Torque, Angular Momentum & Equilibrium

1. Torque is the _____ effect produced by a force acting on a body: D
   a) Accelerating b) Stopping
   c) Lifting d) Turning

2. Torque is a vector quantity that produces _____ in a body: B
   a) Momentum b) Angular acceleration
   c) Angular momentum d) Linear acceleration

3. The torque due to a force $\vec{F}$ can be found by the formula: A
   a) $\vec{\tau} = \vec{\gamma} \times \vec{F}$ b) $\vec{\tau} = \vec{F} \times \vec{\gamma}$
   c) $\vec{\tau} = \vec{V} \times \vec{F}$ d) $\vec{\tau} = \vec{F} \times \vec{V}$

4. The magnitude of torque is given by: A
   a) $\vec{\tau} = rF \sin\theta$ b) $\vec{\tau} = rF \cos\theta$
   c) $\vec{\tau} = \frac{r}{F} \sin\theta$ d) $\vec{\tau} = \frac{F}{\gamma} \cos\theta$

5. Units of torque in the SI system are: D
   a) mS^{-1} b) mS
   c) NS d) Nm

6. Torque is also called: A
   a) Moment of force b) Moment of the inertia
   c) Centrifugal force d) Centripetal force

7. The shortest distance between the line of action of the force and the origin (fixed point) is called: B
   a) Moment b) Moment arm
   c) Position vector d) Radius vector

8. For given values of F and $\vec{r}$, the magnitude of the torque will be maximum when the angle between them is: D
   a) 30° b) 45°
   c) 60° d) 90°

9. By convention, torques producing anti-clockwise rotation are taken as: A
   a) Positive b) Negative
   c) Zero d) None of the above

10. Two equal and anti-parallel forces acting on a body form a _____. B
   a) Pair b) Couple
   c) Torque d) Moment

11. If the distance between the lines of action of two forces forming a couple and having a magnitude F is L, then the magnitude of the couple is: C
   a) $\frac{1}{2} F \times L$ b) $2F \times L$
   c) $F \times L$ d) $F \times L^2$

12. The point in a body at which an applied force produces linear acceleration but no rotation is called its: C
   a) Geometric centre b) Centre of gravity
   c) Centre of mass d) Core

13. During the motion of a rigid body, its centre of mass describes only: A
   a) Translational motion b) Rotational motion
   c) Vibrational motion d) Rotational and translational motion

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14. The point on which the weight of a body acts is called its: A
   a) Centre of gravity b) Centre of mass
   c) Geometric centre d) Core

15. If the gravitational field is uniform the centre of mass and centre of gravity of a body: C
   a) Are opposite to each other b) Lie in the same line
   c) Coincide with each other d) Have no relation with each other

16. If $\vec{P}$ is the linear momentum of a body revolving in a circle of radius $\vec{r}$, its angular momentum is given by: A
   a) $\vec{L} = \vec{P} \times \vec{\gamma}$ b) =

c) =

d) =

_C• _17. The direction of torque and angular momentum is determined by the:

_17. The direction of torque and angular momentum is determined by the:
   a) Right hand rule b) Left hand rule
   c) Addition of vector d) None of the above

20. The torque and angular momentum are related to each other by the expression: D
   a) $\vec{\tau} = \overrightarrow{\Delta L}\ \Delta t$ b) $\vec{\tau} = \frac{1}{2}\frac{\overrightarrow{\Delta L}}{\Delta t}$
   c) $\vec{\tau} = \overrightarrow{\Delta L}\ \Delta t^2$ d) $\vec{\tau} = \frac{\Delta L}{\Delta t}$

21. Angular momentum and moment of inertia are related to each other by the relation: C
   a) $I = L \times \omega$ b) $I = L\omega^2$
   c) $L = I \times \omega$ d) $I = L^2\omega$

22. The magnitude of angular momentum can be found by the expression: D
   a) $mr\omega$ b) $mr\omega^2$
   c) $m^2r\omega$ d) $mr^2\omega$

