# CIRCULAR MOTION

1. A body of mass *m* is moving in a circle of radius *r* with a constant speed $\upsilon$. The force on the body is $\frac{m\upsilon^2}{r}$ and is directed towards the centre. What is the work done by this force in moving the body over half the circumference of the circle.

(a) $\frac{m\upsilon^2}{r} \times \pi r$ (b) zero (c) $\frac{m\upsilon^2}{r^2}$ (d) $\frac{\pi r^2}{m\upsilon^2}$

2. An object moves at a constant speed along a circular path in a horizontal XY plane, with the centre at the origin. When the object is at '$x = -2m$ its is $-(4m/s)j$. What is the object's acceleration when it is '$y = 2m$

(a) $-(8m/s^2)\hat{j}$ (b) $-(8m/s^2)\hat{i}$ (c) $-(4m/s^2)\hat{j}$ (d) $-(4m/s^2)\hat{i}$

3. A body is moving in a circular path with acceleration *a*. If its velocity gets doubled, find the ratio of acceleration after and before the change

(a) 1:4 (b) $\frac{1}{4}:2$ (c) 2:1 (d) 4:1

4. If the length of the second's hand in a s top clock is 3cm the angular velocity and linear velocity of the tip is

(a) 0.2047 *rad /sec.*, 0.0314 *m/sec* (b) 0.2547 *rad /sec.*, 0.314 *m/sec*

(c) 0.1472 *rad /sec.*, 0.06314 *m/sec* (d) 0.1047 *rad /sec.*, 0.00314 *m/sec*

5. What is the angular velocity of earth

(a) $\frac{2\pi}{86400} rad/\sec$ (b) $\frac{2\pi}{3600} rad/\sec$

(c) $\frac{2\pi}{24} rad/\sec$ (d) $\frac{2\pi}{6400} rad/\sec$

6. A particle describes a horizontal circle in a conical funnel whose inner surface is smooth with speed of 0.5 *m/s*. What is the height of the plane of circle from vertex of the funnel

(a) 0.25 *cm* (b) 2 *cm* (c) 4 *cm* (d) 2.5 *cm*

7. A stone tied to the end of a string 1*m* long is whirled in a horizontal circle with a constant speed . I f the stone makes 22 revolution in 44 seconds, what is the magnitude and direction of acceleration of the stone.

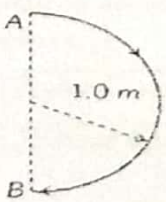
(a) $\pi^2/4 ms^{-2}$ and direction along the radius towards the centre

(b) $\pi^2 ms^{-2}$ and direction along the radius away the 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 centre

8. In 1.0 s, a particle goes from point A to point B, moving in s semi circle of radius 1.0 m (see figure). The magnitude of the average velocity is




(a) 3.14 *m/s*

(b) 2.0 *m/s*

(c) 1.0 *m/s*

(d) Zero

9. For a particle in uniform circular motion, the acceleration $\bar{a}$ at a point $P(R,\theta)$ on the circle of radius R is (Here $\theta$ is measured from the x-axis)

Scanned with CamScanner

(a) $\frac{\upsilon^2}{R}\hat{i}+\frac{\upsilon^2}{R}\hat{j}$ (b) $-\frac{\upsilon^2}{R}\cos\theta\hat{i}+\frac{\upsilon^2}{R}\sin\theta\hat{j}$

(c) $-\frac{\upsilon^2}{R}\sin\theta\hat{i}+\frac{\upsilon^2}{R}\cos\theta\hat{j}$ (d) $-\frac{\upsilon^2}{R}\cos\theta\hat{i}-\frac{\upsilon^2}{R}\sin\theta\hat{j}$

10. The earth moves round the sun in near circular orbit of radius $1.5\times10^{11}$ m. Its centripetal acceleration is

(a) $1.5\times10^{-3}m/s^2$ (b) $3\times10^{-3}m/s^2$ (c) $6\times10^{-3}m/s^2$ (d) $12\times10^{-3}m/s^2$

