1. If the equation for the displacement of a particle moving on a circular path is given by $(\theta) = 2t^3+0.5$, where θ is in radian and t in second, then the angular velocity of the particle after 2 s from its start is :-

(1) 8 rad/s (2) 12 rad/s

(3) 24 rad/s (4) 36 rad/s

2. The angular speed of second hand in a mechanical watch is :-

(1) $\frac{\pi}{30}$ rad / s (2) 2π rad/s

(3) π rad/s (4) $\frac{60}{\pi}$ rad / s

3. What is the value of linear velocity, if $\vec{\omega} = 3\hat{i} - 4\hat{j} + \hat{k}$ and $\vec{r} = 5\hat{i} - 6\hat{j} + 6\hat{k}$:-

(1) $6\hat{i} + 2\hat{j} - 3\hat{k}$

(2) $-18\hat{i} - 13\hat{j} + 2\hat{k}$

(3) $4\hat{i} - 13\hat{j} + 6\hat{k}$

(4) $6\hat{i} - 2\hat{j} + 8\hat{k}$

4. A particle moves along a circle of radius R with constant angular velocity ω. Its displacement magnitude in time t is :-

(1) ωt (2) $2R \sin \omega t$

(3) $2R \cos \omega t$ (4) $2R \sin \frac{\omega t}{2}$

5. A particle of mass 'm' describes a circle of radius (r). The centripetal acceleration of the particle is $\frac{4}{r^2}$. The momentum of the particle :–

(1) $\frac{2m}{r}$ (2) $\frac{2m}{\sqrt{r}}$ (3) $\frac{4m}{r}$ (4) $\frac{4m}{\sqrt{r}}$

6. A particle moving along a circular path. The angular velocity, linear velocity, angular acceleration and centripetal acceleration of the particle at any instant respectively are $\vec{\omega}$, $\vec{v}$, $\vec{\alpha}$, $\vec{a}_c$. Which of the following relation is/are correct :–

(a) $\vec{\omega} \perp \vec{v}$

(b) $\vec{\omega} \perp \vec{\alpha}$

(c) $\vec{v} \perp \vec{a}_c$

(d) $\vec{\omega} \perp \vec{a}_c$

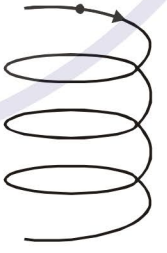
(1) a,b,d (2) b,c,d

(3) a,b,c (4) a,c,d

7. Two stones of masses m and 2 m are whirled in horizontal circles, the heavier one in a radius r and the lighter one in radius 2r. The tangential speed of lighter stone is n times that of the value of heavier stone when they experience same centripetal forces. The value of n is :

(1) 1 (2) 2 (3) 3 (4) 4

8. A particle is going in a spiral path as shown in figure, with constant speed.



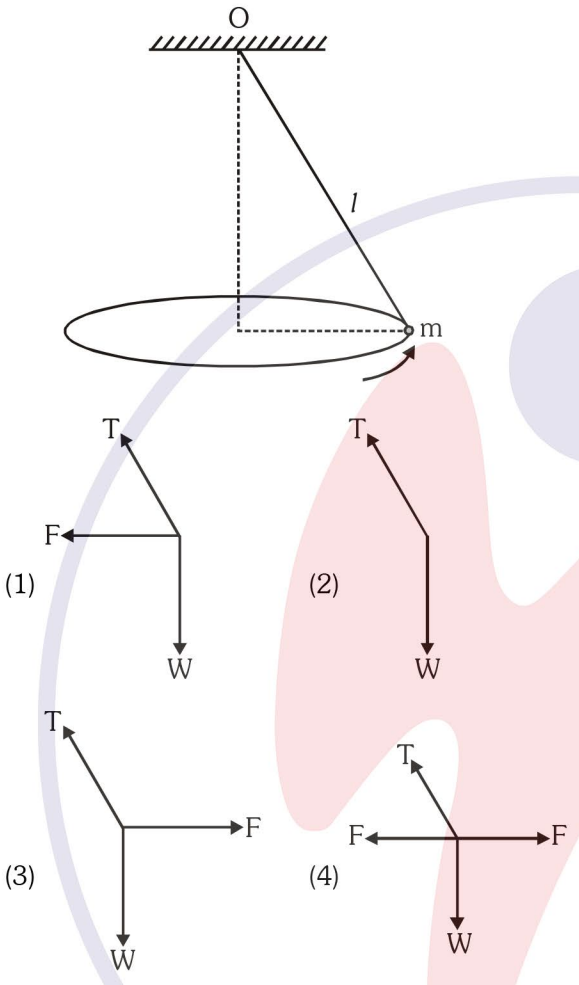
(1) The velocity of particle is constant

