PHYSICS

BOOKS - CP SINGH PHYSICS (HINGLISH)

CIRCULAR MOTION

Example

1. A pariticle is moving in a circle of radius $12m$. At an instant its speed is $6m/s$ and the

speed is increasing at the rate $4m/s^2$. Find the acceleration of the particle.

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2. A particle is moving in a circle of radius R and its speed is given by $v = \lambda t^2$, where λ is a constant. Find (a) radial acceleration, (b) tangential acceleration, (c) resultant acceleration and (d) angle between acceleration and velocity.

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3. A point moves along an arc of a circle of radius R. Its velocity depends on the distance s covered as $v = \lambda\sqrt{s}$, where λ is a constant. Find the angle θ between the acceleration and velocity as a function of s.

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4. A point moves along a circle with a velocity $v = t/2$. Find the acceleration of the point at the moment when it has covered a quarter circle from the beginning of motion.

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5. A point moves with decleration along the circle of radius R so that at any moment of time its tangential and normal accelerations are equal in moduli. At the initial moment $t = 0$ the velocity of the point equals v_0. Find:

(a) the velocity of the point as a function of time and as a function of the distance covered

s_1,

(b) the total acceleration of the point as a function of velocity and the distance covered.

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6. The kinetic energy of a particle moving along a circle of radius R depends on the distance covered s as $K = \lambda s^2$, where λ is a constant. Find the force acting on the particle as a function of s.

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7. A paricle of mass m moves along a circle of radius R with a normal acceleration varying with time as $w_n = at^2$, where a is a constant. Find the time dependence of the power developed by all the forces acting on the particle, and the mean value of this power averaged over the first t seconds after the beginning of motion.

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8. A balloon starts rising from the surface of the earth with a verticle component of velocity v_0. The baloon gathes a horizontal velocity $v_x = \lambda_y$, where λ is a constant and y is the height from the surface of earth, due to a horizontaln wind. determine (a) the equation of trajectory and (b) the tangential, normal and total acceleration of the balloon as a function of y.

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9. A particle moves in a circle of radius $4m$ with a linear speed of $20m/s$. Find the angular speed.

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10. A ball is moving in a circle of radius $3m$. At a certain instant its angular speed is $2rad/s$ and the angular speed is increasing at $3rad/s^2$. Find the tangential and centripetal components of the acceleration of the ball and magnitude of acceleration.

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11. Find the acceleration of a particle placed on the surface of the earth at the equator due to earth's rotation. The diameter of erth =12800 km andit takes 24 hour for the earth to comlete one revolution about its axis.

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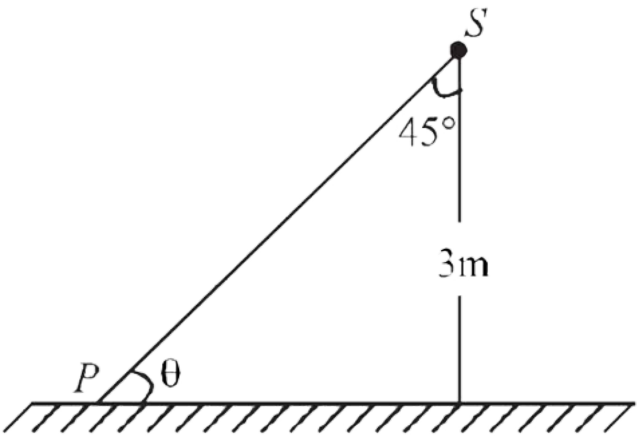
12. Spotlight S rotates in a horizontal plane with constant angular velocity of 0.1 radian

//second. $The spot of light$ p

$moves along the wall at a dis\tan ce of$ 3 m

. $The velocity of the spot$ p $when$ theta = 45(@)

$(see - fig.) is\ldots\ldots\ldots\ldots$ m//s `



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13. (a) Find the maximum speed at which a vehicle can turn round a curve of $20m$ radius on a level road, $\mu_s = 0.5$.

