratio of I_1 to I_2 is
(1) 1 : 1 **(2) $\pi^2 : 3$**
(3) $\pi : 4$ (4) 3 : 5

02. A particle performs uniform circular motion with an angular momentum L. If the frequency of particle's motion is doubled and its kinetic energy is halved it's angular momentum becomes
(1) $\frac{L}{2}$ **(2) $\frac{L}{4}$**
(3) $\frac{L}{6}$ (4) $\frac{L}{8}$

03. A body of mass m slides down an incline and reaches the bottom with a velocity v. If the same mass was in the form of a ring which rolls down this incline, the velocity of the ring at the bottom would have been
(1) v (2) $\sqrt{2}$v
(3) $\frac{v}{\sqrt{2}}$ (4) $\left(\sqrt{\frac{2}{5}}\right)$v

04. Two rings of same mass and radius R are placed with their planes perpendicular to each other and centres at a common point. The radius of gyration of the system about an axis passing through the centre and perpendicular to the plane of one ring is
(1) 2R (2) $\frac{R}{\sqrt{2}}$
(3) $\sqrt{\frac{3}{2}}$R **(4) $\frac{\sqrt{3}R}{2}$**

05. A solid sphere of radius R is placed on a smooth horizontal surface. A horizontal force F is applied at height h from the lowest point. For the maximum acceleration of centre of mass, which is correct ?
(1) h = R (2) h = 2R
(3) h = 0
(4) Centre of mass has same acceleration in each case

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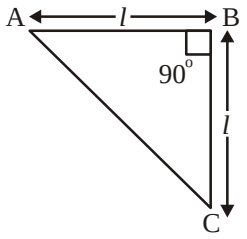
06. Figure shows a thin metallic triangular sheet ABC. The mass of the sheet is M. The moment of inertia of the sheet about side AC is:



(1) $\frac{Ml^2}{18}$ **(2) $\frac{Ml^2}{12}$**
(3) $\frac{Ml^2}{6}$ (4) $\frac{Ml^2}{4}$

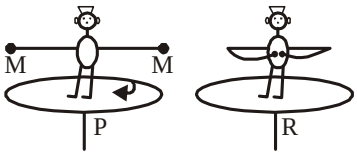
07. A thin rod of length L and mass M is held vertically with one end on the floor and is allowed to fall. Find the velocity of the other end when it hits the floor, assuming that the end on the floor does not slip:
(1) $\sqrt{\frac{3g}{L}}$ **(2) $\sqrt{3gL}$**
(3) $\sqrt{\frac{L}{3g}}$ (4) $\sqrt{\frac{g}{3L}}$

08. Two identical solid cylinders run a race starting from rest at the top of an inclined plane. If one cylinder slides and the other rolls:
(1) the sliding cylinder will reach the bottom first with greater speed
(2) the rolling cylinder will reach the bottom first with greater speed
(3) both will reach the bottom simultaneously with the same speed
(4) both will reach the bottom simultaneously but with different speeds

09. A uniform metre stick of mass M is hinged at one end and supported in a horizontal direction by a string attached to the other end. What should be the initial angular acceleration (in rad/sec^2) of the stick if the string is cut?
(1) $\frac{3}{2}$ g (2) g
(3) 3 g (4) 4 g

10. The moment of inertia of a uniform circular disc about its diameter is l. Its moment of inertia about an axis parallel to its plane and passing through a point on its rim will be
(1) $3l$ (2) $4l$
(3) $5l$ (4) $6l$

11. Figure P and R below shows a boy on a frictionless turning wheel, carrying two masses M, M on stretched arms. The wheel is set turning at angular velocity ω. The boy now folds his arms so that the masses come close to his chest . Let the moment of inertial of the wheel and boy about the axis of rotation be 3.0 kg. m^2, let each mass M be 1.0 kg. and initial separation MM = 1.4 m. As a result of the boy folding his arms, the angular velocity will become close to



(1) (5/3) ω **(2) (4/3) ω**
(3) (7/3) ω (4) (9/7) ω

12. The moment of inertia of a uniform disc about an axis perpendicular to disc at the centre is $\frac{1}{2}MR^2$ (M = mass, R = radius of disc). If the disc is rolling on its edge without slipping on a straight line path, the ratio of rotational kinetic energy to translational one is:
(1) 1 **(2) 1/2**
(3) 1/4 (4) 1/8

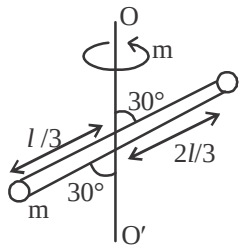
13. Three thin metal rods, each of mass M and length L, are welded to form an equilateral triangle. The moment of inertia of the composite structure about an axis passing through the center of mass of the structure and perpendicular to its plane is