(2) The acceleration of particle is constant

(3) The magnitude of acceleration is constant

(4) The magnitude of acceleration is increasing continuously

9. A point mass m is suspended from a light thread of length *l*, fixed at O, is whirled in a horizontal circle at constant speed as shown. From your point of view, stationary with respect to the mass, the forces on the mass are



10. A car is travelling with linear velocity v on a circular road of radius R. If its speed is decreasing at the rate a m/s², then the net acceleration will be :-

(1) $\frac{v^2}{R}+a$ (2) $\frac{v^2}{R}-a$

(3) $\sqrt{\left(\frac{v^2}{R}\right)^2+a^2}$ (4) $\sqrt{\left(\frac{v^2}{R}\right)^2-a^2}$

11. One end of a string of length *l* is connected to a particle of mass m and the other to a small peg on a smooth horizontal table. If the particle moves in a circle with speed v, the net force on the particle (directed towards the centre) is :-

(1) T (2) $T-\frac{mv^2}{l}$ (3) $T+\frac{mv^2}{l}$ (4) zero

12. A motor cyclist moving with a velocity of 72 km/h on a flat road takes a turn on the road at a point where the radius of curvature of the road is 20 m. The acceleration due to gravity is 10 m/sec². In order to avoid skidding, he must not bend with respect to the vertical plane by an angle greater than :-

(1) $\theta = \tan^{-1}6$ (2) $\theta = \tan^{-1}2$

(3) $\theta = \tan^{-1}25.92$ (4) $\theta = \tan^{-1}4$

13. A ball is suspended by thread of length ℓ. What minimum horizontal velocity has to be imparted to the ball for it to reach the height of suspension ?

(1) $\sqrt{(g\ell)}$ (2) $\sqrt{(2g\ell)}$ (3) $2g\ell$ (4) $g\ell$

14. 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 ω. The force exerted by the liquid at the other end is :-

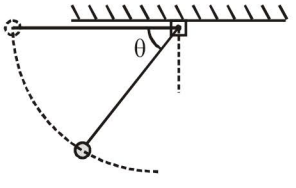
(1) $\frac{ML\omega^2}{2}$ (2) $ML\omega^2$

(3) $\frac{ML\omega^2}{4}$ (4) $\frac{ML^2\omega^2}{2}$

15. A car is moving in a circular horizontal track of radius 10 m with a constant speed of 10 m/s. A plumb bob is suspended from the roof of the car by a light rigid rod of length 1 m. The angle made by the rod with track is :-

(1) zero (2) 30° (3) 45° (4) 60°

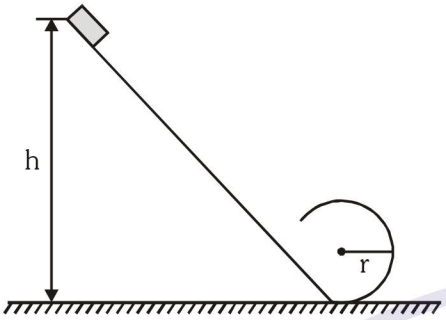
16. Figure shows a small mass connected to a string, which is attached to a vertical post. If the mass is released when the string is horizontal as shown, the magnitude of the total acceleration of the mass as a function of the angle θ is :-



(1) g sin θ (2) g cos θ

(3) $g\sqrt{3\cos^2\theta+1}$ (4) $g\sqrt{3\sin^2\theta+1}$

17. A block follows the path as shown in the figure from height h. If radius of circular path is r, then relation that holds good to complete full circle is :-



(1) $h < \frac{5r}{2}$ (2) $h > \frac{5r}{2}$

(3) $h = \frac{5r}{2}$ (4) $h \geq \frac{5r}{2}$

18. Radius of the curved road on national highway is R. Width of the road is b. The outer edge of the road is raised by h with respect to inner edge so that a car with velocity v can pass safely over it. The value of h is :–

(1) $\frac{v^2b}{Rg}$ (2) $\frac{v}{Rgb}$ (3) $\frac{v^2R}{bg}$ (4) $\frac{v^2b}{R}$

19. A boy holds a pendulum in his hand while standing at the edge of a circular platform of radius r rotating at an angular speed ω. The pendulum will hang at an angle θ with the vertical so that :–

