



Kegna Academy

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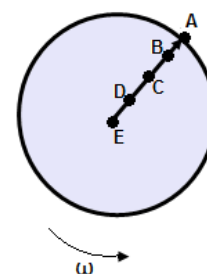
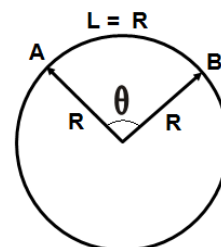
2016 1stSemester1st Quarter Physics 3rd worksheet for grade 12th.

Name:- _____ Section _____ No. _____

Rotational Motion

Multiple-Choice questions

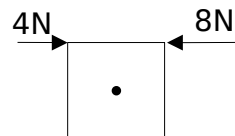
- Which of the following is the unit for angular displacement?
A. meters B. seconds C. radians D. radians per second
- An object moves from point A to point B along a circular path with a radius R. What is the size of the angle θ ?
A. 1 rad B. 2 rad C. 3 rad D. 4 rad
- A solid disk with a radius R rotates at a constant rate ω . Which of the following represents the period of rotations?
A. $2\pi\omega$ B. $\pi/2\omega$ C. $2\pi/\omega$ D. 2ω
- A toy car moves around a circular track with a radius of 10 m. When the car's velocity is instantaneously directed south, its acceleration is directed west at 10 m/s^2 . When viewed from above, the car moves:
A. clockwise at 1 rad/s C. clockwise at 10 rad/s
C. counterclockwise at 1 rad/s D. counterclockwise at 10 rad/s
- An object starts from rest and accelerates at a constant rate α in a circular path with a radius R. The radius describes an angle θ after time t. Which of the following represents the angular velocity as a function of θ ?
A. $2\alpha\theta$ B. $2\theta/\alpha$ C. $\sqrt{2\alpha\theta}$ D. $\sqrt{2\theta/\alpha}$
- A solid disk with a radius R rotates at a constant rate ω . Which of the following points has the greater angular velocity?
A. A B. B C. E
D. All points have the same angular velocity.
- A solid disk with a radius R rotates at a constant rate ω . Which of the following points has the greater angular displacement?
A. A B. B C. C
D. All points have the same angular displacement.
- A rod rotates about a pivot at its center at 2 rad/s. Its angular velocity increases uniformly to 14 rad/s in 3 s. Find the rod's angular acceleration over this time period.
A. 2 rad/s^2 B. 4 rad/s^2 C. 6 rad/s^2 D. 8 rad/s^2
- An object starts from rest and accelerates at a constant rate in a circular path. After a certain time t, the object reaches the angular velocity ω . How many revolutions did it make during time t?
A. $4\pi\omega$ B. $4\omega/\pi t$ C. $\omega t/4\pi$ D. $4\omega t$
- A rod rotates about a pivot at its center at 2 rad/s. Its angular velocity increases uniformly to 14 rad/s in 3 s. Find the rod's angular displacement over this time period.
A. 6 rad B. 12 rad C. 18 rad D. 24 rad



