INTRODUCTION

1. In a spinning top, axis moves around the vertical through its point of contact with the ground sweeping out a cone. This movement of the axis of the top around the vertical is known as
   a) rotation b) translation
   c) precession d) rolling

CENTRE OF MASS

2. The centre of mass of a body
   a) lies always at the geometrical centre
   b) lies always inside the body
   c) lies always outside the body
   d) may lie within or outside the body
3. The position of the centre of mass of a cube of uniform mass density will be at
   a) the centre of one face
   b) the centre of the interaction of diagonals of one face.
   c) the geometric centre of the cube
   d) the edge of a cube
4. The reduce mass of two particles having masses m and 2m is
   a) 2 m b) 3 m
   c) d)
5. Three particles of masses 1 kg, are located at the vertices of an equilateral triangle of side a. The x, y coordinates of the centre of mass are
   a) b)
   c) d)
6. The x, y coordinates of the centre of mass of a uniform L-shaped lamina of mass 3 kg is
   a)
   b)
   c)
   d)
7. The centre of mass of a system of two particles of masses is at a distance and at a distance from mass such that
   a) b)
   c) d)
8. Centre of mass of three particles of masses 1 kg, 2 kg and 3 kg lies at the point (1, 2, 3) and centre of mass of another system of particles
   3 kg and 2 kg lies at the point Where should we put a particle of mass 5 kg so that the centre of mass of entire system lies at the centre of mass of first system?
   a) (0, 0, 0) b)
   c) d)
9. Two particles of mass 1 kg and 3 kg have position vectors respectively. The centre of mass has a position vector
   a) b)
   c) d)

MOTION OF CENTRE OF MASS

10. When an explosive shell travelling in a parabolic path under the effect of gravity explodes in the mid air, the centre of mass of the fragments will move
    a) vertically downwards
    b) along the original parabolic path
    c) vertically upwards and then vertically downwards
    d) horizontally followed by parabolic path
11. The velocity of centre of mass of the system remains constant, if the total external force acting on the system is
    a) minimum b) maximum
    c) unity d) zero
12. Two particles of equal mass have velocities First particle has an acceleration while the acceleration of the other particle is zero. The centre of mass of the two particles moves in a path of
    a) straight line b) parabola
    c) circle d) ellipse
13. A child is standing at one end of a long trolley moving with a speed on a smooth horizontal floor. If the child starts running towards the other end of the trolley with a speed , the centre of mass of the system (trolley + child) will move with a speed
    a) zero b)
    c) d)
14. Two masses and are connected by a light inextensible string and suspended by means of a weightless pulley as shown in the figure. Assuming that both the masses start from rest, the distance travelled by the centre of mass in two seconds is

a) b)

c) d)

ANGULAR VELOCITY AND ITS RELATION WITH LINEAR VELOCITY

15. Which of the following is the correct relation between linear velocity and angular velocity of a particle?

    a) b)
    c) d)

16. The direction of the angular velocity vector is along
    a) the tangent to the circular path
    b) the inward radius
    c) the outward radius
    d) the axis of rotation

17. Which of the following statements is correct?
    a) For a general translation motion, momentum need not parallel.
    b) For a general rotational motion, angular momentum and angular velocity always be parallel.
    c) For a general translation motion, acceleration and velocity are always parallel.
    d) For a general rotational motion, angular momentum and angular velocity need not be parallel.

18. A body is rotating with angular velocity The linear velocity of a point having position vector is

    a) b)
    c) d)

19. A disc rotating about its axis with angular speed is placed lightly (without any translational push) on A perfectly frictionless table. The radius of the disc is R. Let be the magnitudes of linear velocities of the points A, B and C on the disc as shown. Then

    a) b)
    c) d)

TORQUE AND ANGULAR MOMENTUM

20. Figure shows a lamina in x-y plane. Two axes pass perpendicular to its plane. A force F acts in the plane of lamina at point P as shown. Which of the following statements is incorrect?
    (The point P is closer to than the z-axis).

    a) Torque caused by F about z axis is along
    b) Torque caused by F about axis is along
    c) Torque caused by F about z axis is greater in magnitude than that about axis.
    d) Total torque is given by

21. When a torque acting upon a system is zero. Which of the following will be constant?
    a) Force
    b) Linear impulse
    c) Linear momentum
    d) Angular momentum

22. If is the force acting on a particle having position vector be the torque of this force about the origin, then

    a)
    b)
    c)
    d)