(b) A circular track of radius $100m$ is to be designed for vehicles at an average speed of $72km/h$. Find the angle of banking of the track.

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14. A train has to negotitate a curve of radius $2000m$. By how much should the outer rail be raised with respect to inner rail for a speed $72km/h$. The distance between the rails is $1m$

.

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15. A body of mass $200g$ tied to one end of string is revolved in a horizontal circle of radius $50cm$ with angular speed 60 revolution per minute (rpm) on a smooth horizontal surface. Find (a) linear speed, (b) the acceleration and (c) tension in the sting. what will happen if string is broken? (Take $\pi^2 = 10)$

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16. A particle of mass m is suspended from a ceiling through a string of length L. The particle moves in a horizontal circle of radius r. Find a. the speed of the particle and b. the tension in the string. Sch a system is called a conical pendulum.

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17. A string of length $50cm$ is fixed at one end and carries a mass of $200g$ at the other end. The string makes $5/2\pi$ revolution per second around the verticle axis through the fixed end. Calculate (a) the tension in the string (b) the angle of incilination of the string with verticle and (c) linear velocity of the mass.

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18. A coical pendulum consists of a string of length L whose upper end is fixed and another end is tied to a bob. The bob is moving in horizontal circle with constant angular speed ω such that the string makes a constant angle θ with the verticle. calculate time period T_0 of revolution of bob in terms of L, g and θ.

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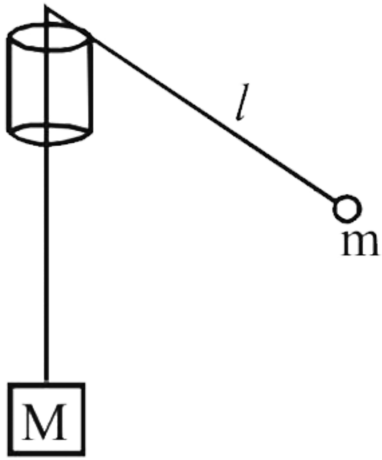
19. A large mass M and a small mass m hang at two ends of a string that passes over a smooth tube as shown in the figure. The mass m moves around a circular path which lies in a horizontal plane. The length of string from the mass m to the top of the tube is l and θ is the 'angle' this length makes with the vertical. What should be the frequency of rotation of mass m, so that the mass M remains stationary?



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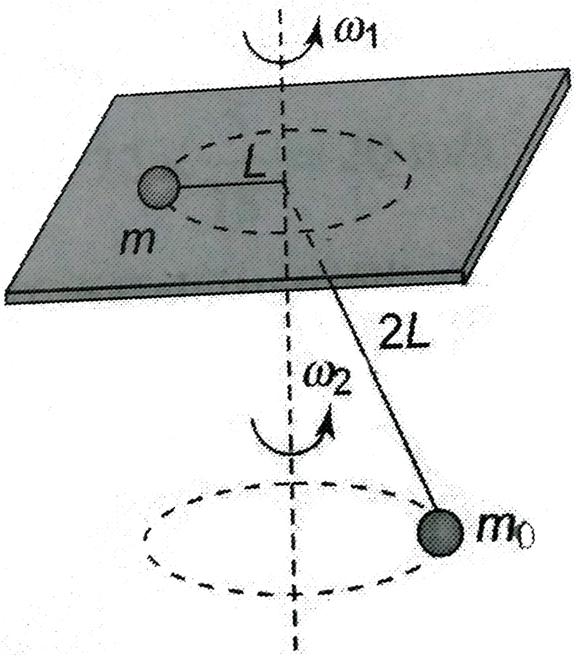
20. A particle of mass m is attacted to one end of string of length $3L$. The particle is on a smooth horizontal table. The string passes through a hole in the table and to its other end is attached to a small particle of mass m_0. The particle describe horizontal circular motion with angular velocity ω_1 and ω_2. find the value of (a) $\frac{\omega_1}{\omega_2}$ and (b) the value of $\left(\frac{1}{\omega_1^2}+\frac{1}{\omega_2^2}\right)$.