11. A bicycle wheel of radius 40.0 cm and angular velocity of 10.0 rad/s starts accelerating at 80.0 rad/s^2 . What is the tangential acceleration of the wheel at this time point?
 A. 4 m/s^2 B. 32 m/s^2 C. 40 m/s^2 D. 320 m/s^2
12. A bicycle wheel of radius 40.0 cm and angular velocity of 10.0 rad/s starts accelerating at 80.0 rad/s^2 . What is the centripetal acceleration of the wheel at this time point?
 A. 12 m/s^2 B. 24 m/s^2 C. 36 m/s^2 D. 40 m/s^2
13. A record on a turntable is spinning and coming to rest. At $t = 0 \text{ s}$, the angular velocity of the record is 20 rad/s with a constant acceleration of -5 rad/s^2 . What is the record's angular velocity at $t = 0.5 \text{ s}$?
 A. 10.5 rad/s B. 15.5 rad/s C. 16.5 rad/s D. 17.5 rad/s
14. A record on a turntable is spinning and coming to rest. At $t = 0 \text{ s}$, the angular velocity of the record is 20.0 rad/s with a constant acceleration of -5.0 rad/s^2 . What is the record's angular displacement at $t = 2.0 \text{ s}$?
 A. 15 rad B. 30 rad C. 40 rad D. 50 rad
15. A tire is rolling with an initial angular velocity of 10.0 rad/s. It slows down with an angular acceleration of -5.0 rad/s^2 and comes to rest. What is the net angular displacement of the wheel?
 A. 5 rad B. 10 rad C. 25 rad D. 30 rad
16. Find the linear displacement of a car wheel of radius 9.0 m as it moves through an angular displacement of 3.0 rad.
 A. 0.33 m B. 3.3 m C. 27 m D. 81 m
17. If an object starts from rest and accelerates with a constant angular acceleration of 6.0 rad/s^2 , what is the angular velocity at 3.0 s?
 A. 0.50 rad/s B. 2.0 rad/s C. 18 rad/s D. 54 rad/s
18. A car's tire of radius 0.50 m has an angular velocity of $\omega = 3t^2 - 5t + 20$. Find the angular velocity of the tire at $t = 2.0 \text{ s}$.
 A. 14 rad/s B. 22 rad/s C. 24 rad/s D. 28 rad/s
19. A car's tire of radius 0.50 m has an angular velocity of $\omega = 3t^2 - 5t + 20$. Find the linear velocity of the tire at $t = 2.0 \text{ s}$.
 A. 7 m/s B. 11 m/s C. 12 m/s D. 14 m/s
20. An object has an initial angular velocity of 5.0 rad/s and undergoes an angular acceleration of 15 rad/s^2 . What is the final angular velocity after 3.0 s?
 A. 25 rad/s B. 30 rad/s C. 50 rad/s D. 60 rad/s
21. An object has a final angular velocity of 25 rad/s and sweeps through 80.0 rads with an angular acceleration of 2.5 rad/s^2 . What was its initial angular velocity?
 A. 15 rad/s B. 25 rad/s C. 32 rad/s D. 48 rad/s
22. An object has an initial angular velocity of 5.00 rad/s and undergoes a constant angular acceleration of -0.100 rad/s^2 . What is the angular displacement that it moves through in 3.00 s?
 A. 12.3 rad B. 14.6 rad C. 16.3 rad D. 19.3 rad
23. A ball is attached to a string and rotates in a circle. If it takes 1.00 s to complete one revolution, what is the angular velocity of the ball?
 A. 3.14 rad/s B. 6.28 rad/s C. 9.42 rad/s D. 12.6 rad/s
24. Torque is the rotational analog of which of the following quantities?
 A. kinetic energy B. linear momentum C. acceleration D. force

Questions 26-28

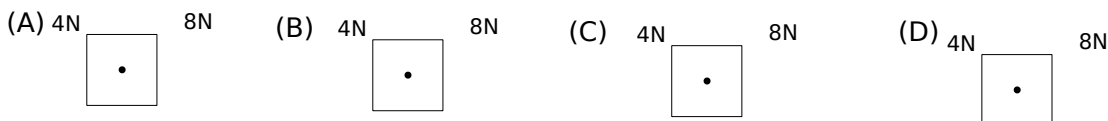
A wooden square of side length 1.0 m is on a horizontal tabletop and is free to rotate about its center axis. The square is subject to two forces and rotates.



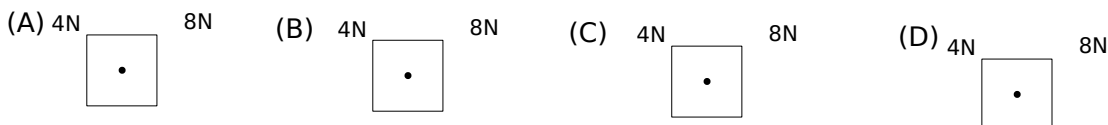
25. Find the net torque of the system.

A. 2 N-m B. 4 N-m C. $4\sqrt{2}$ N-m D. $2\sqrt{2}$ N-m

26. Where should another 4 N force be applied to maximize its torque?



27. Where should another 4 N force be applied to place the block in an equilibrium state?



28. Two wheels are fixed to each other and are free to rotate about a frictionless axis through their concentric centers. Four forces are exerted tangentially to the wheels. The magnitude of the net torque is:

A. zero B. FR C. $2FR$ D. $4FR$

29. The dimensional formula for moment of inertia is :

a) ML^2T^2 b) $M^2L^2T^2$ c) ML^2T^0 d) $M^2L^2T^0$

30. The dimensions of the radius of gyration are the same as that of :

A. length / mass B. length² / mass C. length D. length

31. The moment of inertia of a body does not depend upon :

a) the angular speed b) mass of the body c) nature of distribution of the mass d) location of the axis of rotation