23. Angular momentum of the particle rotating with a central force is constant due to
    a) constant torque
    b) constant force
    c) constant linear momentum
    d) zero torque

24. The force acts on a particle whose position vector is What is the torque of a given force about the origin?

    a) b)
    c) d)

25. A disc is rotating with angular velocity about its axis. A force acts at a point whose position vector with respect to the axis of rotation is . The power associated with the torque due to the force is given by

    a) b)
    c) d)

26. A mass M is moving with a constant velocity parallel to x-axis. Its angular momentum w.r.t. origin
    a) is zero

b) remains constant
c) goes on increasing
d) goes on decreasing

27. A small mass m is attached to a massless string whose other end is fixed at P as shown in figure. The mass is undergoing circular motion in x-y plane with centre O and constant angular speed .If the angular momentum of the system, calculated about O and P and denoted by respectively, then

a) do not vary with time.
b) varies with time while remains constant.
c) remains constant while varies with time.
d) both vary with time.

28. The position of a particle is given by and its linear momentum is given by .
Then its angular momentum about the origin is perpendicular to
a) x-axis b) y-axis
c) z-axis d) yz-plane

29. The z component of the angular momentum of a particle whose position vector is with components x, y and z and linear momentum is with components

a) b)
c) d)

30. Consider a particle of mass m having linear momentum at position relative to the origin O.
Let be the angular momentum of the particle with respect to the origin. Which of the following equations correctly relate (s)

a) b)
c) d)

EQUILIBRIUM OF A RIGID BODY

31. A rigid body is said to be in partial equilibrium, when it is in
a) translational equilibrium only
b) rotational equilibrium only
c) either a) or b)
d) neither a) nor b)

32. Moment of couple is called
a) angular momentum
b) force
c) torque
d) impulse

33. A couple produces
a) purely translational motion
b) purely rotational motion
c) both translational and rotational motion
d) no motion

34. Which of the following statements is incorrect?
a) A pair of equal and opposite forces with different lines of action is known as couple.
b) A couple produces rotation without translation.
c) When we open the lid of a bottle by turning it, our fingers apply a couple to the lid.
d) Moment of a couple depends on the point about which we take the moment.

35. Which of the following relations is correct?
a)
b)
c)
d) None of these

36. A rigid rod of length 2L is acted upon by some forces. All forces labelled F have the same magnitude. Which cases have a non-zero net torque acting on the rod about its centre?

a) I and II only
b) II and III only
c) I and III only
d) The net torque is zero in all cases.

37. (1) Centre of gravity of a body is the point at which the weight of the body acts.
(2) Centre of mass coincides with the centre of gravity if the earth is assumed to have infinitely large radius.
(3) To evaluate the gravitational field intensity due to any body at an external point, the entire mass of the

body can be considered to be concentrated at its centre of gravity.

(4) The radius of gyration of any body rotating about an axis is the length of the perpendicular dropped from the centre of gravity of the body to the axis.

Which one of the following pairs of statements is correct?

a) (1) and (4) b) (1) and (2)
c) (2) and (3) d) (3) and (4)

38. A non-uniform bar of weight W and length L is suspended by two strings of negligible weight as shown in figure. The angles made by the strings with the vertical are respectively. The distance d of the centre of gravity of the bar from its left end is

a)

b)

c)

d)

39. A uniform rod of length 1 m and mass 4 kg is supported on two knife edges placed 10 cm from each end. A 60 N weight is suspended at 30 cm from one end. The reactions at the knife edges is
a) 60 N, 40 N b) 75 N, 25 N
c) 65 N, 35 N d) 55 N, 45 N
40. A car weighs 1800 kg. The distance between its front and back axles is 1.8 m. Its centre of gravity is 1 m behind the front axle. The force exerted by the level ground on each front wheel and each back wheel is

a) 4000 N on each front wheel, 5000 N on each back wheel
b) 5000 N on each front wheel, 4000 N an each back wheel
c) 4500 N on each front wheel, 4500 N on each back wheel
d) 3000 N on each front wheel, 6000 N on each back wheel

41. A uniform ladder 3 m long weighing 20 kg leans against a frictionless wall. Its foot rest on a rough floor 1 m from the wall. The reaction forces of the wall and floor are
a) b)
c) d)
42. A metre stick is balanced on a knife edge at its centre. When two coins, each of mass 5 g are put one on top of the other at the 12 cm mark, the stick is found to be balanced at 45 cm. The mass of the metre stick is
a) 56 g b) 66 g
c) 76 g d) 86 g
43. A uniform cube of mass M and side a is placed on a frictionless horizontal surface.