11. If a car is to travel with a speed '$\upsilon$ along the frictionless, banked circular track of radius *r*, the required angle of banking so that the car does skid is

(a) $\theta=\tan^{-1}\left(\frac{\upsilon^2}{rg}\right)$ (b) $\theta=\tan^{-1}\left(\frac{\upsilon}{rg}\right)$

(c) $\theta=\tan^{-1}\left(\frac{r^2}{\upsilon g}\right)$ (d) $\theta<\tan^{-1}\left(\frac{\upsilon^2}{rg}\right)$

12. A stone of mass 2 kg is tied to a string of length 0.5 m. If the breaking tension of the string is 900 N, then the maximum angular velocity, the stone can have in uniform circular motion is

(a) $30\,\text{rad}\,s^{-1}$ (b) 20 rad $s^{-1}$ (c) 10 rad $s^{-1}$ (d) 25 rad $s^{-1}$ (e) 40 rad $s^{-1}$

13. A particle moves in a circle of radius 5 *cm* with constant speed and time period $0.2\pi s$. the acceleration of the particle is

(a) 5 $m/s^2$ (b) 15 $m/s^2$ (c) 25 $m/s^2$ (d) 36 $m/s^2$

14. A car of mass 1000 kg negotiates a banked curve of radius 90 m o n a frictional road. If the banking angle is $45^o$, the speed of the car is

(a) 20 $ms^{-1}$ (b) 30 $ms^{-1}$ (c) 5 $ms^{-1}$ (d) 10 $ms^{-1}$

15. Two cars of masses $m_1$ and $m_2$ are moving in circles of radii $r_1$ and $r_2$ respectively. Their speeds are such that they make complete circles in the same time *t*. The ratio of their centripetal acceleration is

(a) $m_1r_1:m_2r_2$ (b) $m_1:m_2$ (c) $r_1:r_2$ (d) 1:1

16. A particle moves in a circle of radius 30 *cm*. Its linear speed is give n by $\upsilon=2t$ where *t* in sec and $\upsilon$ in m/s. Find out its radial and tangential acceleration at $t=3\,\text{sec}$. respectively,

(a) $220\,m/\text{sec}^2, 50\,m/\text{sec}^2$ (b) $100\,m/\text{sec}^2, 5\,m/\text{sec}^2$

(c) '$120\,m/\text{sec}^2, 2\,m/\text{sec}^2$ (d) '$110\,m/\text{sec}^2, 10\,m/\text{sec}^2$

17. A body moving along a circular path of radius R with velocity $\upsilon$, has centripetal acceleration *a*. If its velocity is made equal to $2\upsilon$, the n its centripetal acceleration is

(a) 4*a* (b) 2*a* (c) $\frac{a}{4}$ (d) $\frac{a}{2}$

18. A cyclist turns around a curve at 15 miles/hour. If he turns at double the speed, the tendency to overturn is

(a) Doubled (b) Quadrupled (c) Halved (d) Unchanged

19. A body of mass m is moving in a circle of radius *r* with a constant speed *v*. The force on the body is $\frac{m\upsilon^2}{r}$ and is directed towards the centre. What is the work done by this force in moving the body over half the circumference of the circle

Scanned with CamScanner

(a) $\frac{mv^2}{r} \times \pi r$ (b) Zero (c) $\frac{mv^2}{r^2}$ (d) $\frac{\pi r^2}{mv^2}$

20. If the length of the second's hand in a stop clock is *cm* the angular velocity and linear velocity of the tip is

(a) 0.2047 rad / sec 0.0314 m /sec

(b) 0.2547 *rad* / sec ., 0.314 m/ sec

(c) 0.1472 *rad* /sec., 0.06314 m/ sec

(d) 0.1047 *rad* / sec., 0.00314 m/ sec

21. What is the angular velocity of earth

(a) $\frac{2\pi}{86400} rad/\sec$ (b) $\frac{2\pi}{3600} rad/\sec$ (c) $\frac{2\pi}{24} rad/\sec$ (d) $\frac{2\pi}{6400} rad/\sec$

