JEE MAIN : CHAPTER WISE TEST PAPER-6

SUBJECT :- PHYSICS **DATE.....**
CLASS :- 11th **NAME.....**
CHAPTER :- CIRCULAR MOTION **SECTION.....**

(SECTION-A)

1. If the radii of circular paths of two particles of same masses are in the ratio of 1 : 2, then in order to have same centripetal force, their speeds should be in the ratio of :

(A) 1 : 4 (B) 4 : 1

(C) 1 : $\sqrt{2}$ (D) $\sqrt{2}$: 1

2. A particle is kept fixed on a uniformly rotating turn-table As seen from the ground , the particle goes in a circle, its speed is 10 cm/s and acceleration is 10 cm/s^2.The particle is now shifted to a new position to make the radius double of the original value.The new values of the speed and acceleration will be

(A) 20 cm/s, 20 cm/s^2 (B) 10 cm/s, 80 cm/s^2

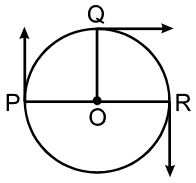
(C) 40 cm/s, 10 cm/s^2 (D) 40 cm/s,40 cm/s^2

3. If the apparent weight of the bodies at the equator is to be zero, then the earth should rotate with angular velocity

(A) $\sqrt{\frac{g}{R}}$ rad/sec (B) $\sqrt{\frac{2g}{R}}$ rad/sec

(C) $\sqrt{\frac{g}{2R}}$ rad/sec (D) $\sqrt{\frac{3g}{2R}}$ rad/sec

4. Three point particles P, Q, R move in a circle of radius 'r' with different but constant speeds. They start moving at t = 0 from their initial positions as shown in the figure. The angular velocities (in rad/sec) of P, Q and R are 5π, 2π & 3π respectively, in the same sense. The time interval after which they all meet is:



(A) 2/3 sec (B) 1/6 sec

(C) 1/2 sec (D) 3/2 sec

5. A particle of mass m begins to slide down a fixed smooth sphere from the top. What is its tangential acceleration when it breaks off the sphere ?

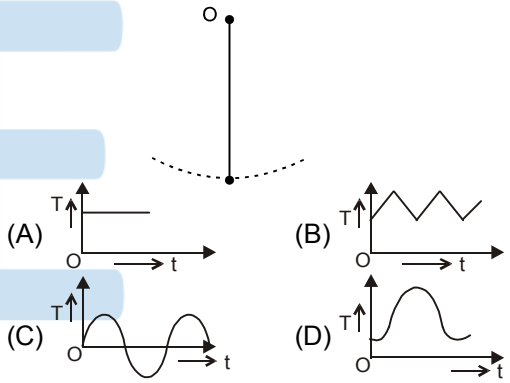
(A) $\frac{2g}{3}$ (B) $\frac{\sqrt{5}g}{3}$ (C) g (D) $\frac{g}{3}$

6. A stone of mass 1 kg tied to a light inextensible string of length L = $\frac{10}{3}$ m, whirling in a circular path in a vertical plane. The ratio of maximum tension in the string to the minimum tension in the string is 4, If g is taken to be 10 m/s^2, the speed of the stone at the highest point of the circle is :

(A) 10 m/s (B) $5\sqrt{2}$ m/s

(C) $10\sqrt{3}$ m/s (D) 20 m/s

7. A particle of mass m is suspended from a fixed point O by a string of length ℓ. It is displaced by angle θ ($\theta < 90°$) from equilibrium position and released from there at t = 0 . The graph, which shows the variation of the tension T in the string with time 't', may be :



8. A particle moves along an arc of a circle of radius R. Its velocity depends on the distance covered s as v = a$\sqrt{s}$, where a is a constant then the angle α between the vector of the total acceleration and the vector of velocity as a function of s will be

(A) tan α = $\frac{R}{2s}$ (B) tanα = 2s / R

(C) tan α = $\frac{2R}{s}$ (D) tan α = $\frac{s}{2R}$

9. A mass of M kg is suspended by a weightless string. The horizontal force that is required to displace it until the string makes an angle of 45° with the initial vertical direction is

(A) Mg ($\sqrt{2}$ +1) (B) Mg $\sqrt{2}$

(C) $\frac{Mg}{\sqrt{2}}$ (D) Mg ($\sqrt{2}$ – 1)

10. A particle is moving in a circle
(A) The resultant force on the particle must be towards the centre.
(B) The resultant force may be towards the centre.
(C) The direction of the angular acceleration and the angular velocity must be the same.
(D) The cross product of the tangential acceleration and the angular velocity will be zero.

11. A stone tied to the end of a string of 1 m long is whirled in a horizontal circle with a constant speed. If the stone makes 22 revolutions in 44 s, what is the magnitude and direction of acceleration of the stone ?
(A) $\frac{\pi^2}{4}$ ms^{-2} and direction along the radius towards the centre
(B) $\pi^2 ms^{-2}$ and direction along the radius away from centre
(C) $\pi^2 ms^{-2}$ and direction along the radius towards the centre
(D) $\pi^2 ms^{-2}$ and direction along the tangent to the circle

12. A particle moves in a circle of radius 5 cm with constant speed and time period 0.2 πs. The acceleraiton of the particle is :
(A) 15 m/s^2 (B) 25 m/s^2
(C) 36 m/s^2 (D) 5 m/s^2

13. A car of mass 1000 kg negotiates a banked curve of radius 90 m on a frictionless road. If the banking angle is 45°, the speed of the car is :
(A) 20 ms^{-1} (B) 30 ms^{-1}
(C) 5 ms^{-1} (D) 10 ms^{-1}