(1) $\frac{1}{2}ML^2$ (2) $\frac{1}{3}ML^2$

(3) $\frac{2}{3}ML^2$ (4) $\frac{1}{4}ML^2$

14. A solid homogeneous sphere is moving on a rough horizontal surface, partly rolling and partly sliding. During this kind of motion of the sphere
(1) total kinetic energy is conserved
(2) angular momentum of the sphere about the point of contact with the plane is conserved
(3) only the rotational kinetic energy about centre of mass is conserved
(4) angular momentum about centre of mass is conserved

15. Two objects of same mass m are attached at the end of a light rod of length l and rotating about the axis OO′ as shown in the figure. The moment of inertia of the system about the axis OO′ is



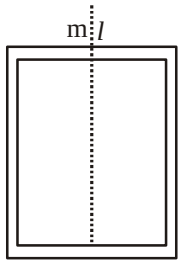
(1) $\frac{ml^2}{12}$ (2) $\frac{5ml^2}{18}$

(3) $\frac{5ml^2}{24}$ **(4)** $\frac{5ml^2}{36}$

16. A thin horizontal circular disc is rotating about a vertical axis passing through its centre. An insect is at rest at a point near the rim of the disc. The insect now moves along a chord of the disc to reach its other end near rim. During the journey of the insect, the angular speed of the disc.
(1) remains unchanged
(2) first decreases and then increases
(3) first increases and then decreases
(4) continuously increases

17. What is the ratio of moment of inertia of a thin rod about an axis through midpoint and perpendicular to its length and that about an axis through one end and perpendicular to its length?
(1) 1/4 (2) 1/3
(3) 1/2 (4) 1

18. Four rods each mass m and length l are arranged in form of rectangles as shown in the figure. The moment of inertia about perpendicular bisector of opposite sides is



(1) ml^2 (2) $\frac{ml^2}{6}$

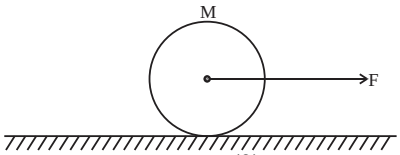
(3) $\frac{2}{3}ml^2$ (4) $\frac{ml^2}{3}$

19. A uniform solid drum of radius R and mass M rolls without slipping down a plane inclined at an angle θ. Its acceleration along the plane is

(1) $\frac{1}{3}$ g sin θ (2) $\frac{1}{2}$ g sin θ

(3) $\frac{2}{3}$ g sin θ (4) $\frac{5}{7}$ g sin θ

20. A uniform disc of radius R is resting on a table on its rim. The coefficient of friction between disc and table is μ. Now the disc is pulled with a force F as shown in the figure. The maximum value of F for which the disc rolls without slipping is:



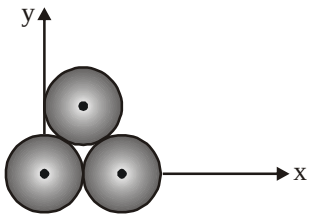
(1) 3μmg (2) μmg

(3) 2μmg (4) $\frac{2}{3}$ μmg

21. Two bodies A and B initially at rest are attracted towards each other due to gravitation. Given that A is much heavier than B. Which of the followings correctly describes the relative motion of the centre of mass of the bodies?
(1) it moves towards A
(2) it moves towards B
(3) it moves perpendicular to the line joining the particles
(4) it remains at rest

22. The position of centre of mass of system of particles at any moment does not depend on
(1) masses of the particles
(2) forces on the particles
(3) positions of the particles
(4) relative distances between the particles

23. Three identical spheres each of radius R are placed touching each other on a horizontal table as shown in figure. The co-ordinates of centre of mass are:

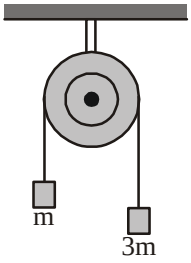


(1) (R, R) (2) (0, 0)

(3) $\left(\frac{R}{2}, \frac{R}{2}\right)$ **(4)** $\left(R, \frac{R}{\sqrt{3}}\right)$

24. Three balls of different masses are thrown at different instants up against gravity. While all the three balls are in air, the centre of mass of the system of three balls has an acceleration:
(1) Equal to 'g'
(2) Which depends on the direction of motion and speeds of different balls
(3) Which depends on the velocities, heights and masses of the balls
(4) Which depends on the direction of motion, speeds and masses of the ball

25. If the system is released, then the acceleration of the centre of mass of the system is:



(1) $\frac{g}{4}$ (2) $\frac{g}{2}$

(3) g (4) 2g