(1) $\tan\theta = 0$ (2) $\tan\theta = \frac{\omega^2 r^2}{g}$

(3) $\tan\theta = \frac{r\omega^2}{g}$ (4) $\tan\theta = \frac{g}{\omega^2 r}$

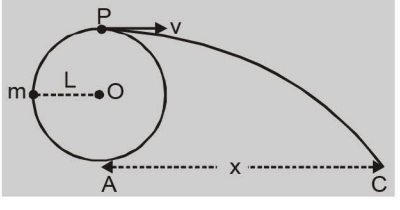
20. A body tied to a string of length L is revolved in a vertical circle with minimum velocity, when the body reaches the upper most point the string breaks and the body moves under the influence of the gravitational field of earth along a parabolic path. The horizontal range AC of the body will be :–

(1) x = L

(2) x = 2L

(3) $x = 2\sqrt{2L}$

(4) $x = \sqrt{2L}$



21. Keeping the banking angle of the road constant, the maximum safe speed of passing vehicles is to be increased by 10%. The radius of curvature of the road will have to be changed from 20 m to :-

(1) 16 m (2) 18 m

(3) 24.20 m (4) 30.5 m

22. Three identical particles are joined together by a thread as shown in figure. All the three particles are moving in a horizontal plane. If the velocity of the outermost particle is v_0, then the ratio of tensions in the three sections of the string is :-

(1) 3 : 5 : 7 (2) 3 : 4 : 5

(3) 7 : 11 : 6 (4) 3 : 5 : 6

23. A mass m is attached to the end of a rod of length ℓ. The mass goes around a verticle circular path with the other end hinged at the centre. What should be the minimum velocity of mass at the bottom of the circle so that the mass completes the circle ?

(1) $\sqrt{4g\ell}$ (2) $\sqrt{3g\ell}$ (3) $\sqrt{5g\ell}$ (4) $\sqrt{g\ell}$

24. A stone is tied to a string of length 'ℓ' and is whirled in a vertical circle with the other end of the string as the centre. At a certain instant of time, the stone is at its lowest position and has a speed 'u'. The magnitude of the change in velocity as it reaches a position where the string is horizontal (g being acceleration due to gravity) is :–

(1) $\sqrt{u^2 - g\ell}$ (2) $u - \sqrt{u^2 - 2g\ell}$

(3) $\sqrt{2g\ell}$ (4) $\sqrt{2(u^2 - g\ell)}$

25. A gramophone record is revolving with an angular velocity ω. A coin is placed at a distance r from the centre of the record. The static coefficient of friction is μ. The coin will revolve with the record if :-

(1) $r \geq \frac{\mu g}{\omega^2}$ (2) $r = \mu g\omega^2$

(3) $r < \frac{\omega^2}{\mu g}$ (4) $r \leq \frac{\mu g}{\omega^2}$

26. A car of mass m is moving on a level circular track of radius R. If μ_s represents the static friction between the road and tyres of the car, the maximum speed of the car in circular motion is given by :-

(1) $\sqrt{mRg/\mu_s}$ (2) $\sqrt{\mu_s Rg}$

(3) $\sqrt{\mu_s mRg}$ (4) $\sqrt{Rg/\mu_s}$

27. A particle of mass 10 g moves along a circle of radius 6.4 cm with a constant tangential acceleration. What is the magnitude of this acceleration if the kinetic energy of the particle becomes equal to 8×10^{-4} J by the end of the second revolution after the beginning of the motion?

(1) 0.1 m/s^2 (2) 0.15 m/s^2

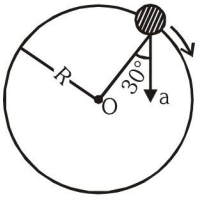
(3) 0.18 m/s^2 (4) 0.2 m/s^2

28. A car is negotiating a curved road of radius R. The road is banked at an angle θ. The coefficient of friction between the tyres of the car and the road is μ_s. The minimum safe velocity on this road is :-

(1) $\sqrt{gR^2 \frac{\tan\theta + \mu_s}{1 - \mu_s \tan\theta}}$ (2) $\sqrt{gR \frac{\tan\theta - \mu_s}{1 + \mu_s \tan\theta}}$

(3) $\sqrt{\frac{g}{R} \frac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}}$ (4) $\sqrt{\frac{g}{R^2} \frac{\mu_s + \tan\theta}{1 + \mu_s \tan\theta}}$

29. In the given figure, a = 7.5 m/s^2 represents the total acceleration of a particle moving in the clockwise direction in a circle of radius R = 5 m at a given instant of time. The speed of the particle is :-



(1) 5.7 m/s (2) 6.2 m/s

(3) 4.5 m/s (4) 5.0 m/s

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	**3**	**1**	**2**	**4**	**2**	**4**	**2**	**3**	**3**	**3**	**1**	**2**	**2**	**1**	**3**
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
Ans.	**4**	**4**	**1**	**3**	**2**	**3**	**4**	**1**	**4**	**4**	**2**	**1**	**2**	**1**	