A vertical force F is applied to the edge as shown in figure. Match the Column I with Column II

Column I		Column II	
(A)		(p)	Cube will move up.
(B)		(q)	Cube will not exhibit motion.
(C)		(r)	Cube will begin to rotate and slip at A.
(D)		(s)	Normal reaction effectively at a/3 from A, no motion.

a) A – p, B – q, C – s, D – r
b) A – r, B – s, C – q, D – p
c) A – q, B – r, C – p, D – s
d) A – s, B – p, C – r, D – q

MOMENT OF INERTIA

44. Analogue of mass in rotational motion is
a) moment of inertia
b) torque
c) radius of gyration
d) angular momentum
45. The moment of inertia of a body depends upon
a) mass of the body
b) axis of rotation of the body
c) shape and size of the body
d) all of these
46. Which of the following has the highest moment of inertia when each of them has the same mass and the same radius?
a) A ring about any of its diameter.
b) A disc about any of its diameter.
c) A hollow sphere about any of its diameter.
d) A solid sphere about any of its diameter.
47. A person is standing on a rotating table with metal spheres in his hands. If he withdraws his hands to his chest, then the effect on his angular velocity will be
a) increase b) decrease
c) remain same d) can't say

48. A solid cylinder of mass M and radius R rotates about its axis with angular speed . Its rotational kinetic energy is

a) b)

c) d)

49. Match the Column I with Column II.

Column I		Column II	
(A)	For translational equilibrium	(p)	
(B)	For rotational equilibrium	(q)	Angular acceleration
(C)	Moment of inertia of a body	(r)	
(D)	Torque required to produce	(s)	

a) A – p, B – q, C – r, D – s
b) A – q, B – r, C – s, D – p
c) A – r, B – q, C – p, D – s
d) A – r, B – s, C – p, D – q

50. The radius of gyration of an uniform rod of length l about an axis passing through one of its ends and perpendicular to its length is

a) b)

c) d)

THEOREMS OF PERPENDICULAR AND PARALLEL AXES

51. Two masses each of mass M are attached to the end of a rigid massless rod of length L. The moment of inertia of the system about an axis passing centre of mass and perpendicular to its length is

a) b)

c) d)

52. From a circular disc of radius R and mass 9 M, a small disc of radius is removed as shown in figure. The moment of inertia of the remaining disc about an axis perpendicular to the plane of the disc and passing through O is

a) b)

c) d)

53. A uniform rectangular plate R of sides a and b and a uniform square plate s of side c have same masses and areas as shown in the figure.
Then,

(i) (ii)

Which of the above relations is correct?
a) (i) only b) (ii) only
c) Both (i) and (ii) d) Neither (i) nor (ii)

54. The moment of inertia of a solid sphere of mass M and radius R about a tangent to the sphere is

a) b)

c) d)

55. With reference to figure of a cube of edge a and mass m, which of the following is the incorrect statement? (O is the centre of the cube)

(a) The moment of inertia of cube about is

b) The moment of inertia of cube about is

c)

d) None of these

KINEMATICS OF ROTATIONAL MOTION ABOUT A FIXED AXIS

56. An athlete throws a discus from rest to a final angular velocity of before releasing it. During acceleration, discus moves a circular arc of radius 0.810 m. Acceleration of discuss before it is released is

a) b)

c) d)

57. A flywheel rotating at 420 rpm slows down at a constant rate of The time required to stop the flywheel is
    a) 22 s b) 11 s
    c) 44 s d) 12 s
58. The angular speed of a motor wheel is increased from 1200 rpm to 3120 rpm in 16 seconds. The angular acceleration of the motor wheel is
    a) b)
    c) d)

