



**PARISHRAM PUBLICATIONS  
PUNE**

**NAME of Students :-** \_\_\_\_\_

**Physics :- Rotational Dynamics**

**Class : XII**

**Total Marks :-**

1. If a body is rolling down an inclined plane, the rotational KE is 40% of the translational KE. Then the body is.

- (A) ring (B) cylinder  
(C) solid sphere (D) hollow sphere

2. A mass of 2 kg is rotated in a horizontal circle of radius 10 cm. If the angular speed is 0.4 rad/s, then the centripetal force acting on the mass is

- (A) 0.32 N (B) 0.032 N  
(C) 0.16 N (D) 0.0016 N

3. The angular speed of the second's hand of the clock is

- (A)  $1.04 \times 10^{-4}$  rad/s (B)  $1.04 \times 10^{-3}$  rad/s  
(C)  $1.04 \times 10^{-2}$  rad/s (D)  $1.02 \times 10^{-1}$  rad/s

4. A wheel of radius 4 m is making 60 revolutions per minute. The angular velocity is

- (A)  $2\pi$  rad/s (B)  $4\pi$  rad/s  
(C)  $6\pi$  rad/s (D)  $8\pi$  rad/s

5. A 0.3 kg mass stone is tied to the end of a string. It is whirled in a circle of radius 1m with a speed of 40 rev  $\text{min}^{-1}$ . If the string can withstand a maximum tension of 200 N, then the tension with which the stone can be whirled is

- (A) 5.285 N (B) 7.528 N  
(C) 9.215 N (D) 200 N

6. Which of the following statements is not correct for non-uniform circular motion?

- (A) The velocity is tangential to radial acceleration.  
(B) The magnitude of tangential velocity is changing.  
(C) The angular acceleration is changing at every instant.  
(D) The particles of motion are in different planes.

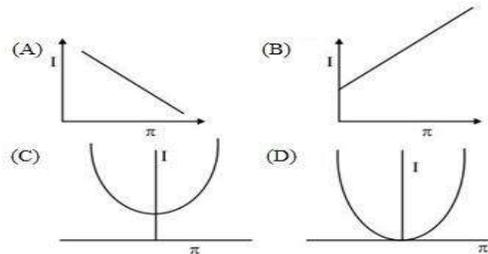
7. During circular motion, the resultant of all real force acting on the body towards the centre is known as

- (A) Centripetal force (B) Centrifugal force  
(C) Average force (D) Total force

8. Identify the correct relation.

- (A)  $\vec{v} = \vec{\omega} \times \vec{r}$  (B)  $\vec{\omega} = \vec{v} \times \vec{r}$   
(C)  $\vec{\alpha} = \vec{\omega} \times \vec{r}$  (D)  $\vec{\omega} = \vec{\alpha} \times \vec{r}$

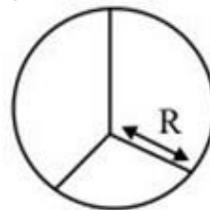
9. Which of the following graphs represents the relation between  $I \rightarrow d$  in the theorem of parallel axis  $I = I_{cm} + md^2$ ?



10. What is the dimensional formula for the radius of gyration.

- (a)  $[m - L^2]$  (b)  $[LT^{-1}]$   
(c)  $[L]$  (d)  $[L^2]$

11. A wheel comprises of ring with three spokes as shown in the figure. The radius of ring is R and mass M, the mass of each spoke is M. Which of the following option shows the moment of inertia about its axis?



- (a)  $\left(M + \frac{m}{4}\right)R^2$  (b)  $(M + m)R^2$   
(c)  $(M + 3m)R^2$  (d)  $\left(\frac{M + m}{2}\right)R^2$

12. Which of the following equation represents the moment of inertia of a uniform disc of mass M and radius R?

- (a)  $\frac{1}{2}mR^2$  (b)  $MR^2$   
(c)  $\frac{3}{2}mR^2$  (d)  $\frac{5}{2}mR^2$

13. Which of the following equation correctly represents the magnitude of centripetal force?

- (a)  $mR\omega^2$  (b)  $\frac{mv^2}{R}$   
(c)  $mv\omega$  (d) All of the above

14. On what variables the centripetal force depends?

- (A)  $\omega$  (B) g  
(C)  $\alpha$  (D) t

15. Which of the following is true for centrifugal force?  
 (A) It is a real force. (B) It is a non-real force.  
 (C) It is an imaginary force  
 (D) It is a transit force.

16. Which of the following equation represents the maximum possible speed of a vehicle along a horizontal circular track?

- (a)  $V_{\max} = \sqrt{\mu_s R g}$  (b)  $V_{\max} = \sqrt{\mu_s R \sqrt{g}}$   
 (c)  $V_{\max} = \mu_s R g$  (d)  $V_{\max} = \mu_s R^2 g$

17. What is the  $\frac{K^2}{R^2}$  ratio of thin walled hollow sphere ?

- (A) 3 : 2 (B) 2 : 3  
 (C) 4 : 3 (D) 3 : 4

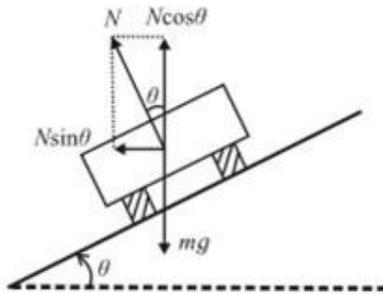
18. During \_\_\_\_\_, every particle in the object undergoes circular motion about some point outside the object or about some other object.