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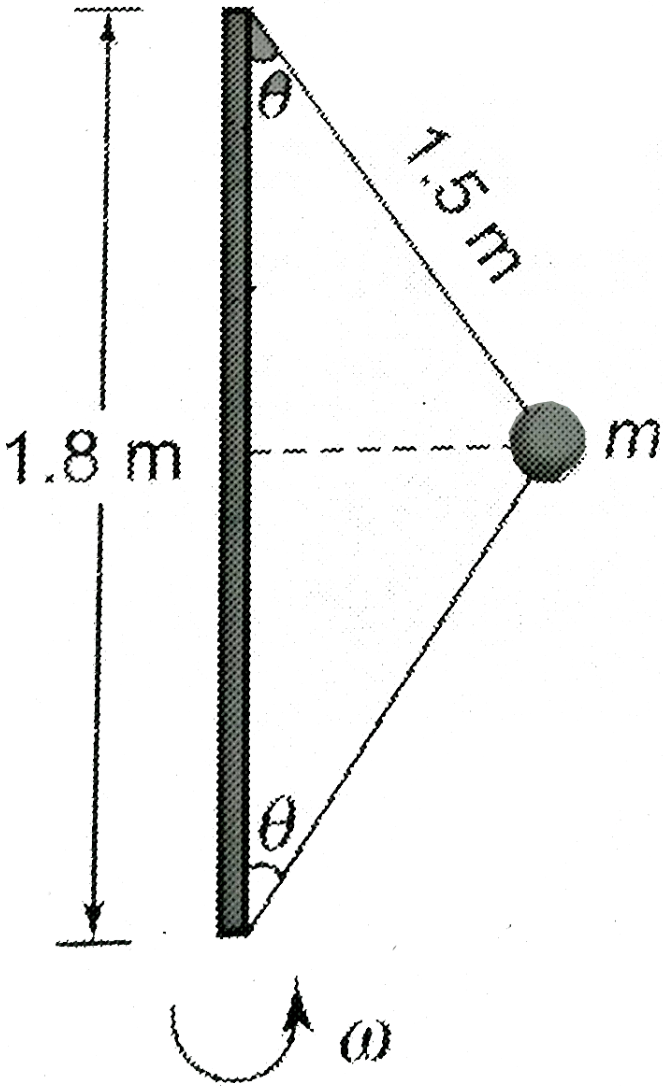
21. a ball of mass $240g$ is attached to the verticle rod by means of two strings. When the ball rotates about the axis of rod, the strings are extended as shown in the figure.

(a) find the angular speed of the ball if tension in lower string is $16N$.

(b) What is tension in the upper string?



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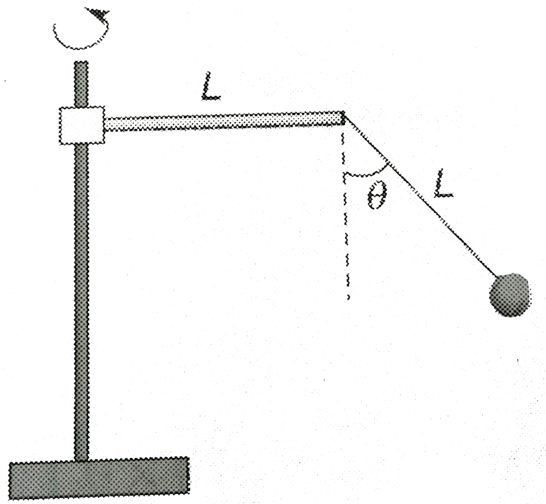
22. Consider the situation as shown in the figure. A rod of length $L = 2/27m$ pivodated near an end which is made to rotate in a horizontal plane with a constant angular speed. A ball is suspended bu a string also of length $2/27m$ from the other end of the rod. if the string makes $\theta = 53^\circ$ with vertical, find the angular speed of rotation.