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23. The angular momentum of a particle having uniform velocity about a fixed origin: C
a) Varies with its position w.r.t. the origin b) Varies with time
c) Remains constant d) Is zero

24. If a particle moves in a circular orbit with constant speed, its angular momentum about the centre of the circle: C
a) Change with time b) Depends on its angular displacement
c) Remains constant d) Depends on its angular velocity

25. According to the law of conservation of angular momentum, the angular momentum of a rotating body or system of bodies is constant if no external _____ acts on the body about that axis: A
a) Torque b) Force
c) Couple d) Moment of inertia

26. A diver uses the law of conservation of momentum when he curls his body while diving so as to: C
a) Make his jumping time shorter b) Plunge into water at a farther point
c) Make one or two extra somersaults d) Jump into the water more safely

27. Torque is also called as: B
a) Moment of inertia b) Moment of momentum
c) Moment of force d) Quantity of motion

28. The unit of torque is SI system is: C
a) $N\text{-}m^{-3}$ b) $N\text{-}m^{3}$
c) N-m d) $N\text{-}m^{-1}$

29. Spin angular momentum is a property of: D
a) Planets b) Stars
c) Wheels d) Atomic and sub-atomic particles

30. If a body remains at rest or continues to move with uniform velocity, its is said to be in a state of: A
a) Equilibrium b) Rest
c) Free fall d) None of the above

31. There are _____ types of equilibrium: A
a) Two b) Three
c) Four d) Six

32. When an object does not change its position with respect to its surroundings, it is said to be in a state of: B
a) Dynamic equilibrium b) Static equilibrium
c) Total equilibrium d) Uniform motion

33. A book lying on a table is in a state of equilibrium because: A
a) Net force acting on the book is zero b) Net torque acting on the book is zero
c) Total momentum of the book is zero d) The book is lying at a certain height from the ground

34. A paratrooper falling towards the earth is in a state of equilibrium because: D
a) He experiences no gravitational force b) The air is not blowing
c) He is falling vertically downward d) Force of gravity is balanced by air friction

35. The dynamic equilibrium is described for bodies: B
a) At rest b) Not at rest
c) Falling freely d) Rotating

36. The first condition of equilibrium is described mathematically as: C
a) F = ma b) F = W
c) $\sum f_{ext} = 0$ d) $\sum f_{int} = 0$

Torque, Angular Momentum & Equilibrium

37. The second condition of equilibrium is: B
a) $\sum F_{ext} = 0$ b) $\sum \tau_{ext} = 0$
c) $\sum L = 0$ d) $\sum P = 0$

38. A body is said to be in complete equilibrium if the sum of external forces and _____ is zero: C
a) Momentum b) Energies
c) Torques d) Angular momentum

39. The perpendicular distance between the line of action of force the axis of rotation is called: C
a) Displacement b) Distance
c) Moment arm d) Angular displacement

40. The _____ effect on a body produced due to a force is called torque: A
a) Turning b) Line
c) Equal d) Moment

41. Torque is also called the _____ of the force: B
a) Magnitude b) Moment
c) Changed d) Concept

42. Torque is a _____ quantity which produces angular acceleration in a body: B
a) Scalar b) Vector
c) Negative d) Position vector

43. The generally formula for torque is _____: A
a) $\vec{T} = \vec{r} \times \vec{F}$ b) $\vec{T} = \vec{I} \times \vec{F}$
c) $\vec{T} = \frac{\vec{r}}{\vec{F}}$ d) None of these

44. The torque produced by a force depends upon two major factors, the force and the _____: C
a) Acceleration b) Velocity
c) Moment arm d) None of these

45. The magnitude of torque can be written as: A
a) $T = rF \sin\theta$ b) $T = rF \cos\theta$
c) $T = \frac{r}{F \sin\theta}$ d) $T = \frac{r}{F \cos\theta}$

46. The unit of torque in SI unit is _____: B
a) kgm / s b) Nm
c) N/m d) None of these

47. A force of 10N is applied on the edge of a wheel of radius 0.20m. Find the torque acting on a wheel? C
a) 8 Nm b) 6 Nm
c) 2 Nm d) 4 Nm

