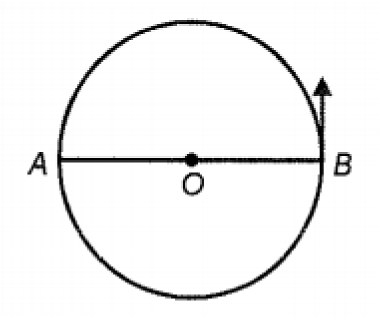
1.

The moment of inertia of a horizontal ring about its vertical axis through the centre is mR^2. Moment of inertia about its tangent parallel to the plane is:

1. $\frac{3\,mR^2}{2}$
2. $\frac{mR^2}{4}$
3. $\frac{mR^2}{2}$
4. $\frac{3\,mR^2}{4}$

2.

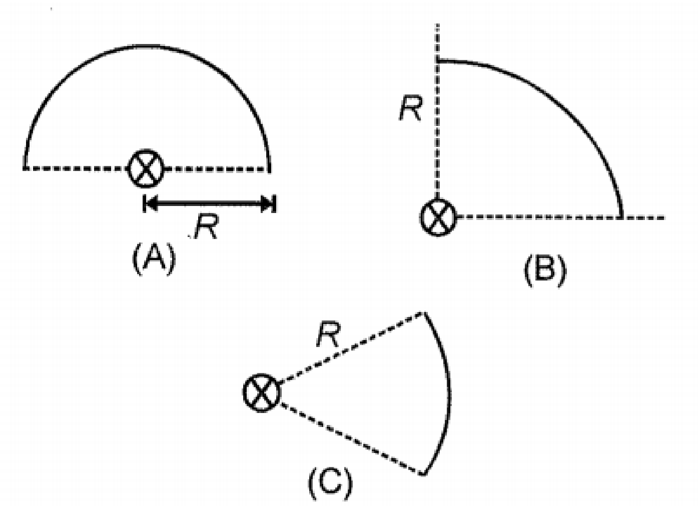
A particle moves in a circle with constant angular speed (ω) about point O. Then angular speed about point A will be:



1. 2ω
2. $\frac{\omega}{2}$
3. ω
4. $\frac{\omega}{4}$

3.

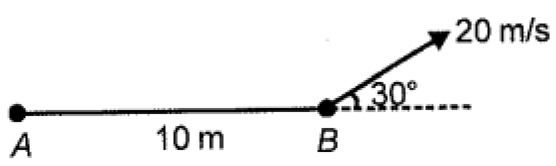
In the three figures, each wire has mass M, radius R and has uniform mass distribution. If they form part of a circle of radius R, then about an axis perpendicular to the plane and passing through the centre (shown by crosses), their moment of inertia is in the order:



1. $I_A > I_B > I_C$
2. $I_A = I_B = I_C$
3. $I_A < I_B < I_C$
4. $I_A < I_C < I_B$

4.

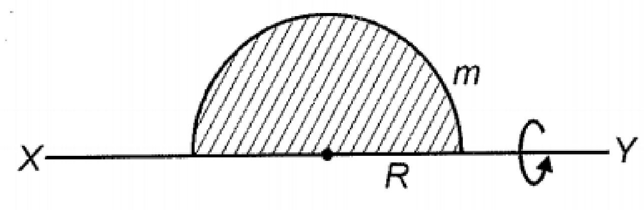
Particles A and B are separated by 10 m. A is at rest and B started moving with a speed of 20 m/s as shown in the figure. Angular velocity of B w.r.t. A at the instant is:



1. 1 rad s^{-1}
2. 1.5 rad s^{-1}
3. 2 rad s^{-1}
4. 2.5 rad s^{-1}

5.

Moment of inertia of a semicircular disc of radius R and mass m about XY lying in the place of the disc as shown in the figure is:



1. $\frac{3}{4}mR^2$
2. $\frac{1}{4}mR^2$
3. mR^2
4. $\frac{5}{4}mR^2$

6.

The moment of inertia of a uniform ring about an axis tangent to the ring and normal to its plane is *I*. Its moment of inertia about the diameter is:

1. I
2. $\frac{I}{4}$
3. $\frac{I}{2}$
4. $4I$

7.

A monkey is hanging on the rope of a balloon in the air. Both the monkey and balloon are at rest in mid-air. If the monkey climbs up the rope, then:

1. the balloon rises up.
2. the balloon comes down.
3. the centre of mass of the balloon and monkey system falls down.
4. the centre of mass of the balloon and monkey system rises up.

8.

A bomb is projected from the ground for horizontal range R. If the bomb is exploded in mid-air, then the range of its centre of mass is:

1. $\frac{R}{2}$
2. R
3. 2R
4. $\frac{2R}{3}$

9.

The moment of inertia of a uniform rod about its perpendicular bisector is I. Its moment of inertia about an axis normal to it and passing through one end is:

1. I
2. 3I
3. 4I
4. 12I

10.