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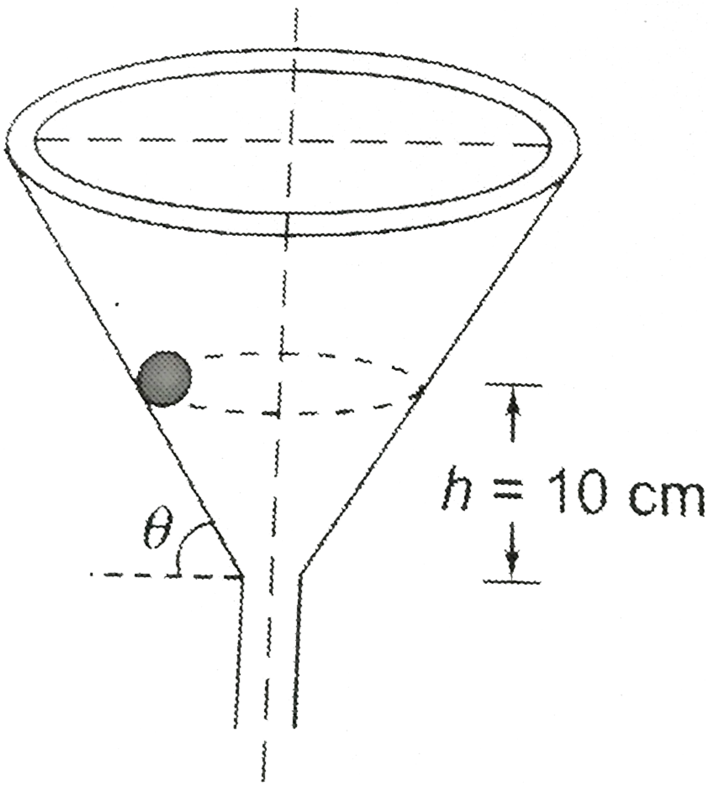
23. A particle describes a horizontal circle on smooth inner surface of a conical funnel as shown. If the height of the plane of the circle.

Above the vertax is $10cm$, find the speed of the

paricle.



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24. A hemispherical bowl of radius $R = 0.1m$ is rotating about its own axis (which is verticle) with an angular velocity ω. A particle of mass $10^{-2} kg$ on the smooth inner surface of the bowl is also rotating with the same ω. The particle is at a height h from the bottom of the bowl (a) obtain the relation betweemn h and ω. what is the minimum value of ω needed, in order to have a non-zero value of h ? (b) it is desired to measure g using this set up, by measuring h accurately. assuming that R and Ω are known precisely and least count in the measurement of h is $10^{-4}m$, what is the minimum possible error Δg in the measured value of g? $\left(g = 10m / s^2\right)$

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25. A small block of mass m moving on inside of the smooth hemisphere of radius R, describes a horizontal circle at a distance $R / 2$ below the centre of the sphere. Find the time period of revolution and force with which the block pushes against the hemisphere.

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26. One end of a light spring constant k and natural length l_0 is fixed and the other end is attached to a block of mass m lying on smooth horizontal surface. If the block is rotating in the horizontal circle of radius l, find the frequency of the revolution.

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27. Two blocks of mass $m_1 = 10kg$ and $m_2 = 5kg$ connected to each other by a massless inextensible string of length $0.3m$ are placed along a diameter of the turntable. The coefficient of friction between the table and m_1 is 0.5 while there is no friction between m_2 and the table. the table is rotating with an angular velocity of $10rad/s$. about a vertical axis passing through its center O. the masses are placed along the diameter of the table on either side of the center O such that the mass m_1 is at a distance of $0.124m$ from O. the masses are observed to be at a rest with respect to an observed on the tuntable $\left(g = 9.8m/s^2\right)$.

(a) Calculate the friction on m_1

(b) What should be the minimum angular speed of the turntable so that the masses will slip from this position?

(c) How should the masses be placed with the string remaining taut so that there is no friction on m_1.

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28. A hemispherical bowl of radius R is rotated about its axis of symmetry which is kept vertical.A small block is kept in the bowl at a position where the radius makes an angle θ with the vertical. The block rotates with the bowl without any slipping. The friction coefficient between the block and the bowl surface is μ. Find the range of the angular speed for which the block will not slip.