48. The magnitude of the torque will be maximum when the angle between "F" and $\vec{r}$ is _____: C
a) 45° b) 60°
c) 90° d) 120°

49. Two equal and _____ forces acting on a body form a couple: A
a) Anti-parallel b) Equal
c) Positive d) None of these

50. The center of gravity of a circle lies at _____. A
a) Center of the circle b) Edge of the circle
c) At diameter d) None of these

51. The center of gravity of a cylinder is at _____: A
a) Mid-point of the axis b) Quarter of cylinder
c) At the top face d) None of these

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52. If the velocity of a body is constant , its acceleration is _____: C
a) Positive b) Negative
c) Zero d) Ten

53. The unit of angular momentum in SI unit is _____: A
a) Js b) J/s
c) Kg / J d) Kg / m

54. The formula for moment of inertia is _____: C
a) Js b) J/s
c) $I = mr^2$ d) P = rv

55. If the linear momentum is variable, then its _____ momentum is also variable: C
a) Constant b) Core
c) Angular d) None of these

56. The magnitude of angular momentum can be found by the expression _____: A
a) mr^2w b) mw^2r
c) m^2rw d) None of these

57. The angular momentum about the center of the circle of a particle which is moving in a circular orbit with constant speed is _____: A
a) Remains constant b) Same
c) Change d) Energy

58. Static equilibrium and dynamic equilibrium both are discussed under one heading is called: A
a) Translational equilibrium b) Angular momentum
c) Vertical pull d) None of these

59. The body is said to be in equilibrium if all the forces and torques will become equal to _____: B
a) One b) Zero
c) Four d) Six

60. The body will be in translational equilibrium only if the vector sum of all the _____ acting on it is equal to zero: A
a) External forces b) All forces
c) Uniform forces d) None of these

61. The body is said to be in rotational equilibrium only if the sum of all the _____ acting on the body about any arbitrary axis is zero: A
a) External torques b) External forces
c) Second condition d) None of these

62. When an object does not change its position with respect to its _____, it is said to be in a state of static equilibrium: B
a) Static equilibrium b) Linear momentum
c) Energy d) None of these

63. The formula or representation of first state of equilibrium is _____: B
a) $\sum f_{ext} = f_o$ b) $\sum f_{ext} = 0$
c) $\sum f_{ext} = f_y$ d) None of these

64. The second condition of equilibrium is _____: A
a) $\sum t_{ext} = 0$ b) $\sum t_{ext} = 4$
c) $\sum t_{ext} = 1$ d) None of these

65. If a body remains at rest or continues to move with uniform _____ it s said to be in equilibrium: C
a) Dynamic b) Static
c) Velocity d) Acceleration

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66. Torque produced by a force is equal to the product of: C
a) Magnitude of force and angular velocity b) Magnitude of force and displacement
c) Magnitude of force and moment arm d) Magnitude of force and acceleration

67. In rotational motion the analogue of force is: B
a) Angular momentum b) Moment of inertia
c) Moment of force d) Torque

68. A force passing through the centre of gravity of a body: B
a) Results only in rotational motion b) Results only in translational motion
c) Results in both translational & rotational motion d) Holds the body in equilibrium

69. The time rate of change of angular momentum of a body is equal to: D
a) The moment of inertia b) Rate of change of linear momentum
c) The applied force d) The applied torque

70. The centre of gravity of a body is: C
a) The center of the body b) The point at which the mass of body acts
c) The point at which the whole weight of the body acts d) None of these

71. The center of mass of a body is: D
a) The center of the body b) The middle of the body
c) The point where whole weight of the body acts d) The point at which the whole mass of the body acts

72. The angular momentum is defined as: B
a) The dot product of position vector and linear momentum
b) The cross product of position vector and linear momentum
c) The product of displacement and linear momentum
d) None of the above

73. Angular momentum of a body under a central force is: C
a) Minimum b) Maximum
c) Constant d) Zero

74. In rotational motion, the quantity which plays the same role as the inertial mass in rectilinear motion is called: D
a) Moment of force b) Angular momentum
c) Inertia d) Moment of inertia