32. The angular kinetic energy of a body is independent of :

a) speed b) angular momentum c) moment of inertia d) none of the above

33. Two circular discs have masses in the ratio of 1 : 2 and diameters in the ratio of 2 : 1. The ratio of their moments of inertia is :

A. 1 B. 2 C. 4 D. 8

Questions 34-35

Two masses of mass 10.0 and 6.0 kg are hung from massless strings at the end of a light rod. The rod is virtually weightless. A pivot (fulcrum) is placed off center and the system is free to rotate.

34. If the 6.0 kg mass is 4.0 m away from the pivot, how far away is the 10.0 kg mass if the system is not rotating?

A. 0.42 m B. 2.4 m C. 4.8 m D. 6.3 m

35. If the string supporting the 6.0 kg mass is cut, find the net torque of the system.

A. 60 N-m B. 120 N-m C. 240 N-m D. 480 N-m

36. Which of the following must be true for the below system of two concentric massless pulleys and two masses to be at equilibrium?

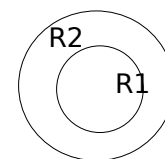
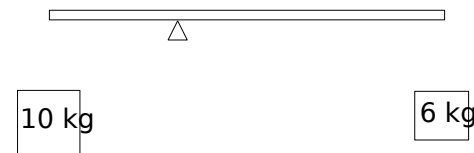
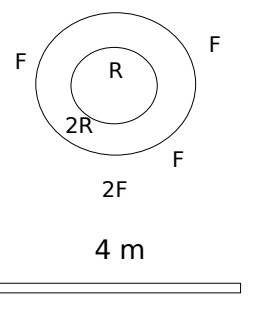
A. $m_1 = m_2$ B. $m_1R_1 = m_2R_2$ C. $m_1R_2 = m_2R_1$ D. $m_1R_1^2 = m_2R_2^2$

37. The radius of gyration of a body is independent of :

a) mass of the body b) nature of distribution of mass c) axis of rotation d) none of the above

38. A ring, a solid sphere and a disc have the same mass and radius. Which of them have the largest moment of inertia?

a) Ring b) Solid sphere c) Disc d) All have the same moment of inertia



m_1

m_2

39. Moment of inertia of a ring about one of its diameters is I . What will be its moment of inertia about the tangent parallel to the diameter?
 A. $4I$ B. $3I$ C. $2I$ D.
40. In the above question, what will be the moment of inertia about the tangent parallel to the axis of the ring?
 A. $4I$ B. $3I$ C. $2I$ D.
41. About which of the following axis, the moment of inertia of a thin circular disc is minimum?
 A. Through centre perpendicular to the surface C. Through centre parallel to the surface
 B. Tangential and perpendicular to the surface D. Tangential and parallel to the surface
42. What is the moment of inertia of a disc of mass M and radius R about an axis parallel to its diameter and at a distance $R/2$ from the center?
43. Two circular loops of radii R and nR are made from the same wire. The moment of inertia about the axis passing through the centre and perpendicular to the plane of the larger loop is 8 times that of the smaller loop. What is the value of n ?
 A. 2 B. 4 C. 6 D. 8
44. The centre of mass of a system of particles does not depend on the :
 A. masses of the particles C. forces on the particles
 B. position of the particles D. relative separation between the particles
45. A cracker at rest explodes into a large number of parts. What happens to the centre of mass of the system ?
 A. It describes a straight line
 B. It describes a parabola
 C. It continues to be at the same point at which it existed before explosion
 D. Nature of the path described cannot be predicted
46. A system consists of 3 particles each of mass m and located at $(1, 1)$ $(2, 2)$ $(3, 3)$. The co-ordinates of the centre of mass are :
 A. $(6, 6)$ B. $(3, 3)$ C. $(2, 2)$ D. $(1, 1)$
47. Two identical balls each of radius 10 cm are placed touching each other. The distance of their centre of mass from the point of contact is :
 a) zero b) 5 cm c) 10 cm d) 15 cm
48. Three identical balls each of radius 10 cm and mass 1 kg are placed touching one another on a horizontal surface. Where is their centre of mass located ?
 a) On the horizontal surface c) At the point of contact of any two spheres
 b) At the centre of one ball d) None of the above
49. Four identical spheres each of radius 10 cm and mass 1 kg each are placed on a horizontal surface touching one another so that their centres are located at the corners of square of side 20 cm. What is the distance of their centre of mass from centre of either sphere ?
 a) 5 cm b) 10 cm c) 20 cm d) none of the above
50. If the net force acting on the system of particles is zero, then which of the following varies ?
 a) Momentum of the system c) Kinetic energy of the system
 b) Velocity of centre of mass d) Position of centre of mass
51. The separation between carbon and oxygen molecules in CO is 0.12 nm. What is the distance of the centre of mass from carbon atom ?
 a) 0.03 nm b) 0.05 nm c) 0.07 nm d) 0.09 nm