14. **Statement-1 :** To move a body uniformly in a circular path, an external agent has to apply a force.
Statement- 2 : To more a body uniformly in a circular path, an external agent has to do work.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

15. A particle is moving with constant angular acceleration (α) in a circular path of radius $\sqrt{3}$ m . At t = 0, it was at rest and at t = 1 sec, the magnitude of its acceleration becomes $\sqrt{6}$ m/s^2, then α is :
(A) 2 rad/s^2 (B) $\sqrt{3}$ rad/s^2
(C) $\sqrt{2}$ rad/s^2 (D) 1 rad/s^2

16. A point on the periphery of rotating disc has its acceleration vector making on angle 30º with velocity vector then the ration of magnitude of centripetal acceleration to tangential acceleration is -
(A) sin30º (B) cos 30º
(C) tan 30º (D) None of these

17. A particle is projected horizontaly with speed 10m/s from a certain point above ground. Find the tangential acceleration of particle at t = 2 sec. (Take g = 10 m/s^2).
(A) $\frac{10}{\sqrt{5}}$ (B) $\frac{25}{\sqrt{5}}$
(C) $4\sqrt{5}$ (D) $10\sqrt{5}$

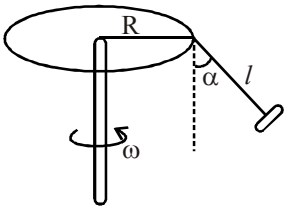
18. A particle is tied to one end of a light inextensible string and is moving in a vertical circle, the other end of string is fixed at the centre. Then for complete motion in circle, which is **correct**. (air resistance is negligible) (A) Acceleration of the particle is directed towards the centre.
(B) Total mechanical energy of the particle and earth remains constant
(C) Tension in the string remains constant
(D) Acceleration of the particle remains constant

19. The magnitude of displacement of a particle moving in a circle of radius a with constant angular speed ω varies with time t as -
(A) 2a sinωt (B) 2a sin$\frac{\omega t}{2}$
(C) 2a cosωt (D) 2a co$\frac{\omega t}{2}$

20. Which of the following correctly describes the centripetal acceleration vector for a particle moving in a circular path ?
(A) Constant and always perpendicular to the velocity vector for the particle
(B) Constant and always parallel to the velocity vector for the particle
(C) Of constant magnitude and always perpendicular to the velocity for the particle
(D) Of constant magnitude and always parallel to the velocity vector for the particle

(SECTION-B)

21. With what angular velocity ω (in rad/s) should we rotate the disc so that a mass hanging on to the periphery by a thread of length l = 35/24 m is deviated from the vertical by an angle α = 37° in steady state(Fig.)? Radius of the disc R = 1m.

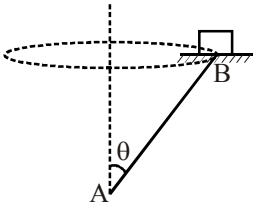


22. The particle begins to move in a circle with constant tangential acceleration. Find the angle α between the velocity and acceleration after the first revolution. The initial angular velocity of the particle is zero. Fill $\frac{\tan\alpha}{\pi}$ in OMR sheet.

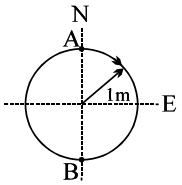
23. A coin placed on a rotating turntable just slips if it is placed at a distance of 4 cm from the centre. If the angular velocity of the turntable is doubled , it will just slip at a distance of

24. A stone of mass 0.5 kg tied with a string of length 1 metre is moving in a circular path with a speed of 4 m/sec. The tension acting on the string in newton is -

25. A rod AB of length 2m is hinged at point A and it's other and B is attached to a platform on which a block of mass m is kept. Rod rotates about point A maintaining angle θ = 30° with the vertical in such a way that platform remains horizontal and revolves on the horizontal circular path. If the coefficient of static friction between the block and platform is μ = 0.1 then find the maximum angular velocity in rad/s of rod so that block does not slip on the platform. (g = 10 m/s^2)



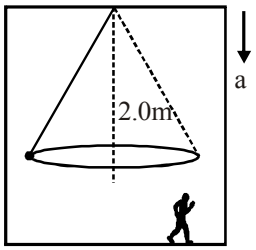
26. In one second a particle moves with constant speed from point A to point B along the circular track of radius 1.0 m as shown in the figure. What is the average acceleration of the particle during this motion. [Particle is moving from A to B in clockwise direction.]



27. Sunset is defined as the instant that the top of the sun disappears below the horizon. How long is it from the time when the bottom of the sun hits the horizon until the instant of sunset assuming that you are standing on the equator on March 21. Call this time t_{sunset} and find it in seconds? Take diameter of Sun = 14×10^8 m & sun-earth distance = 1.5×10^{11} m.

28. The particle begins to move in a circle with constant tangential acceleration. Find the angle α between the velocity and acceleration after the first revolution. The initial angular velocity of the particle is zero. Fill $\frac{\tan\alpha}{\pi}$ in OMR sheet.

29. In the figure shown, a lift goes downward with a constant retardation. An observer in the lift observes a conical pendulum, revolving in a horizontal circle, with time period 2s. The distance between the centre of circle and the point of suspension is 2.0 m. Find the retardation of the lift (in m/s^2).
[use : π^2 = 10 and g = 10 m/s^2]



30. A rock is launched upward at 45°. A bee moves along the trajectory of the rock at a constant speed equal to the initial speed of the rock. What is the magnitude of acceleration (in m/s^2) of the bee at the top point of the trajectory? For the rock, neglect the air resistance.