DYNAMICS OF ROTATIONAL MOTION ABOUT A FIXED AXIS

59. An automobile engine develops 100 kW when rotating at a speed of 1800 rpm. The torque delivered by the engine is
    a) b)
    c) d)
60. A grindstone has a moment of inertia of . A constant torque is applied and the grindstone is found to have a speed of 150 rpm, 10 seconds after starting from rest. The torque is
    a) b)
    c) d)
61. The instantaneous angular position of a point on a rotating wheel is given by the equation The torque on the wheel becomes zero at
    a) b)
    c) d)
62. A rope of negligible mass is wound round a hollow cylinder of mass 3 kg and radius 40 cm. If the rope is pulled with a force of 30 N, then the angular acceleration produced in the cylinder is
    a) b)
    c) d)
64. A hollow cylinder of mass M and radius R is rotating about its axis of symmetry and a solid sphere of same mass and radius is rotating about an axis passing through its centre. If torques of equal magnitude are applied to them, then the ratio of angular accelerations produced is
    a) b)
    c) d)
65. To maintain a rotor at a uniform angular speed of an engine needs to transmit torque of The power of the engine is
    a) 10 kW b) 100 kW
    c) 10 MW d) 100 MW
66. A cord of negligible mass is wound round the rim of a flywheel of mass 20 kg and radius 20 cm. A steady pull of 25 N is applied on the cord. The work done by the pull when 2 m of the cord is unwound is
    a) 20 J b) 25 J
    c) 45 J d) 50 J
67. In the question number 66, if wheel starts from rest, what is the kinetic energy of the wheel when 2 m of the cord is unwound?
    a) 20 J b) 25 J
    c) 45 J d) 50 J
68. A uniform disc of mass M and radius R, is resting on a table on its rim. The coefficient of friction between disc and table is . Now the disc is pulled with a force F as shown in the figure. What is the maximum value of F for which the disc rolls without slipping?
    a) b)
    c) d)

ANGULAR MOMENTUM IN CASE OF ROTATIONS ABOUT A FIXED AXIS

69. Which of the following principles a circus acrobat employs in his performance?
    a) Conservation of energy
    b) Conservation of linear momentum
    c) Conservation of mass
    d) Conservation of angular momentum
70. Total angular momentum of a rotating body is conserve, if the net torque acting on the body is
    a) zero b) maximum
    c) minimum d) unity
71. When a mass is rotating in a plane about a fixed point its angular momentum is directed along
    a) the radius
    b) the tangent the orbit
    c) the line at angle of to the plane of rotation
    d) the axis of rotation
72. Figure shows two identical particles 1 and 2, each of mass m, moving in opposite directions with same speed v along parallel lines. At a particular instant, and are their respective position vectors drawn from point A which is in the plane of the parallel

lines. Which of the following is the correct statement?

a) Angular momentum of particle 1 about A is

b) Angular momentum of particle 2 about A is

c) Total angular momentum of the system about A is

d) Total angular momentum of the system about A is

represents a unit vector going into the page.

represents a unit vector coming out of the page

73. A solid cylinder of mass and radius rotates about its axis with a angular speed . The angular momentum of the cylinder about its axis is

a) b)

c) d)

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

a) b)

c) d)

75. A child is standing with his two arms outstretched at the centre of a turntable that is rotating about its central axis with an angular speed . Now, the child folds his hands back so that moment of inertia becomes 3 times the initial value. The new angular speed is

a) b)

c) d)

76. A circular plat form is mounted on a vertical frictionless axle. Its radius is and its moment of inertia . It is initially at rest. A man stands on the edge of the platform and begins to walk along the edge at speed relative to the ground. The angular velocity of the platform is

a) b)

c) d)

77. A man stands on a rotating platform with his arms stretched holding a weight in each hand. The angular speed of the platform is . The moment of inertia of the man together with the platform may be taken to be constant and equal to . If the man brings his arms close to is chest with the distance of each weight from the axis changing from . The new angular speed of the platform is

a) b)

c) d)

78. Two discs of moments of inertia and about their respective axes, rotating with angular frequencies and respectively, are brought into contact face to face with their axes of rotation coincident. The angular frequency of the composite disc will be

a) b)

c) d)

79. A ballet dancer, dancing on a smooth floor is spinning about a vertical axis with her arms folded with an angular velocity of . When she stretches her arms fully, the spinning speed decrease in . If I is the initial moment of inertia of the dancer, the new moment of inertia is

a) b)

c) d)

80. Angular momentum L and rotational kinetic energy of a rigid body are related to each other by the relation. (I= moment of inertia)

a) b)

c) d)

