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Subject : Physics | **MHT-CET- QUESTION PAPER** | **Total Marks : 50**
Class : XII | **Topic: 1. Rotational Dynamics** | **Time : 1 Hr.**

1) Moment of inertia of a disc about an axis which is tangent and parallel to its plane is I. then the moment of inertia of disc about a tangent, but perpendicular to its plane will be

(a) $\frac{3I}{4}$ (b) $\frac{3I}{2}$ (c) $\frac{5I}{6}$ (d) $\frac{6I}{5}$

2) Calculate the M.I. of a thin uniform ring about an axis tangent to the ring and in a plane of the ring, if its M.I. about an axis passing through the centre and perpendicular to plane is 4 kg m².

(a) 12 kg m² (b) 3 kg m²
(c) 6 kg m² (d) 9 kg m²

3) For increasing the angular velocity of a object by 10%, the kinetic energy has to be increased by

(a) 40% (b) 20%
(c) 10% (d) 21%

4) A thin uniform ring of mass M and radius R passing through its centre and perpendicular to its plane. Then its M.I. is,

(a) $\frac{1}{2}MR^2$ (b) MR^2 (c) $2MR^2$ (d) $\frac{3}{2}MR^2$

5) Ratio of rotational K.E. to rolling K.E. of a solid sphere is

(a) $\frac{2}{3}$ (b) $\frac{2}{5}$ (c) $\frac{2}{7}$ (d) ∞

6) A dancer on ice spins faster when she folds here arms. This is due to

(a)Increases in energy and increase in angular momentum
(b)Decrease in friction at the skates
(c)Constant angular momentum and increase in kinetic energy
(d)Increase in energy an decreases in angular momentum

7) Which is the wrong relation from the following?

(a) $T = I\alpha$ (b)$F = ma$
(c) $L = I\omega$ (d) $I = T\alpha$

8) The angular momentum of a system of particles is conserved

(a) when no external force acts upon the system
(b) when no external torque acts upon the system
(c) when no external impulse acts upon the system
(d) when the axis of the rotation remains the same

9) A body rolls down an inclined plane. If its K.E. of rotational motion is 40% of its K.E. of translational, then the body is a

(a) cylinder (b) ring
(c) solid disc (d) solid sphere

10) A solid sphere, disc and solid cylinder all of the same mass and made of the same material are allowed to roll down (from rest) on an inclined plane, then

(a) the solid sphere reaches the bottom first
(b) the solid sphere reaches the bottom last

(c) the disc will reach the bottom first

(d) all reach the bottom at the same time not

11) The ratio of the accelerations for a ring (mass m and radius R) rolling down an incline of angle '0' without slipping and slipping down the incline without rolling is

(a) 1 : 2 (b) 2 : 3 (c) 2 : 5 (d) 2 : 1

12) By keeping moment of inertia of a body constant, if we double the time period, then angular momentum of body

(a) Remains constant (b)Becomes half

(c)Doubles (d) Quadruples

13) $\frac{L^2}{2I}$ represents

(a)Rotational kinetic energy of a particle.

(b)Potential energy of a particle

(c)Torque on a particle

(d)Power

14) The M.I. of a disc about an axis passing through its centre and perpendicular to plane is , then its M.I. about a tangent parallel to its diameter is

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

15) The torque acting is 2000Nm with an angular acceleration of 2 rad/s². the moment of inertia of body is

(a) 1200 kgm² (b) 900 kgm²

(c) 1000 kgm² (d) Can't say

16) A thin uniform circular disc of mass M and radius r is rotating in a horizontal plane about an axis passing through its centre and perpendicular to its plane with an angular velocity ω. Another disc of the same dimensions but of mass M/4 is placed gently on the first disc co-axially.The angular speed of the composite disc will be

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

17) Two bodies have their moments of inertia I and 2I respectively about their axis of rotation. If their kinetic energies of rotation are equal, their angular momenta will be in the ratio of

(a) 1:2 (b) 2:1 (c) $\sqrt{2}:1$ (d) $1:\sqrt{2}$

18) Angular momentum is

(a) A scalar (b) A polar vector

(c) A scalar as well as vector

(d) An axial vector

19) Two circular discs A and B have equal masses and uniform thickness but have densities ρ_1 and ρ_2 such that $\rho_1 > \rho_2$ their moment of inertia is

(a) $I_1 > I_2$ (b) $I_1 >> I_2$

(c) $I_1 < I_2$ (d) $I_1 = I_2$

20) A particle performing uniform circular motion has angular momentum L. If its angular frequency is doubled and its kinetic energy halved, then the new angular momentum is

(a) $\frac{L}{2}$ (b) $\frac{L}{4}$ (c)2L (d) 4L

21) Choose an INCORRECT statement. For a spinning top,

(a) particles of the top lying on the axis of rotation of the top are stationary with respect to the spinning body of the top.

