DPP
DAILY PRACTICE PROBLEMS
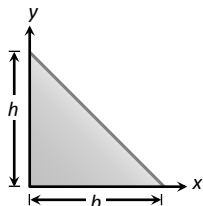
CLASS : XITH
DATE :

SUBJECT : PHYSICS
DPP NO. : 10

Topic :- SYSTEM OF PARTICLES AND ROTATIONAL MOTION

1. Consider a uniform square plate of side 'a' and mass 'm'. The moment of inertia of this plate about an axis perpendicular to its plane and passing through one of its corners is

    a) $\frac{1}{12} ma^2$
    b) $\frac{7}{12} ma^2$
    c) $\frac{2}{3} ma^2$
    d) $\frac{5}{6} ma^2$

2. 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) $\frac{2I}{3}$
    c) $\frac{I}{5}$
    d) $\frac{I}{10}$

3. A solid cylinder on moving with constant speed v_0 reaches the bottom of an incline of 30°. A hollow cylinder of same mass and radius moving with the same constant speed v_0 reaches the bottom of a different incline of θ. There is no slipping and both of them go through the same distance in the same time ; θ is then equal to

    a) 37°
    b) 30°
    c) 42°
    d) 45°

4. The centre of mass of triangle shown in figure has coordinates

    a) $x = \frac{h}{2}, y = \frac{b}{2}$
    b) $x = \frac{b}{2}, y = \frac{h}{2}$
    c) $x = \frac{b}{3}, y = \frac{h}{3}$
    d) $x = \frac{h}{3}, y = \frac{b}{3}$

5. A body of mass M moving with a speed u has a head-on collision with a body of mass m originally at rest. If $M >> m$, the speed of the body of mass m after collision will be nearly

    a) $\frac{um}{M}$
    b) $\frac{uM}{m}$
    c) $\frac{u}{2}$
    d) $2u$

6. A smooth steel ball strikes a fixed smooth steel plate at an angle θ with the vertical. If the coefficient of restitution is e, the angle at which the rebounce will take place is

   a) θ
   b) $\tan^{-1}\left[\frac{\tan\theta}{e}\right]$
   c) $e\tan\theta$
   d) $\tan^{-1}\left[\frac{e}{\tan\theta}\right]$

7. If the earth shrinks such that its mass does not change but radius decreases to one quarter of its original value then one complete day will take

   a) 96 h
   b) 48 h
   c) 6 h
   d) 1.5 h

8. A circular turn table has a block of ice placed at its centre. The system rotates with an angular speed ω about an axis passing through the centre of the table. If the ice melts on its own without any evaporation, the speed of rotation of the system

   a) Becomes zero
   b) Remains constant at the same value ω
   c) Increases to a value greater than ω
   d) Decreases to a value less than ω

9. Two blocks of masses 10 kg and 4 kg connected by a spring of negligible mass and placed on a frictionless horizontal surface. An impulse gives a velocity of 14 ms^{-1} to the heavier block in the direction of the lighter block. The velocity of the centre of mass is

   a) 30 ms^{-1}
   b) 20 ms^{-1}
   c) 10 ms^{-1}
   d) 5 ms^{-1}

10. A spherical hollow is made in a lead sphere of radius R such that its surface touches the outside surface of lead sphere and passes through the centre. What is the shift in the centre of lead sphere as a result of this hollowing?
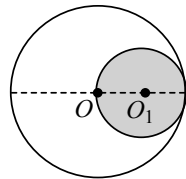
   a) $\frac{R}{7}$
   b) $\frac{R}{14}$
   c) $\frac{R}{2}$
   d) R

11. If the earth is treated as a sphere of radius R and mass M; its angular momentum about axis of rotation with period T is

   a) $\frac{\pi MR^3}{T}$
   b) $\frac{MR^2\pi}{T}$
   c) $\frac{2\pi MR^3}{5T}$
   d) $\frac{4\pi MR^2}{5T}$

12. Two masses m_1 and $m_2(m_1 > m_2)$ are connected by massless flexible and inextensible string passed over massless and frictionless pulley. The acceleration of centre of mass is

   a) $\left(\frac{m_1 - m_2}{m_1 + m_2}\right)^2 g$
   b) $\frac{m_1 - m_2}{m_1 + m_2} g$
   c) $\frac{m_1 + m_2}{m_1 - m_2} g$
   d) Zero

13. A man of mass M stands at one end of a plank of length which is at rest on a frictionless horizontal surface. The man walks to he other end of the plank. If mass of the plank is $M/3$, the distance that the man moves relative to ground is

   a) L
   b) $L/4$
   c) $3L/4$
   d) $L/3$

14. Two discs of same thickness but of different radii are made of two different materials such that their masses are same. The densities of the materials are in the ratio 1:3. The moments of inertia of these discs about the respective axes passing through their centres and perpendicular to their planes will be in the ratio

    a) $1 : 3$ b) $3 : 1$ c) $1 : 9$ d) $9 : 1$

15. A bullet of mass M hits a block of mass M'. The transfer to energy is maximum, when

    a) $M' = M$ b) $M' = 2M$ c) $M' < < M$ d) $M' > > M$

16. Which relation is not correct of the following
    a)   Torque= Moment of inertia $\times$ angular acceleration
    b)   Torque=Dipole moment $\times$ magnetic induction
    c)   Moment of inertia = Torque/angular acceleration
    d)   Liner momentum = Moment of inertia $\times$ angular velocity

17. If a ball is dropped from rest, its bounces from the floor. The coefficient of restitution is 0.5 and the speed just before the first bounce is 5ms^{-1}. The total time taken by the ball to come to rest is

    a)   2 s   b)   1 s   c)   0.5 s   d)   0.25 s

18. Angular momentum of a system of particles changes when
    a)   Force acts on a body   b)   Torque acts on a body
    c)   Direction of velocity changes   d)   None of these

19. The moment of inertia of 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 o the scale is negligible)

    a)   0.078   b)   0.104   c)   0.148   d)   0.208

20. A particle moves in the x-y plane under the action of a force F such that the value of its linear momentum $\vec{P}$ at any time t is $p_x = 2 \cos t, p_y 2\sin t$

    The angel θ between $\vec{F}$ and $\vec{P}$ at a given time t will be

    a)   90°   b)   0°   c)   180°   d)   30°