Moment of inertia of a uniform ring about a diameter is I. Moment of inertia about its axis through the centre and normal to the plane is:

1. 2I
2. I
3. $\frac{2I}{3}$
4. $\frac{I}{3}$

11.

A particle rotating on a circular path of the radius $\frac{4}{\pi}$m with 300 rpm reaches 600 rpm in 6 revolutions. If the angular velocity increases with a constant rate, find the tangential acceleration of particle:

1. 10 m/s^2
2. 12.5 m/s^2
3. 25 m/s^2
4. 50 m/s^2

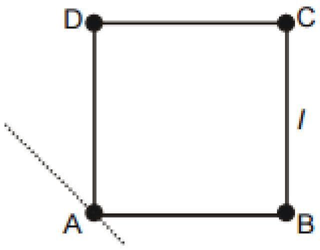
12.

Consider a system of two identical particles. One of the particles is at rest and the other has an acceleration a. The centre of mass has an acceleration:

1. zero
2. $\frac{1}{2}$a
3. a
4. 2a

13.

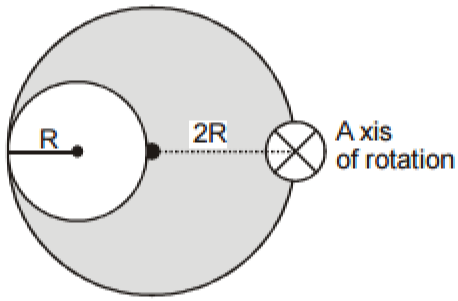
Four-point masses each of value m are placed at the corners of a square ABCD of side l. The moment of inertia of this system about an axis passing through A and parallel to BD is:



1. 2ml^2
2. 4ml^2
3. 3ml^2
4. ml^2

14.

Mass of bigger disc having radius 2R is M. A disc of radius R is cut from the bigger disc as shown in the figure. Moment of inertia of remaining disc about an axis passing through periphery and perpendicular to plane (shown in the figure) is:



1. $\frac{27\,MR^2}{8}$
2. $\frac{29\,MR^2}{8}$
3. $3.5\,MR^2$
4. $2\,MR^2$

15.

The mass per unit length of a non-uniform rod of length L is given by $\mu = \lambda x^2$ where λ is a constant and x is the distance from one end of the rod. The distance of the centre of mass of the rod from this end is:

1. $\frac{L}{2}$
2. $\frac{L}{4}$
3. $\frac{3L}{4}$
4. $\frac{L}{3}$

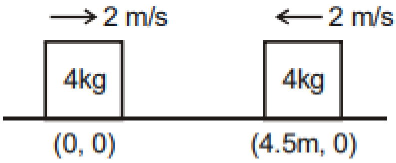
16.

A wheel was at rest. Its angular velocity increases uniformly and becomes 80 radians per second after 5 seconds. Its total angular displacement is:

1. 800 rad
2. 400 rad
3. 200 rad
4. 100 rad

17.

At t = 0 the positions of the two blocks are shown. There is no external force acting on the system. Find the coordinates of center of mass of the system at t = 3 seconds:



1. (1, 0)
2. (3, 0)
3. (4.5, 0)
4. (2.25, 0)

18.

Two gear wheels that are meshed together have radii of 0.50 cm and 0.15 cm. The number of revolutions made by the smaller one when the larger one goes through 3 revolutions is:

1. 5 revolutions
2. 20 revolutions
3. 1 revolution
4. 10 revolutions

19.

The angular speed of the wheel of a vehicle is increased from 360 rpm to 1200 rpm in 14 seconds. Its angular acceleration is:

(1) 2π rad/s^2

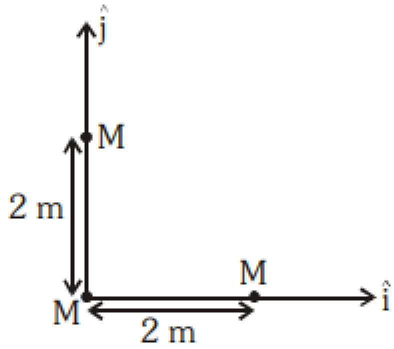
(2) 28π rad/s^2

(3) 120π rad/s^2

(4) π rad/s^2

20.

Three identical spheres, each of mass M, are placed at the corners of a right-angle triangle with mutually perpendicular sides equal to 2m (see figure). Taking the point of intersection of the two mutually perpendicular sides as the origin, find the position vector of the centre of mass.



1. $2\left(\hat{i}+\hat{j}\right)$

2. $\left(\hat{i}+\hat{j}\right)$

3. $\frac{2}{3}\left(\hat{i}+\hat{j}\right)$

4. $\frac{4}{3}\left(\hat{i}+\hat{j}\right)$

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