22. A particle describes a horizontal circle in a conical funnel whose inner surface is smooth with speed of 0.5 *m/s*. What is the height of the plane of circle from vertex of the funnel

(a) 0.25 cm (b) 2 *cm* (c) 4 *cm* (d) 2.5 *cm*

23. A stone tied to the end of a string 1m long is whirled in a horizontal circle with a constant speed. If the stone makes 22 revolution in 44 seconds, what is the magnitude and direction of acceleration of the stone

(a) $\pi^2 / 4ms^{-2}$ and direction along the radius towards the centre

(b) $\pi^2 m s^{-2}$ and direction along the radius away from the centre

(c) $\pi^2 m s^{-2}$ *and* direction along the radius towards the centre

(d) $\pi^2 m s^{-2}$ and direction along the tangent to the circle

24. When a body moves with a constant speed along a circle

(a) No work is done on it

(b) No acceleration is produced in the body

(c) No force acts on the body

(d) Its velocity remains constant

25. A car sometimes overturns while taking a turn. When it overturns, it is

(a) The inner wheel which leaves the ground first

(b) The outer wheel which leaves the ground first

(c) Both the wheels leave the ground simultaneously

(d) Either wheel leaves the ground first

26. The length of second's hand in a watch is 1 *cm*. The change in velocity of its tip in 15 seconds is

(a) Zero (b) $\frac{\pi}{30\sqrt{2}} cm/\sec$ (c) $\frac{\pi}{30} cm/\sec$ (d) $\frac{\pi\sqrt{2}}{30} cm/\sec$

27. A particle of mass *m* is executing uniform circular motion on a path of radius *r*. If p is the magnitude of its linear momentum. The radial force acting on the particle is

(a) *pmr* (b) $\frac{rm}{p}$ (c) $\frac{mp^2}{r}$ (d) $\frac{p^2}{rm}$

28. Two masses M and m are attached to a vertical axis by weightless threads of combined length *l*. They are set in rotational motion in a horizontal plane about this axis with constant angular velocity $\omega$. If the tensions in the threads are the same during motion, the distance of M from the axis is

Scanned with CamScanner

(a) $\frac{Ml}{M+m}$ (b) $\frac{ml}{M+m}$ (c) $\frac{M+m}{M}l$ (d) $\frac{M+m}{m}l$

29. The average acceleration vector for a particle having a uniform circular motion is
(a) A constant vector of magnitude $v^2/r$
(b) A vector of magnitude $v^2/r$ directed normal to the plane of the given uniform circular motion
(c) Equal to the instantaneous acceleration vector at the start of the motion
(d) A null vector

30. 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 *u* can pass safe over it. The value of *h* is

(a) $\frac{v^2b}{Rg}$ (b) $\frac{v}{Rgb}$ (c) $\frac{v^2R}{g}$ (d) $\frac{v^2b}{R}$

31. A motorcycle is going on an overbridge of radius R. The driver maintains a constant speed. As the motorcycle is ascending on the overbridge, the normal force on it
(a) Increases (b) Decreases (c) Remains the same (d) Fluctuates

32. A mass of 2 *kg is* whirled in a horizontal circle by means of a string at an initial speed of 5 *revolutions per minute.* Keeping the radius constant the tension in the string is doubled. The new speed is nearly
(a) 14 rpm (b) 10 rpm (c) 2.25 rpm (d) 7 rpm

33. If a particle of mass *m* is moving in a horizontal circle of radius r with a centripetal force ($-k/r^2$), the total energy is

(a) $-\frac{k}{2r}$ (b) $-\frac{k}{r}$ (c) $-\frac{2k}{r}$ (d) $-\frac{4k}{r}$

34. A circular road of radius 1000 m has banking angle $45^\circ$ The maximum safe speed of a car having mass 2000 *kg* . be, if the coefficient of friction between tyre and road is 0.5
(a) 172 m/s (b) 124 m/s (c) 99 m/s (d) 86 m/s