(b) point of contact of the top with the ground is fixed.

(c) its axis of rotation varies from time to time depending upon the cones it is sweeping in the space.

(d) its axis of rotation always passes through the point of contact with the ground.

22) A large value of the radius of gyration indicates

(a) a large value of M.I. with mass distributed widely about an axis.

(b) a large value of M.I. with mass distributed widely away from the axis.

(c) a large value of M.I. with no information about mass distribution.

(d) a large value of M.I. and a large value of mass.

23) The angular speed of a motor wheel is increased from 1200 rpm to 3120 rpm in 16 seconds. What is its angular acceleration to be uniform?

(a) 4π (b) 3π (c) 2π (d) None of these

24) The radius of a solid sphere is 10 cm. The radius of gyration, when the axis of rotation is along a tangent, is

(a) 10 cm (b) 11.8 cm

(c) 15 cm (d) 14.3 cm

25) The SI unit of moment of inertia is_____

(a) gram-cm^2 (b) kg-m^2

(c) kg/m^2 (d) kg-m

26) The dimensional formula for the radius of gyration of a body is_____

a) $[M^0L^0T^0]$ b) $[M^0L^1T^0]$

c) $[M^1L^1T^0]$ d) $[M^2L^0T^1]$

27) Two circular rings A and B of radii nR and R are made from the same wire. The M.I. of A about an axis passing through the centre and perpendicular to the plane of A is 27 times that of the smaller loop B. What is the value of n?

(a) 2 (b) 3 (c) 4 (d) 5

28) A torque of 100 N-m acting on a wheel at rest, rotates it through 200 radian in 10s. What is the moment of inertia of the wheel?

(a) 10 kg-m^2 (b) 15 kg-m^2

(c) 20 kg-m^2 (d) 25 kg-m^2

29) Moment of inertia of a body is considered only in the case of_____

(a) Rectilinear motion

(b) Rotational motion

(c) Curvilinear motion

(d) Translational motion

30) The cyclist riding a bicycle at a speed of $14\sqrt{3}$ m/s takes a turn around a circular road of radius $20\sqrt{3}$ m without skidding. Given g=9.8 m/s^2.What is inclination to the vertical?

(a) 30^0 (b) 45^0 (c) 60^0 (d) 90^0

31) A string of length l fixed at one end carries a mass m at the other.The string makes $\frac{2}{\pi}$ revolutions/sec around the vertical axis through the fixed end.The tension in the string is----------

(a) 2 ml (b) 4 ml (c) 8 ml (d) 16 ml

32) What should be the minimum coefficent of static friction between the plane and the cylinder for the cylinder not to slip on an inclined plane?

a) $\frac{1}{3}\tan\theta$ b) $\frac{1}{3}\sin\theta$

c) $\frac{2}{3}\tan\theta$ d) $\frac{2}{3}\sin\theta$

33) For increasing the angular velocity of an object by 10% the kinetic energy has to be increased by

a) 40% b) 20%

c) 10% d) 21%

34) If a gymnast sitting on a rotating stool with his arms outstreched suddenly lowers his arms

a) the angular velocity increases

b) his moment of inertia increases

c) the angular velocity remain same

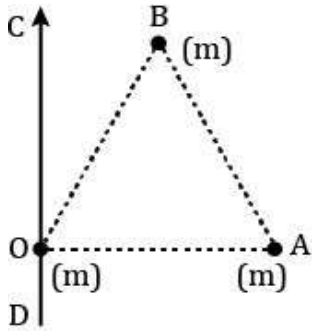
d) the angular momentum increases

35) Two circular discs made of same material are of the same thickness.The diameter of A is twice that of B.The moment of inertia of A as compared to that of B is