81. A person, with outstretched arms, is spinning on a rotating stool. He suddenly brings his arms down to his sides. Which of the following is true about his kinetic energy K and angular momentum L?
    a) Both K and L increase
    b) Both K and L remain unchanged
    c) K remains constant, L increases
    d) K increases but L remains constant
82. A child is standing with folded hands at the centre of a platform rotating about its central axis. The kinetic energy of the system is K. Now, the child stretches his arms so that moment of inertia of the system doubled. Now, the kinetic energy of the system is

    a) b)

    c) d)
83. A solid sphere of mass m and radius R is rotating about its diameter. A solid cylinder of the same mass and same radius is also rotating about its geometrical axis with an angular speed twice that of the sphere. The ratio of their kinetic energies of rotation will be

    a) b)
    c) d)
84. Two discs of moments of inertia and about their respective axes (normal to the disc and passing through the centre), and rotating with angular speed and are brought into contact face to face with their axes of rotation coincident. What is the loss in kinetic energy of the system in the process?

    a)

    b)

    c)

    d)

ROLLING MOTION

85. A solid sphere rolls down two different inclined planes of the same heights but different angles of inclination. In both cases
    a) the speed and time of descend will be same
    b) the speed will be same but time of descend will be different
    c) the speed will be different but time of descend will be same
    d) speed and time of descend both are different.
86. Which of the following statements is incorrect?
    a) Torque is the rotational analogue of force
    b) Rolling motion of a cylinder down an inclined plane is combination of translation and rotational motion
    c) If the effort arm is larger than the load arm, the mechanical advantage is lesser than one
    d) For the extended body, the centre of mass and centre of gravity do not coincide
87. Which of the following statements is cot correct?
    a) During rolling, the instantaneous speed of the point of contact is zero.
    b) During rolling, the instantaneous acceleration of the point of contract is zero
    c) For perfect rolling motion, work done against friction is zero
    d) A wheel moving down a perfectly frictionless inclined plane will slip but not roll on the plane.
88. A ball rolls without slipping. The radius of gyration of the ball about an axis passing through its centre of mass is k. If radius of the ball be R, then the fraction of total energy associated with its rotation will be

    a) b)

    c) d)

89. A solid cylinder of mass M and radius R rolls without slipping down an inclined plane making an angle with the horizontal. Then its acceleration is

    a) b)

    c) d)

90. In the question number 89, the force of friction acting on the cylinder is

a) b)

c) d)

91. A solid cylinder rolls up an inclined plane of inclination with an initial velocity v. How far does the cylinder go up the plane?

a) b)

c) d)

92. The solid cylinder is rolling without slipping on a plane having inclination and the coefficient of static friction . The relation between and is

a) b)

c) d) none of these

93. A ring of radius R is rotating with an angular speed about a horizontal axis. It is placed on a rough horizontal table. The coefficient of kinetic friction is . The time after which it starts rolling is

a) b)

c) d)

94. When a solid sphere rolls without slipping down an inclined plane making an angle with the horizontal, the acceleration of its centre of mass is *a*. If the same sphere slides without friction, its acceleration will be

a) f b)

c) d)

95. A uniform sphere of mass M and radius R is placed on a rough horizontal surface (Figure). The sphere is struck horizontally at a height h from the floor. Match the Column I with Column II.

	Column I		**Column II**
A		p	Sphere rolls without slipping with a constant velocity and no loss of energy
B		q	Sphere spins clockwise, loses energy by friction
C		r	Sphere spins anti-clockwise, loses energy by friction
D		s	Sphere has only a translational motion, loses energy by friction

a) A-r B-S, C-q, D-p

b) A-s, B-p, C-r, D-q

c) A-q, B-r, c-p, D-s

d) A-p, B-q, C-s, D-r

96. The moments of inertia of two rotating bodies A and B are .

If their angular momenta are equal, then

a) Kinetic energy of A = Kinetic energy of B

b) Kinetic energy of A Kinetic energy of B

c) Kinetic energy of A Kinetic energy of B

d) Kinetic energy of the two bodies cannot be compared with the given data

97. A body is rolling down an inclined plane. If kinetic energy of rotation is of kinetic energy in translatory state, then the body is a

a) ring b) cylinder

c) hollow ball d) solid ball

98. A wheel of mass and radius is rolling on a road without sliding with angular velocity . The moment of inertia of the wheel about the axis of rotation is . The percentage of kinetic energy of rotation in the total kinetic energy of the wheel is

a) b)

c) d)

99. Three bodies, a ring, a solid cylinder and a solid sphere roll down the same inclined plane without slipping. They start from rest. The radii of the bodies are identical. Which of the bodies reaches the ground with maximum velocity?