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29. A car goes on a horizontal circular road of radius R, the speed increasing at a constant rate $\frac{dv}{dt} = a$. The friction coefficient between the road and the tyre is μ. Find the speed at which the car will skid.

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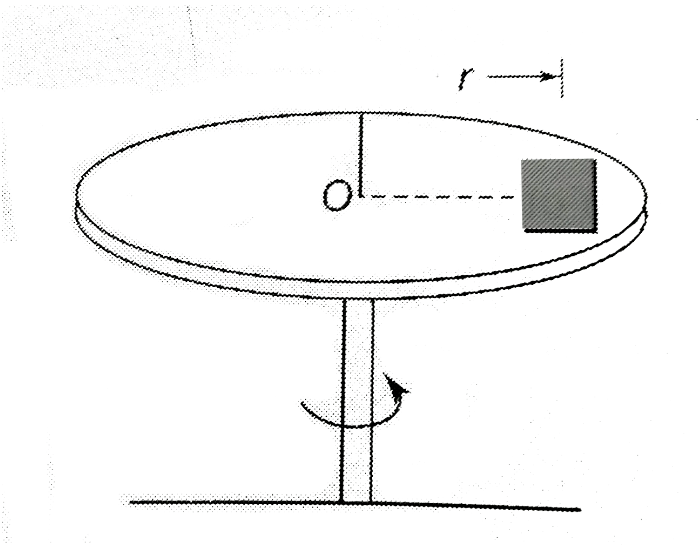
30. A body Is placed on a turntable. The friction coefficient between the body and the table is μ.

(a) If turntable rotates at constant angular speed ω, find the maximum value of ω for which the block will not slip.

(b) if the angular speed is increased uniformly from rest with an angular acceleration α, at what speed will the block slip?



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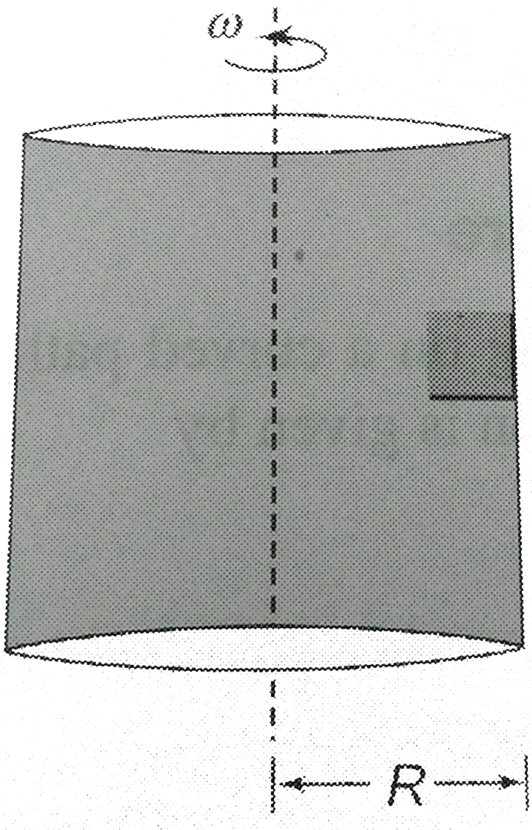
31. A block is rotating in contact with vertical wall (rotor) as shown. Find the minimum value of ω so that the block does not slide down.