35. The second's hand of a watch has length 6 *cm.* Speed of end point and magnitude of difference of velocities at two perpendicular positions will be
(a) 6.28 and 0 *mm/s* (b) 8.88 and 4.44 *mm/s*
(c) 8.88 and 6.28 mm/s (d) 6.28 and 8.88 *mm/s*

36. A sphere of mass m is tied to end of a string of length *l* and rotated through the other end along a horizontal circular path with speed *v*. The work done in full horizontal circle is

(a) 0 (b) $\left(\frac{mv^2}{l}\right).2\pi l$ (c) $mg.2\pi l$ (d) $\left(\frac{mv^2}{l}\right).(l)$

37. If a particle covers half the circle of radius *R* with constant speed then
(a) Change in momentum is *mvr*
(b) Change in *K.E.* is $1/2\ mv^2$
(c) Change in *K.E.* is $mv^2$
(d) Change in *K.E.* is zero

38. What is the value of linear velocity, if $\bar{\omega} = 3\hat{i} - 4\hat{j} + \hat{k}$ and $\bar{r} = 5\hat{i} - 6\hat{j} + 6\hat{k}$
(a) $6\hat{i} + 2\hat{j} - 3\hat{k}$ (b) $-18\hat{i} - 13\hat{j} + 2\hat{k}$ (c) $4\hat{i} - 13\hat{j} + 6\hat{k}$ (d) $6\hat{i} - 2\hat{j} + 8\hat{k}$

39. A cyclist goes round a circular path of circumference 34.3 *m* in, $\sqrt{22}$ *sec.* the angle

Scanned with CamScanner

made by him, with the vertical, will be

(a) 45° (b) 40° (c) 42° (d) 48°

40. A particle of mass *M* is moving in a horizontal circle of radius *R* with uniform speed V. When it moves from one point to a diametrically opposite point, its

(a) Kinetic energy changes by $MV^2 / 4$

(b) Momentum does not change

(c) Momentum changes by 2MV

(d) Kinetic energy changes by $MV^2$

41. A cyclist riding the bicycle at a speed of $14\sqrt{3}\ ms^{-1}$ takes a turn around a circular road of radius $20\sqrt{3}\ m$ without skidding. Given $g = 9.8\ ms^{-2}$, what is his inclination to the vertical

(a) 30° (b) 90° (c) 45° (d) 60°

42. In uniform circular motion, the velocity vector and acceleration vector are

(a) Perpendicular to each other

(b) Same direction

(c) Opposite direction

(d) Not related to each other

43. A car moves on a circular road. It describes equal angles about the centre in equal intervals of time. Which of the following statement about the velocity of the car is true

(a) Magnitude of velocity is not constant

(b) Both magnitude and direction of velocity change

(c) Velocity is directed towards the centre of the circle

(d) Magnitude of velocity is constant but direction changes

44. The maximum velocity (in $ms^{-1}$) with which a car drivel must traverse a flat curve of radius 150 m and coefficient of friction 0.6 to avoid skidding is

(a) 60 (b) 30 (c) 15 (d) 25

45. If $a_r$ and $a_t$ represent radial and tangential accelerations the motion of a particle will be uniformly circular if

(a) $a_r = 0$ and $a_t = 0$ (b) $a_r = 0$ but $a_t \neq 0$

(c) $a_r \neq 0$ but $a_t = 0$ (d) $a_r \neq 0$ and $a_t \neq 0$

46. In uniform circular motion

(a) Both the angular velocity and the angular momentum vary

(b) The angular velocity varies but the angular momentum remains constant

(c) Both the angular velocity and the angular momentum stay constant

(d) The angular momentum varies but the angular velocity remains constant

47. When a body moves in a circular path, no work is done by the force since,

(a) There is no displacement

(b) There is no net force

(c) Force and displacement are perpendicular to each other

(d) The force is always away from the centre

48. Which of the following statements is false for a particle moving in a circle with a

Scanned with CamScanner

constant angular speed

(a) The velocity vector is tangent to the circle

(b) The acceleration vector is tangent to the circle

(c) The acceleration vector points to the centre of the circle

(d) The velocity and acceleration vectors are perpendicular each other

49. For a particle in uniform circular motion, the acceleration $\vec{a}$ at a point $P(R,\theta)$ on the circle of radius R is (Here $\theta$ is from the x-axis)