75. The moment of inertia depends upon: D
a) Mass of the body and its radius b) Mass of the body and its angular speed
c) Angular momentum d) Mass as well as its distribution about the axis of rotation

76. An astronaut is in space with a life belt attached to the spaceship. If the life belt is cut by accident: C
a) He will fall to the earth b) He will go to the outer space
c) He will continue moving in the orbit d) None of the above

77. A car and a bus moving with same kinetic energy are acted upon by the same retarding force, then: C
a) The bus comes to rest in a shorter distance
b) The car comes to rest in a shorter distance
c) Both come to rest after covering the same distance
d) None of the above

78. In a couple, the resultant of two forces is: D
a) 2F b) F
c) F / 2 d) Zero

Torque, Angular Momentum & Equilibrium

79. Which of the following is more elastic? A
a) Steel b) Wood
c) Rubber d) Air

80. A stone attached to a string is being whirled in a vertical circle. The string is likely to break when the stone is: A
a) At the lowest position b) At the highest position
c) At any point during motion d) None of the above

81. Impulse has the same units as that of: D
a) Energy b) Work
c) Force d) Momentum

82. A body can have constant velocity when it follows a: B
a) Circular path b) Rectilinear path
c) Elliptical path d) Zig-zag path

83. The planets in the solar system possess variable velocity: A
a) Due to change in direction b) Due to change in magnitude
c) Due to change in magnitude and direction d) None of the above

84. A couple acting on a body will only: C
a) Accelerate the body b) Vibrate the body about certain axis
c) Rotate the body about certain axis d) Keep the body stationary

85. Rate of work is represented by: B
a) The dot product of velocity and vector area b) The dot product of force and velocity
c) The cross product of velocity and vector area d) None of the above

86. The weight of a body at the centre of the earth is: B
a) Infinite b) Zero
c) Slightly less d) Slightly greater

87. The relation between angular momentum and linear momentum is: D
a) $\vec{L} = \vec{F} \times \vec{V}$ b) $\vec{L} = \vec{r} \times \vec{F}$
c) $\vec{L} = m\vec{v}$ d) $\vec{L} = \vec{r} \times \vec{P}$

88. Unit of Torque in international system is: B
a) Joule b) Newton-meter
c) Newton d) Dyne-meter

89. Torque is a: B
a) Physical quantity b) Vector quantity
c) Scalar quantity d) A quantity with linear acceleration

90. Torque has maximum value if angle between r and F is: B
a) 60 b) 90
c) 180 d) 360

91. Torque depends only on: D
a) Direction of force b) Magnitude of the force
c) Point of application of force relative to the origin
d) Direction of force, magnitude of the force and point of application of the force relative to the origin

92. The point at which an applied force produces a linear acceleration but no rotation is called: D
a) Weight of the body b) Center of frame
c) Center of body d) Center of mass

93. Center of gravity of a uniform rod is at: A
a) At the center of rod b) At its one end
c) At its other end d) At a point in space

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94. The center of gravity of rectangular plate is: C
a) At the intersection of diagonals
b) At the intersection of medians
c) Both a) & b) above
d) None of them

95. The center of mass of a sphere lies at: B
a) Circumference of the sphere
b) Center of sphere
c) Axis of the sphere
d) None of them

96. The quantity mr^2 is known as: A
a) Momentum of inertia
b) Centripetal force
c) Torque
d) Momentum of force

97. Give the example of couple is: C
a) Moving coil of generator
b) Moving coil of galvanometer
c) Both a and b
d) None of them

98. The angular momentum is defined by the equation: C
a) $L = mrw$
b) $L = mrw^2$
c) $L = mr^2w$
d) $L = mr^3w$

99. Angular momentum of a body under a central force is: B
a) Minimum
b) Constant
c) Maximum
d) Zero

100. The body moving with constant velocity may be: C
a) Changing in magnitude
b) Changing in direction
c) In equilibrium
d) None of these