a) Ring b) Solid cylinder

c) Solid sphere

d) All reach the ground with same velocity

100. A hoop of radius weighs . It rolls along a horizontal floor so that its centre of mass has a speed of . How much work has to be done to stop it?

a) b)

c) d)

HOTS

HIGHER ORDER THINKING SKILLS

1. A tube of length L is filled completely with an incompressible liquid of mass M and closed at both the ends. The tube is then rotated in a horizontal plane about one of its ends with a uniform angular velocity . The force exerted by the liquid at the other end is

a) b)

c) d)

2. Let I be the moment of inertia of a uniform square plate about an axis AB that passes through its centre and is parallel to two of its sides. CD is a line in the plane of the plate that passes through the centre of the plate and makes an angle with AB. The moment of inertia of the plate about the axis CD is then equal to

a) b)

c) d)

3. A lamina is made by removing a small disc of diameter from a bigger disc of uniform mass density and radius as shown in the figure. The moment of inertia of this lamina about axes passing through O and P is and respectively. Both these axes are perpendicular to the plane of the lamina. The ratio

a) b)

c) d)

4. A boy is pushing a ring of mass and radius with a stick as shown in the figure. The stick applies a force of on the ring and rolls it without slipping with an acceleration of . The coefficient of friction between the ground and the ring is large enough that rolling always occurs and the coefficient of friction between the stick and the ring.

a) b)

c) d)

5. A tangential force F acts at the top of a disc of mass m and radius R. If it rolls without slipping. Then

a) Acceleration of disc =

b) Friction force between disc and surface

c) Acceleration of disc =

d) Friction force between disc and surface is

6. A stone of mass , tied to the end of a string, is whirled around in a horizontal circle. (Neglect the force due to gravity). The length of the string is reduced gradually keeping the angular momentum of the stone about the centre of the circle constant. Then, the tension in the string is given by where A is a constant, r is the instantaneous radius of the circle and n

a) b)

c) d)

7. A rod of weight W is supported by two parallel knife edges A and B and is in equilibrium in a horizontal position. The knives are at a distance d from each other. The centre of mass of the rod is at distance x from A. The normal reaction on A is

and on B is then is

a) b)

c) d)

8. A particle is projected at time from a point P on the ground with a speed at an angle of to the horizontal. The angular momentum of the particle about P at time is

a) b)

c) d)

NCERT EXEMPLAR PROBLEMS

1. For which of the following does the centre of mass lies outside the body?

   a) A pencil b) A shotput

   c) A dice d) A bangle

2. Which of the following points is the likely position of the centre of mass of the system shown in figure?

   a) A b) B

   c) C d) D

3. A particle of mass m is moving in yz- plane with a uniform velocity v with its trajectory running parallel to +ve y- axis and intersecting z- axis at . The change in its angular momentum about the origin as it bounces elastically from a wall at y= constant is

   a) b)

   c) d)

4. When a disc rotates with uniform angular velocity, which of the following is not true?

   a) The sense of rotation remains same

   b) The orientation of the axis of rotation remains same

   c) The speed of rotation is non- zero and remains same.

   d) The angular acceleration is non-zero and remains same.

5. A uniform square plate has a small piece Q of an irregular shape removed and glued to the centre of the plate leaving a hole behind. The moment of inertia about the z- axis is then

   a) increased b) decreased

   c) the same

   d) changed in unpredicted manner

6. In problem 5, the centre of mass of the plate is now in the following quadrant of x-y plane,

   a) I b) II

   c) III d) IV

7. The density of anon- uniform rod of length is given by where a and b are constants and . The centre of mass of the rod will be at

   a) b)

   c) d)

8. A merry- go – round, made of a ring- like platform of radius R and mass M, is revolving with angular speed . A person of mass M is standing on it. At one instant, the person jumps off the round, radially away from the centre of the round. the speed of the round afterwards is

   a) b)

   c) d) 0

ASSERTION & REASON CORNER

Directions:

In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as:

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true but reason is not the correct explanation of assertion

(c) If assertion is true but reason is false

(d) If both assertion and reason are false

1. **Assertion**: No real body is truly rigid

   Reason: A rigid body is a body with a perfectly definite and unchanging shape. The distances between different pairs of particles of such a body do not change.

2. **Assertion**: The position of centre of mass does not depend upon the reference frame.

   Reason: Centre of mass depends only upon the rest mass of the body.

3 **Assertion**: The centre of mass of a body may lie where there is no mass.