- (A) rotation (B) revolution  
 (C) circular motion (D) oscillatory motion

19. What is the ratio of moment of inertia of solid right circular cone to that of hollow right circular cone of mass  $m$  and radius  $R$ ?

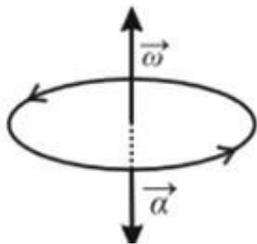
- (A) 3 : 5 (B) 5 : 3  
 (C) 3 : 4 (D) 3 : 3

20. Which of the following relation is NOT correct for the given diagram?



- (A)  $N \cos \theta = mg$  (B)  $N \cos \theta = mg/r$   
 (C)  $N \sin \theta = mr \omega^2$  (D)  $N \sin \theta = mv^2/r$

21. Which of the following can be concluded from the given figure?



- (A) There is no change in the speed of the particle.  
 (B) There is an increase in the speed of the particle.  
 (C) There is a decrease in the speed of the particle.

(D) There is an increase as well as decrease in the speed of the particle.

22. A bridge over a railway track is in the form of a circular arc of radius 50 m. The limiting speed with which a car can cross the bridge so that no contact is lost if the centre of gravity of the car is 0.4 m above the road is

- (A) 12.2 m/s (B) 22.3 m/s  
 (C) 44.6 m/s (D) 50.95 m/c

23. A particle is moving in a circle with angular velocity of  $(\pi/2)$  rad/s in 10 s. The angular displacement of the particle is

- (A)  $\pi$  rad (B)  $3 \pi$  rad  
 (C)  $4 \pi$  rad (D)  $5 \pi$  rad

24. Which of the following quantity is analogous to force?

- (A) Angular acceleration  
 (B) Torque  
 (C) Moment of inertia  
 (D) Angular frequency

25. Identify the INCORRECT statement for the conical pendulum.

- (A) The frequency is inversely proportional to the square root of the length of the pendulum.  
 (B) The string can never become horizontal during the revolution of a conical pendulum.  
 (C) The time period of the conical pendulum on the moon will remain the same as that on the earth.  
 (D) The frequency is directly proportional to the square root of acceleration due to gravity.

26. What is the correct expression for the time period of a conical pendulum?

- (a)  $T = 2\pi \sqrt{\frac{l}{g}}$  (b)  $T = 2\pi \sqrt{\frac{l \theta}{g}}$   
 (c)  $T = 2\pi \sqrt{\frac{l \cos \theta}{g}}$  (d)  $T = 2\pi \sqrt{\frac{l \sin \theta}{g}}$

27. What are the factors affecting the maximum possible speed of vehicle moving along a horizontal circular track?

- (A) Coefficient of static friction and the radius of the track.  
 (B) Coefficient of static friction and the mass of the vehicle.  
 (C) Coefficient of static friction, mass of the vehicle and the radius of the track.  
 (D) Coefficient of static friction, acceleration due to gravity and the radius of the track.

28. The characteristics of circular motion is,

- (a) Accelerated motion  
 (b) Periodic motion  
 which option is correct among the following?  
 (A) only a (B) only b

(C) Both (A) and (B) (D) Neither (A) and (B)

29. 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

30. The direction of the angular velocity is given by

- (A) Right hand thumb rule  
(B) Left hand thumb rule  
(C) Right hand figure rule  
(D) None of the above.

31. On which of the factors the angular velocity in a circular motion depends.

- (A) Period of circular motion  
(B) Frequency  
(C) Both (A) and (B)  
(D) None of the above.

32. When seen from below, the blades of a ceiling fan are seen to be revolving anticlockwise and their speed is decreasing. Select correct statement about the directions of its angular velocity and angular acceleration.

- (A) Angular velocity upwards, angular acceleration downwards.  
(B) Angular velocity downwards, angular acceleration upwards.  
(C) Both, angular velocity and angular acceleration, upwards.  
(D) Both, angular velocity and angular acceleration, downwards.

33. A particle of mass 1 kg, tied to a long string is whirled to perform vertical circular motion, under gravity. Minimum speed of a particle is 5 m/s. Consider following statements.

P) Maximum speed must be  $5\sqrt{5}$  m/s.

Q) Difference between maximum and minimum tensions along the string is 60 N.

Select correct option.

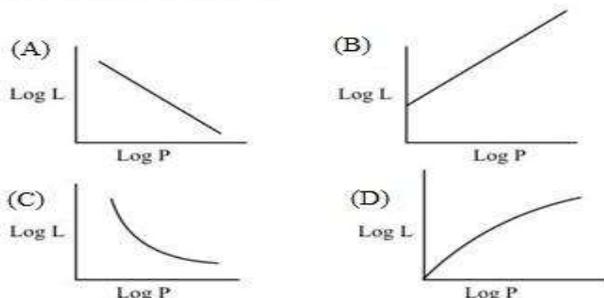
- (A) Only the statement P is correct.  
(B) Only the statement Q is correct.  
(C) Both the statements are correct.  
(D) Both the statements are incorrect.