(a) $\frac{v^2}{R}\hat{i}+\frac{v^2}{R}\hat{j}$ (b) $-\frac{v^2}{R}\cos\theta\hat{i}+\frac{v^2}{R}\sin\theta\hat{j}$

(c) $-\frac{v^2}{R}\sin\theta\hat{i}+\frac{v^2}{R}\cos\theta\hat{j}$ (d) $-\frac{v^2}{R}\cos\theta\hat{i}-\frac{v^2}{R}\sin\theta\hat{j}$

50. The earth moves round the sun in a near circular orbit of radius $1.5\times10^{11}$ m. Its centripetal acceleration is

(a) $1.5\times10^{-3}m/s^2$ (b) $3\times10^{-3}m/s^2$ (c) $6\times10^{-3}m/s^2$ (d) $12\times10^{-3}m/s^2$

51. If a car is to travel with a speed *v* along the frictionless, banked circular track of radius r, the required angle of the car does skid is

(a) $\theta=\tan^{-1}\left(\frac{v^2}{rg}\right)$ (b) $\theta=\tan^{-1}\left(\frac{v}{rg}\right)$ (c) $\theta=\tan^{-1}\left(\frac{r^2}{vg}\right)$ (d) $\theta<\tan^{-1}\left(\frac{v^2}{rg}\right)$

52. A particle moves in a circle of radius 5 *cm* with constant speed and time period $0.2\pi\,s$. The acceleration of the particle is

(a) $5m/s^2$ (b) $15\ m/s^2$ (c) $25\ m/s^2$ (d) $36m/s^2$

53. A car of mass 1000 kg negotiates a banked curve of radius 90 m on a frictionless road. If the banking angle is $45^0$, the speed of the car is

(a) 20 $ms^{-1}$ (b) 30 $ms^{-1}$ (c) 5 $ms^{-1}$ (d) 10 $ms^{-1}$

54. A sphere is suspended by a thread of length 1. What minimum horizontal velocity has to be imparted the ball for it to reach the height of the suspension

(a) *gl* (b) 2g1 (c) $\sqrt{gl}$ (d) $\sqrt{2gl}$

55. A wheel is subjected to uniform angular acceleration about its axis. Initially its angular velocity is zero. In the first 2 *sec*, it rotates through an angle $\theta_1$. In the next 2 *sec*, it rotates through an additional angle $\theta_2$. The ratio of $\theta_2/\theta_1$ is

(a) 1 (b) 2 (c) 3 (d) 5

56. A 1 *kg* stone at the end of 1 m long string is whirled in a vertical circle at constant speed of 4 *m/sec*. The tension in the string is 6 *N*. when the stone is at $(g=10m/\sec^2)$

(a) Top of the circle (b) Bottom of the circle

(c) Half way down (d) None of the above

57. The string of pendulum of length *l* is from the vertical and released. Then the minimum strength of the string in order to withstand the tension, as the pendulum passes through the mean position is

(a) *mg* (b) *3mg* (c) *5mg* (d) *6mg*

58. A particle originally at rest at the highest point of a smooth vertical circle is slightly displaced. It will leave the circle at a vertical distance *h* below the highest point such that