52. Which of the following is zero about the centre of mass of a body ?
 a) Acceleration b) Velocity c) Moment of mass d) Moment of force
53. Two bodies A and B are attracted towards each other due to gravitation. Given that A is much heavier than B, which of the following correctly describes the relative motion of the centre of mass of the bodies ?
 a) It moves towards A b) It remains at rest w.r.t. A as well as B
 c) It moves towards B d) It moves perpendicular to the line joining the particles
54. Four identical spheres each of radius 10 cm and mass 1 kg are placed on a horizontal surface touching one another so that their centres are located at the corners of square of side 20 cm. What is the distance of their centre of mass from centre of either sphere?
 a) 5 cm b) 10 cm c) 20 cm d) none of the above
55. For a particle moving along a circular path with a constant speed, the acceleration is constant in :
 a) magnitude b) direction c) both magnitude and direction d) neither magnitude nor direction
56. A particle moving along a circular path, due to a centripetal force having constant magnitude, is an example of motion with :
 a) constant speed and velocity b) variable speed and velocity
 c) variable speed and constant velocity d) constant speed and variable velocity
57. Which of the following statements about centripetal and centrifugal forces is correct ?
 a) They cancel each other b) Both act on the same body
 c) They are oppositely directed d) None of the above
58. A stone is tied to the end of a string and is made to rotate in a circular path by holding the other end of the string by hand. If the string is let off, the stone flies off tangentially to the circular path. This happens because of :
 a) centripetal force b) centrifugal force c) inertia d) none of the above
59. The angular acceleration of a particle moving along a circular path with constant speed is :
 a) uniform b) variable c) zero d) such as cannot be predicted from the given information
60. A stone is whirled along a circular path with uniform speed. Which of the following is constant both in magnitude and direction?
 a) Velocity b) Angular velocity c) Acceleration d) Centripetal acceleration
61. A stone is tied to the end of a string of length l and is whirled along a circular path. What happens when the string breaks?
 a) Stone flies radially outwards c) Stone flies radially inwards
 b) Stone flies tangential to the circular path d) Stone drops down
62. A body is moving along a circular path with constant speed. Which of the following statements about its motion is true?
 a) No work is done on the body b) The acceleration of the body is zero
 c) No force acts on the body d) The body moves with constant velocity
63. It is easier for a swimmer jumping into water from a height to describe a loop in the air by :
 a) pulling the arms and legs closer b) spreading the arms and legs