34. Select correct statement about the formula (expression) of moment of inertia (M.I.) in terms of mass M of the object and some of its distance parameter/s, such as R, L, etc.

- (A) Different objects must have different expressions for their M.I.  
(B) When rotating about their central axis, a hollow right circular cone and a disc have the same expression for the M.I.  
(C) Expression for the M.I. for a parallelepiped rotating about the transverse axis passing through its centre includes its depth.

(D) Expression for M.I. of a rod and that of a plane sheet is the same about a transverse axis.

35. Which of the following graph represents the relation between  $\log L$  and  $\log P$  where L is angular momentum and P is linear momentum?



36. Which of the following option represent the condition in which the angular momentum remains conserved.

- (A) Presence of external unbalanced torque.  
(B) Does not depend on external unbalanced torque.  
(C) Absence of external unbalanced torque.  
(D) None of these

37. Which of the following values cannot represent the tension in the string with a point mass undergoing vertical circular motion under gravity?

- (A) 10 (B) 0  
(C)  $\sqrt{20} \times 9.8$  (D)  $10 \times 9.8$

38. Which of the following option determines the relation between torque and angular acceleration?

- (A)  $T = I/a$  (B)  $T = Ia$   
(C)  $T = a$  (D)  $T = I/2a$

39. The factor/s on which the moment of inertia of a disc depends is/are

- (A) The mass of the disc only.  
(B) The mass of the disc and acceleration due to gravity.  
(C) The mass and radius of the disc.  
(D) The mass of the disc, radius and acceleration due to gravity.

40. Identify the correct statement.

- (A) Centrifugal force has greater magnitude than the centripetal force.  
(B) Centrifugal force is a real force.  
(C) Centrifugal force cannot be measured by a force measuring device.  
(D) Centrifugal force is directed along the centripetal force.

41. Identify the quantity in circular motion which is analogous to displacement in translational motion.

- (A) Angular displacement  
(B) Angular velocity  
(C) Angular acceleration  
(D) Angular speed

42. What is the ratio of moment of inertia of uniform disc to that of thin hollow sphere about the axis of mass M and radius R?

- (A) 8 : 3                      (B) 4 : 3  
(C) 3 : 4                      (D) 4 : 7

43. Which of the following option represents the ratio of kinetic energy, rotational kinetic energy and Total kinetic energy for a hollow sphere under pure rolling down an inclined plane?

- (A) 2 : 3 : 5                      (B) 3 : 2 : 5  
(C) 1 : 4 : 5                      (D) 4 : 1 : 5

44. If the angular momentum of any rotating body increases by 100% then the increase in KE is,

- (A) 200%                      (B) 300%  
(C) 400%                      (D) 500%

45. Which of the following equation represents the linear acceleration during pure rolling down an inclined plane?

- (A)  $\alpha = \frac{g \cos \delta}{\left(1 + \frac{K^2}{R^2}\right)} g$       (B)  $\alpha = \frac{g \sin \delta}{\left(1 + \frac{K}{R}\right)} g$   
(C)  $\alpha = \frac{g \cos^2 \delta}{\left(1 + \frac{K}{R}\right)} g$       (D)  $\alpha = \frac{g \sin \delta}{\left(1 + \frac{K^2}{R^2}\right)} g$

46. A wheel of mass 20 kg has a moment of inertia of  $320 \text{ kg m}^2$  about the axis. The radius of gyration is

- (A) 10m                      (B) 8m  
(C) 6m                      (D) 4m

47. The earth moves round the sun in an almost circular orbit of radius  $1.5 \times 10^{11} \text{ m}$  with constant angular speed. The angular velocity of earth is

- (A)  $1.589 \times 10^4 \text{ m/s}$       (B)  $2.985 \times 10^4 \text{ m/s}$   
(C)  $3.845 \times 10^4 \text{ m/s}$       (D)  $4.856 \times 10^4 \text{ m/s}$

48. A satellite revolves around the earth in a circular orbit of radius 7000 km. If the time period of revolution is 2 h, then the angular speed of the satellite is

- (A)  $8.72 \times 10^{-4} \text{ rad/s}$       (B)  $8.72 \times 10^{-3} \text{ rad/s}$   
(C)  $8.72 \times 10^{-2} \text{ rad/s}$       (D)  $8.72 \times 10^{-1} \text{ rad/s}$

49. Identify the incorrect pair.

- (A) Linear displacement, angular displacement  
(B) Mass, moment of inertia  
(C) Force, torque  
(D) Linear momentum, angular velocity

50. What is the moment of inertia of a uniform disc about the diameter?

- (A)  $\frac{1}{4} MR^2$                       (B)  $\frac{1}{2} MR^2$   
(C)  $MR^2$                       (D)  $2MR^2$