a) twice as large b)four times as large

c) 8 times as large d)16 times as large

36) Three point masses m are placed at the vertices of an equilateral triangle of side a. Moment of inertia of the system about an axis COD pasing through a mass m at O, and lying in the plane of AOB, and perpendicular to OA is



a) $2ma^2$ b) $\frac{2}{3}ma^2$ c) $\frac{5}{4}ma^2$ d) $\frac{7}{4}ma^2$

37) If the radius of solid sphere is 35cm calculate the radius of gyration when the axis is along a tangent

a) $7\sqrt{10}$ cm b) $7\sqrt{35}$ cm

c) $\frac{7}{5}$ cm d) $\frac{2}{5}$ cm

38) An inclined plane makes an angle of 30^0 with the horizontal.A ring rolling down this inclined plane from rest without slipping has a linear acceleration equal to

a) $\frac{2g}{3}$ b) $\frac{g}{2}$ c) $\frac{g}{3}$ d) $\frac{g}{4}$

39) Two particles of equal masses are revolving in circular paths of radii r_1 and r_2 respectively with the same speed.The ratio of their centripetal forces is

a) $\frac{r_1}{r_2}$ b) $\sqrt{\frac{r_2}{r_1}}$

c) $\left(\frac{r_2}{r_1}\right)^2$ d) $\left(\frac{r_1}{r_2}\right)^2$

40) The safety speed of a vehicle on a curve horizontal road is

a) μrg b) $\sqrt{\mu rg}$

c) $\mu r^2 g$ d) $\mu (rg)^2$

41) Moment of a inertia of a sphere about its diameter is $\frac{2}{5}MR^2$. What its moment of inertia about an axis perpendicular to its two diameter and passing through their point of intersection.?

(a) $I = \frac{2}{5}Mr^2$ (b) $I = \frac{3}{5}Mr^2$

(c) $I = \frac{4}{5}Mr^2$ (d) $I = \frac{5}{5}Mr^2$

42) From the theorem of perpendicular axes

a) $I_x - I_y = I_z$ b) $I_x + I_z = I_y$

c) $I_x + I_y = I_z$ d) $I_y + I_z = I_x$

43) The rail tracks are banked on the curves so that

a) Resultant force will be decreased

b) Weight of train may be reduced.

c) Centrifuagal force may be balanced by the horizontal component of the normal reaction of the rail

d) Frictional force may be produced between the wheels and tracks

44) Which of the following statement is true in case of the principle of perpendicular axes?

a) It is applicable to only three dimensional objects

b) It is applicable to planar as well as three dimensional objects.

c) It is applicable to only planar objects

d) It is applicable to only denser objects.

45) A particle is moving in a verticle circle.If v_1 is the velocity of particle at highest point and v_2 is the velocity of particle at lowest point then the relation between v_1 and v_2 is

a) $v_1 = v_2$ b) $v_1 < v_2$

c) $v_2 = \sqrt{5}\, v_1$ d) $v_1 = \sqrt{5}\, v_2$

46) If the overbridge is concave instead of being convex the thrust on the road at the lowest position will be

a) $mg + \frac{mv^2}{r}$ b) $mg - \frac{mv^2}{r}$

c) $\frac{mv^2 g}{r}$ d) $\frac{v^2 g}{r}$

47) Which of the following quantity remains constant if the torque acting on the body is zero?

a)Linear Momentum

b) Angular Momentum

c) Both a and b d) None of these

48) A flywheel rotating about a fixed axis has a kinetic energy of 360joule when its anngular speed is 30 radian/s.The Moment of inertia of the wheel about the axis of rotation is

a) 0.6 kg m^2 b) 0.15 kg m^2

c) 0.8 kg m^2 d) 0.75 kg m^2

49) A solid sphere of mass 10 kg and diameter 5 cm rolls without slipping on a smooth horizontal surface with velocity 5 cm/s. Its total kinetic energy is

a) 175×10^{-4} J b) 175×10^{-3} J

c) 175×10^{-5} J d) 175×10^{-6} J

50) A thin walled hollow cylinder is rolling down an incline, without slipping. At any instant, the ratio "Rotational K.E.: Translational K.E.: Total K.E." is

a) 1:1:2 b) 1:2:3

c) 1:1:1 d) 2:1:3

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