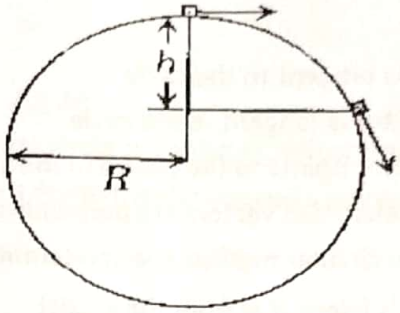
(a) $h=R$

Scanned with CamScanner

(b) $h = \frac{R}{3}$

(c) $h = \frac{R}{2}$

(d) $h = \frac{2R}{3}$




59. If the equation for the displacement of a particle moving on circular path is given by $'(\theta) = 2t^3 + 0.5$, where $\theta$ is in radians and *t* in seconds, then the angular velocity of particle after 2 *sec* from its start is

(a) 8 *rad/sec* (b) 12 *rad/sec* (c) 24 *rad/sec* (d) 36 *rad/sec*

60. A body mass *m* in hangs at one end of a string of length *l*, the other end of which is fixed. It is given a horizontal velocity so that the string would just reach where it makes an angle of 60° with the vertical. The tension in the string at mean position is

(a) 2*mg* (b) *mg* (c) 3 *mg* (d) $\sqrt{3}mg$

61. The tension in the string revolving in a vertical circle with a mass *m* at the end which is at the lowest position

(a) $\frac{mv^2}{r}$ (b) $\frac{mv^2}{r} - mg$ (c) $\frac{mv^2}{r} + mg$ (d) $mg$

62. A hollow sphere has radius 6.4 m. Minimum velocity motor cyclist at bottom to complete the circle will be

(a) 17.7 *m/s* (b) 10.2 m/s (c) 12.4 *m /s* (d) 16.0 *m/s*

63. A fan is making 600 revolutions per *minute*. If after some time it makes 200 revolutions per *minute*, then increase in its angular velocity is

(a) $10\pi\, rad/\sec$ (b) $20\pi\, rad/\sec$ (c) $\frac{40\pi}{3} rad/\sec$ (d) $60\pi\, rad/\sec$

64. A stone tied with a string. is rotated in a vertical circle. The minimum speed with which the string has to be rotated

(a) Is independent of the mass of the stone

(b) Is independent of the length of the string

(c) Decreases with increasing mass of the stone

(d) Decreases with increasing in length of the string

65. For a particle in a non-uniform accelerated circular motion

(a) Velocity is radial and acceleration is transverse only

(b) Velocity is transverse and acceleration is radial only

(c) Velocity is radial and acceleration has both radial and transverse components

(d) Velocity is transverse and accelera'ion has both radial and transverse components

66. A fighter plane is moving in a vertical circle of radius 'r'. Its minimum velocity at the highest point of the circle will be

(a) $\sqrt{3gr}$ (b) $\sqrt{2gr}$ (c) $\sqrt{gr}$ (d) $\sqrt{gr/2}$

67. A stone of mass *m* is tied to a string and is moved in a vertical circle of radius r

Scanned with CamScanner

making n revolutions per *minute*. The total tension in the string when the stone is at its lowest point is

(a) $mg$ (b) $m(g+\pi nr^2)$ (c) $m(g+\pi nr)$ (d) $m\{g+(\pi^2n^2r)/900\}$

68. When a ceiling fan is switched off its angular velocity reduces to 50% while it makes 36 rotations. How many more rotation will it make before coming to rest (Assume uniform angular retardation)

(a) 18 (b) 12 (c) 36 (d) 48

69. A body crosses the topmost point of a vertical circle with critical speed. Its centripetal acceleration, when the string is horizontal will be

(a) $6g$ (b) $3g$ (c) $2g$ (d) $g$

70. A simple pendulum oscillates in a vertical plane. When it passes through the mean position, the tension in the string is 3 times the weight of the pendulum bob. What is the maximum displacement of the pendulum with respect to the vertical

(a) 30° (b) 45° (c) 60° (d) 90°

71. A particle is moving in a vertical circle. The tensions in the string when passing through two positions at angles 30° and 60° from vertical (lowest position) are $T_1$ and $T_2$ respectively, then