- c) keeping the arms and legs straight d) none of the above methods
64. Which of the following is axial vector?
 a) Force b) Torque c) Acceleration d) Momentum
65. What is moment of momentum?
 a) Moment of inertia b) Angular momentum c) Moment of force
 d) Torque
66. The action of a constant torque on a body produces in the body a constant angular :
 a) acceleration b) momentum c) velocity d) displacement
67. The dimensional formula for the torque is same as that for :
 a) Angular kinetic energy b) Power c) Angular momentum d) Impulse
68. A particle is rotating along a circular path in the X-Y plane. The angular momentum vector of the particle will be directed parallel to :
 a) X-axis b) Y-axis c) Z-axis d) none of the above
69. A body is acted upon by a constant force directed towards a fixed point. The magnitude of the force varies inversely as the square of the distance from the fixed point. What is the nature of the path ?
 a) Straight line b) Parabola c) Circle d) Hyperbola
70. In case of a projectile, the angular momentum is minimum :
 a) At the starting point b) At the highest point
 c) On return to the ground d) At some location other than those mentioned above
71. If the radius of the circular path of particle going round the circle is doubled without changing its frequency of rotation, then centripetal force on it is:
 a) halved b) unchanged c) doubled d) quadrupled
72. Which of the following quantities must be conserved when the torque acting on a system is zero ?
 a) Kinetic energy b) Angular momentum c) Angular kinetic energy d) Linear momentum.
73. If the earth shrinks to half of its radius without change in mass, the duration of the day will be :
 a) 48 hours b) 24 hours c) 12 hours d) 6 hours
74. A body is under the action of two equal and oppositely directed forces and the body is rotating with constant acceleration. Which of the following cannot be the separation between the lines of action of the forces?
 a) 1 m b) 0.4 m c) 0.25 m d) zero
75. A body is moving along a circular path with constant speed. If the direction of rotation is reversed and the speed is doubled, then :
 a) direction of centripetal acceleration is reversed
 b) magnitude of centripetal acceleration is doubled
 c) the direction of centripetal acceleration remains unchanged
 d) the magnitude of centripetal acceleration is halved
76. What happens to the centripetal acceleration of a particle, when its speed is doubled and angular velocity is halved?
 a) Halved b) Remains unchanged c) Doubled d) Becomes four times
77. Two satellites are going round the earth at a height of 200 km and 300 km respectively. If angular speed of both is the same, centripetal acceleration will be :
 a) same for both b) more for the first
 c) more for the second d) such as cannot be predicted
78. A particle of mass 2 kg is moving along a circular path of radius 1 m. If its angular speed is $2\pi \text{ rad s}^{-1}$, the centripetal force will be:
 a) 4 N b) 8 N c) 4 π^2 N d) 8 π^2 N

79. A ring starts from rest and acquires an angular speed of 10 rad s^{-1} in 2 s. The mass of the ring is 500 g and its radius is 20 cm. The torque on the ring is :
 a) 0.02 Nm b) 0.20 Nm c) 0.10 Nm d) 0.01 Nm
80. The center of mass of a system of two particles divides. The distance between them is :
 a) in inverse ratio of square of masses of particle b) in direct ratio of square of masses of particle
 c) in inverse ratio of masses of particle d) in direct ratio of masses of particle
81. What fraction of K.E. of rolling circular disc is translational?
 a) $3/2$ b) $2/3$ c) $1/2$ d) 2
82. 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 $\times$ angular acceleration
 d) Linear momentum = Moment of inertia $\times$ angular velocity
83. About which of the following axes moment of inertia of a disc is minimum?
 a) Axis passing through its centre and perpendicular to its plane
 b) Axis along the diameter
 c) Axis along the tangent and in its own plane
 d) Axis along the tangent and perpendicular to its plane
84. A solid sphere, disc and solid cylinder all of the same mass and made up same material are allowed to roll down (from rest) on inclined plane, then:
 a) solid sphere reaches the bottom first b) solid sphere reaches the bottom late
 c) disc will reach the bottom first d) all of them reach the bottom at the same time
85. Let g be the acceleration due to gravity at earth's surface and K be the rotational kinetic energy of the earth. Suppose the earth's radius decreases by 2%, keeping all other quantities same. Then:
 a) g decreases by 2% and K decreases by 4% b) g decreases by 2% and K increases by 4%
 c) g increases by 4% and K decreases by 4% d) g decreases by 4% and K increases by 4%
86. Two circular iron discs are of the same thickness (x). 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) eight times as large d) sixteen times as large
87. What remains constant when the earth revolves around the sun ?
 a) Angular momentum b) Linear momentum c) Angular kinetic energy d) Linear kinetic energy
88. Centre of mass is a point :
 a) which is geometric centre of a body
 b) from which distance of particles are same
 c) where the whole mass of the body is supposed to be centred
 d) which is the origin of reference frame
89. Three identical metal balls each of radius r are placed touching each other on a horizontal surface such that an equilateral triangle is formed when the centres of three balls are joined. The centre of the mass of the system is located at :
 a) horizontal surface c) line joining centres of any two balls
 b) centre of one of the balls d) point of intersection of medians

90. A satellite S is moving in an elliptical orbit around the earth. The mass of the satellite is very small compared to the mass of the earth. Then,
- a) the linear momentum of S remains constant in magnitude
 - b) the acceleration of S is always directed towards the centre of the earth
 - c) the angular momentum of S about the centre of the earth changes in direction, but its magnitude remains constant
 - d) the total mechanical energy of S varies periodically with time