   Reason: The centre of mass has nothing to do with the mass.

4. **Assertion**: To determine the motion of the centre of mass of a system, knowledge of internal forces of the system is required.

   Reason: For this purpose we need not to know the external forces on the system.

5. **Assertion**: If there are no external forces, the centre of mass of a double star moves like a free particle.

   Reason: If we go to the centre of mass frame, then we find that the two stars are moving in a circle about the centre of mass, which is at rest.

6. **Assertion**: A girl sits on a rolling chair, when she stretch her arms horizontally, her speed is reduced.

   Reason: Principle of conservation of angular momentum is applicable in this situation.

7. **Assertion**: The moment of inertia of a rigid body reduces to its minimum value, when the axis of rotation passes through its centre of gravity.

   Reason: The weight of a rigid body always acts through its centre of gravity.

8. **Assertion**: The centre of gravity of a body coincides with its centre of mass only if the gravitational field does not vary from one part of the body to the other.

   Reason: Centre of gravity is independent of the gravitational field.

9. **Assertion**: The moment of inertia of a rigid body depends only on the mass of the body, its shape and size.

   Reason: Moment of inertia , where M is the mass of the body and R is the radius vector.

10. **Assertion**: Value of radius of gyration of a uniform rigid body depends on axis of rotation.

    Reason: Radius of gyration is root mean square distance of particles of the body from the axis of rotation.

11. **Assertion**: A boiled egg can be easily distinguished from a raw unboiled egg by spinning.

    Reason: The hard boiled egg has a moment of inertia which is more than that of the raw egg.

12. **Assertion**: A rigid body not fixed in some way can have either pure translation or a combination of translation and rotation.

    Reason: In rotation about a fixed axis, every particle of the rigid body moves in a circle which lies in a plane perpendicular to the axis and has its centre on the axis.

13. **Assertion**: The motion of a ceiling fan is rotational only.

    Reason: The motion of a rigid body which is pivoted or fixed in some way is rotation.

14. **Assertion**: If the head of a right handed screw rotates with the body, the screw advances in the direction of the angular velocity.

    Reason: For rotation about a fixed axis, the angular velocity vector lies along the axis of rotation.

15. **Assertion**: A sphere cannot roll on a smooth inclined surface.

    Reason: the motion of a rigid body which is pivoted or fixed in some way is rotation.

KEY

1.	c)	2.	D)	3.	C)	4.	C)	5.	A)
6.	a)	7.	A)	8.	D)	9.	D)	10.	B)
11.	d)	12.	A)	13.	D)	14.	A)	15.	B)
16.	D)	17.	D)	18.	C)	19.	D)	20.	D)
21.	d)	22.	B)	23.	D)	24.	A)	25.	A)
26.	B)	27.	C)	28.	A)	29.	A)	30.	D)
31.	c)	32.	C)	33.	B)	34.	D)	35.	C)
36.	a)	37.	A)	38.	B)	39.	C)	40.	A)
41.	a)	42.	B)	43.	C)	44.	A)	45.	D)
46.	c)	47.	A)	48.	C)	49.	D)	50.	C)
51.	b)	52.	A)	53.	C)	54.	D)	55.	B)
56.	a)	47.	A)	58.	B)	59.	B)	60.	a)
61.	a)	62.	C)	63.	B)	64.	A)	65.	A)
66.	D)	67.	D)	68.	c)	69.	D)	70.	A)
71.	d)	72.	D)	73.	A)	74.	C)	75.	B)
76.	c)	77.	B)	78.	A)	79.	A)	80.	B)
81.	d)	82.	B)	83.	B)	84.	A)	85.	B)
86.	c)	87.	B)	88.	C)	89.	B)	90.	B)
91.	d)	92.	B)	93.	D)	94.	C)	95.	A)
96.	c)	97.	D)	98.	D)	99.	C)	100.	b)

HOTS

1.	a)	2.	A)	3.	B)	4.	A)	5.	D)
6.	a)	7.	C)	8.	A)				

NCERT EXEMPLAR PROBLEMS

1.	d)	2.	C)	3.	B)	4.	D)	5.	B)
6.	c)	7.	A)	8.	B)				

ASSERTION & REASON CORNER

1.	a)	2.	C)	3.	C)	4.	D)	5.	B)
6.	a)	7.	A)	8.	C)	9.	D)	10.	A)
11.	c)	12.	B)	13.	A)	14.	A)	15.	B)