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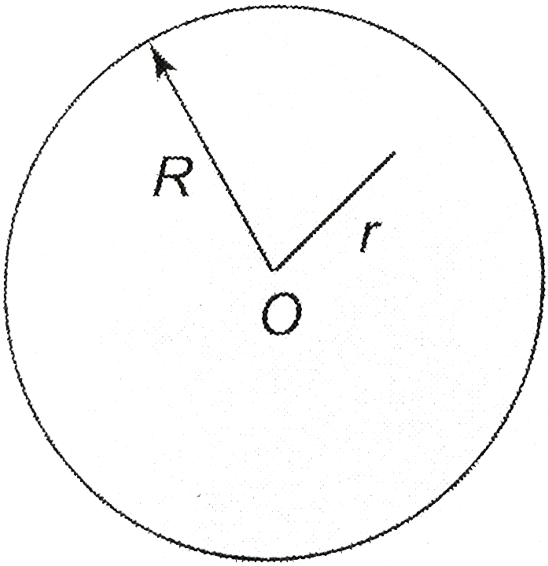
32. A cyclist rides along the circumference of a circular horizontal plane of radius R, with the friction coefficient $\mu = \mu_0\left(1 - \frac{r}{R}\right)$, where μ_0 is constant and r is distance from centre of plane O. Find the radius of the circle along which the cyclist can ride with the maximum velocity, what is this valocity?



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33. A ring of mass m and radius R is being rotated about its axis with constant angular velocity ω in the gravity free space. Find tension in the ring.

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34. Water of density p flows with a linear speed v through a horizontal rubber tube having the form of a ring of radius R. If the diameter of the tube is $d(< < R)$, find the tension in the rubber tube.

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35. A block of mass m moves on a horizontal circle against the wall of a cylindrical room of radius R. The floor of the room onwhich the block moves is smoth but the friction coefficient between the wall and the block is μ. The block is given an initial speed v_0. As a function of the speed v write a. the normal force by the wall on the block. b. thefrictional force by the wall and c. the tangential acceleration of the block. d. Integrate the tangential acceleration $\left(\frac{dv}{dt} = v\frac{dv}{ds}\right)$ to obtain the speed of the block after one revoluton.

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36. A glass filled with water is whirled in a verticle circle of radius R what can be the minimum speed at the top of the path if water does not fall out from glass? If the glass moves with this speed, find the normal contact force the glass exerts on water at the lowest point of the path?

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37. An aicraft loops the loop of radius $R = 3000m$ with a constant speed $v = 200m/s$. Find the weight of the flyer of mass $m = 60kg$ in the lower, upper and middle points of the loop.

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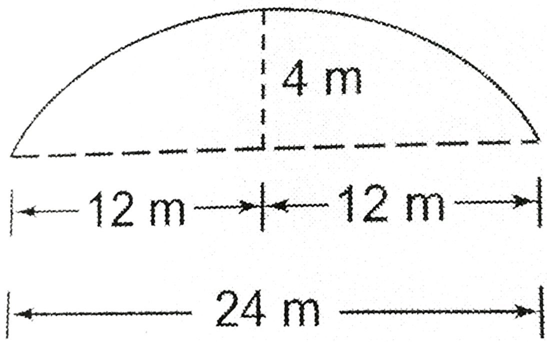
38. The middle point of a bridge, in the form of a circular arc on a canal of width $24m$ at

height $4m$ from either end. Find the maximum speed at which a car can safely pass over the bridge.



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39. A motorcycle has to move with a constant speed on an overbridge which is in the form of a circular arc of radius R and has a total length L. Suppose the motorcycle starts from the highest point.

a. what can its maximum velocity be for which the contact with the road is not broken at the highest point?

b. If the motorcycle goes at speed $\frac{1}{\sqrt{2}}$ times the maximum found in part a. where will it lose the contact with the road?

c. What maximum uniform speed can it maintain on the bridge if it does not lose contact anywhere on the bridge?

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40. The bob of a pendulum at rest is given a sharp hit to impat a horizontal velocity $\sqrt{10gl}$ where l is the length of the pendulum. Find the tension in the string when a. the string is horizontal. B. The bob is at its highest point and c. the string makes an angle of 60^0 with teh upward vertical.

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41. A ball of mass m is attached to a fixed point by a light inextensible string describe a circle in a verticle plane. The tension in the string has the values αmg and βmg, respectively, when the particle is at the highest and the lowest point in the path. find the relation between α and β.

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42. A stone of mass m tied to a light inextensible sting of length $L\left(=\frac{10}{3}m\right)$ is whirling in a circular path of radius L in a verticle plane. If the ratio of the maximum to the minimum tension is four, find the speed of the stone at the highest point of the circle.