(a) $T_1 = T_2$

(b) $T_2 > T_1$

(c) $T_1 > T_2$

(d) Tension in the string always remains the same

72. The angle turned by a body undergoing circular motion depends on time as $\theta = \theta_0 + \theta_1 t + \theta_2 t^2$. Then the angular acceleration of the body is

(a) $\theta_1$ (b) $\theta_2$ (c) $2\theta_1$ (d) $2\theta_2$

73. A small disc is on the top of a hemisphere of radius *R*. What is the smallest horizontal velocity *v* that should be given to the disc for it to leave the hemisphere and not slide down it ? [There is no friction]

(a) $v=\sqrt{2gR}$ (b) $v=\sqrt{gR}$ (c) $v=\frac{g}{R}$ (d) $v=\sqrt{g^2R}$

74. A bucket full of water is revolved in vertical circle of radius 2*m*. What should be the maximum time-period of revolution so that the water doesn't fall off the bucket

(a) 1 *sec* (b) 2 *sec* (c) 3 *sec* (d) 4 *sec*

75. The maximum and minimum tension in the string whirling in a circle of radius 2.5 *m* with constant velocity are in the ratio 5 : 3 then its velocity is

(a) $\sqrt{98}\,m/s$ (b) $7m/s$ (c) $\sqrt{490}\,m/s$ (d) $\sqrt{4.9}$

76. A particle moves in a circular path with decreasing Choose the correct statement. → speed

(a) Angular momentum remains constant

(b) Acceleration ($\vec{a}$) is towards the centre

(c) Particle moves in a spiral path with decreasing

(d) The direction of angular momentum remains constant

77. 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 of its ends with a uniform angular velocity $\omega$. The force exerted by the liquid at the other end is



Scanned with CamScanner

(a) $\frac{ML\omega^2}{2}$ (b) $ML\omega^2$ (c) $\frac{ML\omega^2}{4}$ (d) $\frac{ML^2\omega^2}{2}$

78. kinetic energy *k* of a particle moving along a circle of radius R depends on the distance covered *s* as $k = as^2$ where *a* is a constant. The force acting on the particle is

(a) $2a\frac{s^2}{R}$ (b) $2as\left(1+\frac{s^2}{R^2}\right)^{1/2}$ (c) $2as$ (d) $2a\frac{R^2}{s}$

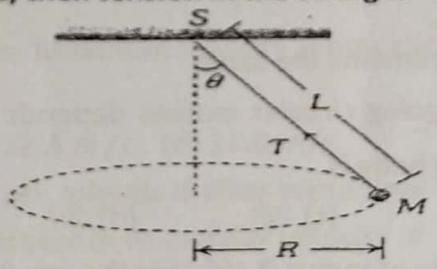
79. A care is moving in a circular horizontal track of radius 10 m with a constant speed of 10 *m/sec.* A plumb bob is suspended from the roof of the car by a light rigid rod of length 1.00 *m*. The angle made by the rod with track is

(a) Zero (b) 30° (c) $45^0$ (d) 60°

80. A particle of mass m is moving in a circular path of constant radius r such that its centripetal acceleration $a_c$, is varying with time *t* as, a, $a_c = k^2rt^2$. The power delivered to the particle by the forces acting on it is

(a) $2\pi mk^2r^2t$ (b) $mk^2r^2t$ (c) $\frac{mk^4r^2t^5}{3}$ (d) *Zero*

81. A string of length L is fixed at one end and carries a mass *M* at the other end. The string makes $2/\pi$ revolutions per *second* around the vertical axis through the fixed end as shown in the figure, then tension in the string is




(a) *ML*
(b) 2 *ML*
(c) 4 *ML*
(d) 16 *ML*

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

(a) 20*m/sec* (b) $10\sqrt{3}m/\sec$ (c) $5\sqrt{2}m/\sec$ (d) 10*m/sec*

Scanned with CamScanner