101. If an object returns to its original position after it is slightly disturbed then it is said to be: C
a) Neutral equilibrium
b) Equilibrium
c) Stable equilibrium
d) Unstable equilibrium

102. A body will be in rotational equilibrium only if the vector sum of all the external Torque's acting in a body is equal to: D
a) Unity
b) Double
c) Maximum
d) Zero

103. The moment of linear momentum is called: D
a) Couple
b) Torque
c) Impulse
d) Angular momentum

104. When a steady torque is acting on a body, the body: C
a) Continues in its state of rest or uniform motion along a straight line
b) Gets linear acceleration
c) Gets angular acceleration
d) Rotated at a constant speed

105. When a mass is rotating in a plane about a fixed point its angular momentum is directed along: D
a) The radius
b) Line at an angle of 45° to the plane of rotation
c) The tangent to orbit
d) The axis of rotation

106. Angular momentum of a body is defined as the product of: D
a) Mass and angular velocity
b) Centripetal force and radius
c) Linear velocity and angular velocity
d) Moment of inertia and angular velocity

107. When a torque acting upon a system is zero, which of the following will be constant: C
a) Force
b) Linear momentum
c) Angular momentum
d) Linear impulse

108. Example of angular momentum is: D
a) The earth rotating about its axis
b) A satellite orbiting round the earth
c) Wheel of a car rotating on their axis
d) All of the above

Torque, Angular Momentum & Equilibrium

109. The center of gravity is also called: D
a) Centre of buoyancy b) Centre of mass
c) Meta centre d) None of these

110. If a gymnast sitting on a rotating stool with his arms outstretched, lowers his arms: A
a) The angular speed increases b) The angular speed decreases
c) The angular speed remains same d) None of the above

111. The moment of inertia depends on: C
a) Volume of the body b) K.E. of the body
c) Mass as well as its distribution w.r.t. axis of rotation
d) Angular momentum

112. When a torque acting on a system is zero. Which of the following will be constant: B
a) Force b) Angular momentum
c) Linear momentum d) Linear impulse

113. The physical quantity which produces angular acceleration in a body is called: D
a) Angular velocity b) Momentum
c) Centripetal force d) Torque

114. Torque acting on a particle with respect to origin is given by: B
a) $\vec{\tau} = \vec{r} \cdot \vec{F}$ b) $\vec{\tau} = \vec{r} \times \vec{F}$
c) $\vec{\tau} = ½ (\vec{r} \times \vec{F})$ d) $\vec{\tau} = \vec{r} \times ½\vec{F}$

115. Torque is a: B
a) Scalar quantity b) Vector quantity
c) Physical quantity d) None of the above

116. The dimensions of torque are: B
a) MLT^{-2} b) ML^2T^{-2}
c) ML^2T^2 d) MLT^{-1}

117. Unit of torque in SI units is: D
a) $N\text{-}m^{-1}$ b) $N\text{-}m^{-2}$
c) $N\text{-}kg^{-1}$ d) N-m

118. Let torque $\vec{\tau} = \vec{r} \times \vec{F}$. The direction of torque is: D
a) In the direction of $\vec{r}$ b) In the direction of $\vec{F}$
c) Opposite to the direction of $\vec{F}$ d) Normal to the plane containing $\vec{r} \times \vec{F}$

119. The angular momentum $\vec{L}$ is defined by the equation: C
a) $\vec{L} = m\vec{v}$ b) $\vec{L} = \vec{r} \times \vec{F}$
c) $\vec{L} = \vec{r} \times \vec{P}$ d) $\vec{L} = m\vec{v} \times \vec{r}$

120. The equation for angular momentum in terms of angular velocity is: B
a) $m^2r^2\omega$ b) $mr^2\omega$
c) $mr\omega$ d) $mr\omega^2$

121. In rotational motion, the torque is equal to: B
a) Rate of change of velocity b) Rate of change of angular momentum
c) Rate of change of linear momentum d) Change of linear momentum