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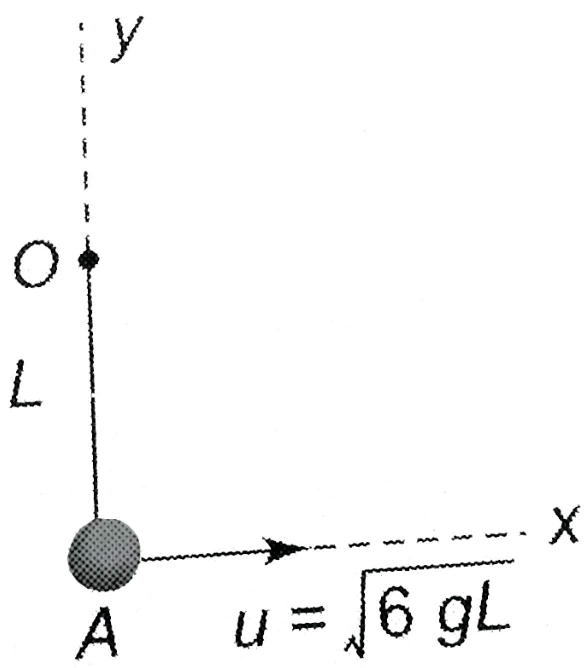
43. Consider the situation as shown in the figure. The ball attached to a string is moving

in the verticle circle find the (a) centripetal acceleration and (b) tanfential acceleration when the string makes an anhle 60° with lower vertical. Also, express the total acceleration in vector from taking A as origin.



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44. A 40 kg mass, hanging at the end of a rope of length l, oscillates in a vertical plane with an angular amplitude θ_0. What is the tension in the rope when it makes en angle θ with the vertical ? If the breaking strength of the rope is 80 kg, what is the maximum amplitude with which the mass can oscillate without the rope breaking?

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45. A ball suspended by a thread swing in a vertical plane that its acceleration values in the lowest possition and the extreme postition are equal . Find the thread deffection angle in the extreme possition.

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46. a small sphere of mass m susopended by a thread is first taken aside so that the thread forms the right angle with the verticle and then realease. (a) find the total acceleration of the sphere and the thread tension as a function of θ, the angle of deflection of the thread from the vertical. (b) Find the angle θ between the thread and the vertical. at the moment when the total acceleration vector of the sphere is directed (i) horizontally (ii)vertically upward and (iii) vertically downward.

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47. A simple pendulum consists of a ball of mass m connected to a string of length L. The ball is pulled aside so that the string makes an angle of 53° with the verticle and is released. Find the ratio of the minumum and the tension in the string.

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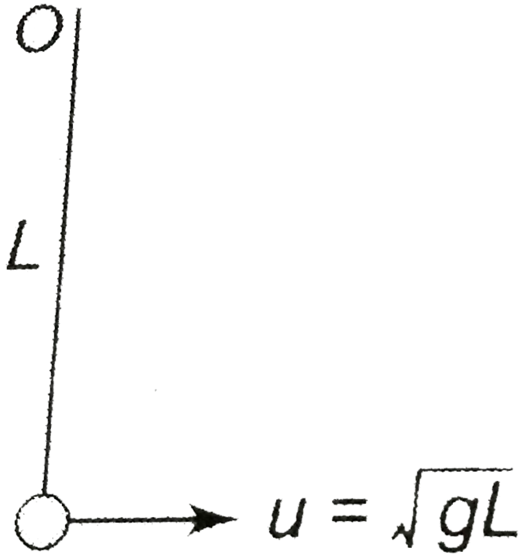
48. Consider the situation as shown in the figure. Find $\frac{T_{\min}}{T_{\max}}$.



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49. The bob of a simple pendulum is given a sharp hit impart it a horizontal speed of $\sqrt{3gL}$. Find an angle made by the string with the upper verticle before it becomes slack. Also, calculate the maximum height attained by the bob above the point of suspension. L is length of the string.