122. Angular momentum is measured by: A
a) $rp \sin\theta$ b) $rp \cos\theta$
c) $mvr \cos\theta$ d) mvr

Torque, Angular Momentum & Equilibrium

123. The total weight of the body acts: A
a) At its centre of gravity b) At its other end
c) At its centre d) None of the above

124. A body will be in translational equilibrium, if: C
a) $\Sigma \vec{\tau} = 0$ b) $\Sigma \vec{p} = 0$
c) $\Sigma \vec{F} = 0$ d) $\Sigma \vec{L} = 0$

125. The condition of complete equilibrium is satisfied if: C
a) Vector sum of all the torques is zero b) Vector sum of all the forces is zero
c) Vector sum of all forces and all torques is zero d) Angular acceleration is zero

126. A body will be in rotational equilibrium only if the vector sum of all the external torques acting on a body is equal to: C
a) Maximum b) Unity
c) Zero d) Double

127. A body is said to be in complete equilibrium if: D
a) $\Sigma F = 0$ b) $\Sigma \tau = 0$
c) $\Sigma F = 0$ and $\Sigma \tau \neq 0$ d) $\Sigma F = 0$ and $\Sigma \tau = 0$

128. A body is said to be in translational equilibrium provided: A
a) The first condition of equilibrium is satisfied
b) The second condition of equilibrium is satisfied
c) No torque is acting on it
d) Its translational motion is not stopped

129. Which of the following pairs does not have identical dimensions? A
a) Mass and moment of inertia b) Momentum and impulse
c) Torque and energy d) Energy and work

130. K.E. of rotation E and angular momentum L of a rigid body of moment of inertia I are related by the relation: C
a) $E = \sqrt{\frac{2L}{I}}$ b) $E = \sqrt{2LI}$
c) $E = \frac{L^2}{2I}$ d) $L = \frac{E^2}{2L}$

131. If a body is moving with a uniform velocity with respect to a fixed origin, then its angular momentum will: C
a) Increase b) Decrease
c) Remain constant d) First increase then decrease

132. Which of the torques given below is required to change the angular momentum of a flywheel from 15 kg m^2 / s to 150 kg m^2 / s during a time interval of 5 seconds? B
a) 25 kg m^2 / s^2 b) 27 kg m^2 / s^2
c) 29 kg m^2 / s^2 d) 31 kg m^2 / s^2

133. The rate of change of angular momentum of a body is equal to: D
a) Impulsive force b) Applied force
c) Moment of inertia d) The applied torque

134. Law of conservation of angular momentum states that in the absence of an external torque, the angular momentum of a rotating body is: B
a) Variable b) Constant
c) Unstable d) Zero

135. Which one the following is the dimensions of moment of inertia? B
a) M^2L^2 b) ML^2
c) ML d) ML^{-2}

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136. The moment of inertia depends upon: B
a) Mass of the body and its radius
b) Mass of the body and square of its distance from the axis of rotation
c) Mass of the body and its angular velocity
d) Mass of the body and its linear velocity

137. Moment of inertia is written mathematically as: C
a) m^2r
b) m^2 / r
c) mr^2
d) mr

138. The linear momentum p of a body is given by: A
a) mv
b) mw
c) mv^2
d) m^2v

139. The centre of gravity of an irregular shaped body lies at: C
a) The centre of the body
b) The axis of rotation of the body
c) The point of intersection of lines drawn vertically from various positions of the body
d) The surface of the body

140. Angular momentum is defined as: B
a) The dot product of position vector and linear momentum
b) The cross product of position vector and linear momentum
c) The simple product of position vector and linear momentum
d) The product of distance and linear momentum

141. Angular momentum is defined as: D
a) The quantity of matter in a body
b) The quantity of motion in a body
c) The moment of force in a body
d) The moment of momentum in a body

142. Angular momentum L is expressed by the: C
a) mv
b) $r \times f$
c) $r \times p$
d) $r \cdot f$

143. The magnitude of angular momentum $L = rp \sin\theta$ is minimum if: A
a) $\theta = 0^o$
b) $\theta = 30^o$
c) $\theta = 60^o$
d) $\theta = 90^o$