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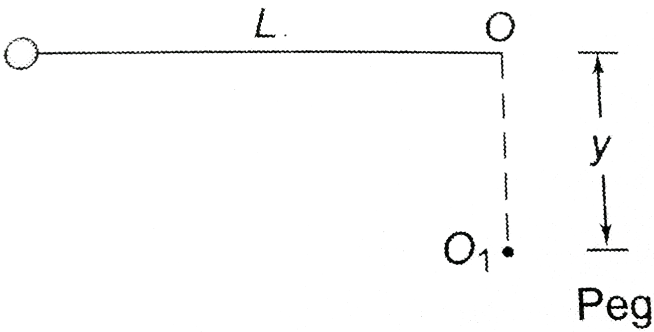
50. A simple pendulum of length L having a bob of mass m is first taken aside so that the string forms the tight angle with the verticle and then released. The string hits a peg which is fixed at a distance below the point of suspension and the bob starts going in a circle centered at the peg. find the minimum value of y for which the bob goes in a complete circle about the peg.



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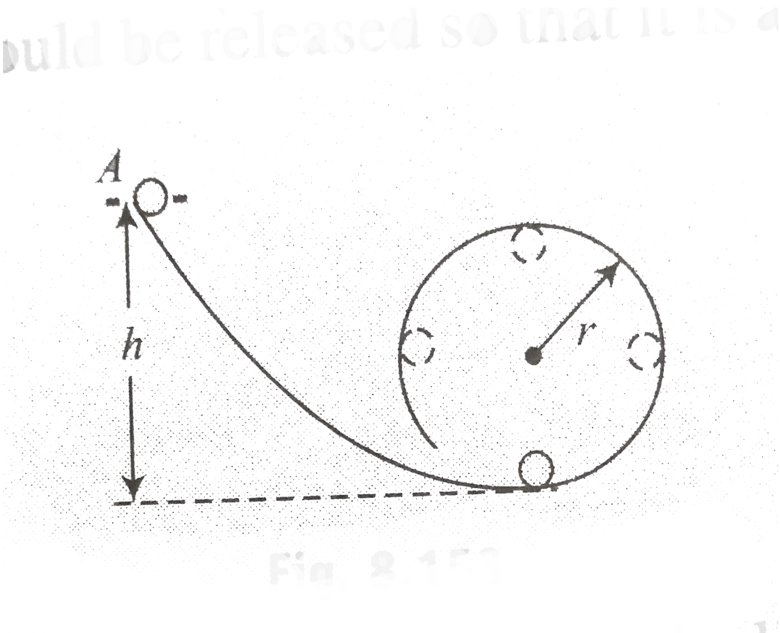
51. A block is released from rest at the top of an inclined plane which later curves into a circular track of radius r as shown in figure. Find the minimum height h from where it should be released so that it is able to complete the circle.



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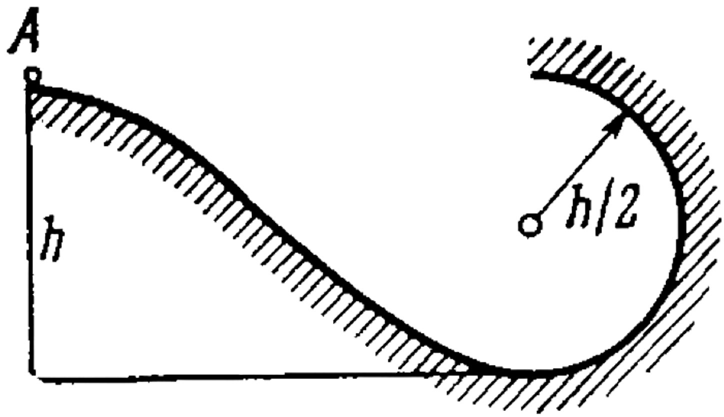
52. A small body A starts sliding from the height h down an inclined groove passing into a half-circle of radius $h/2$ (figure).



Assuming the friction to be negligible, find the velocity of the body at the highest point of its trajectory (after breaking off the groove).

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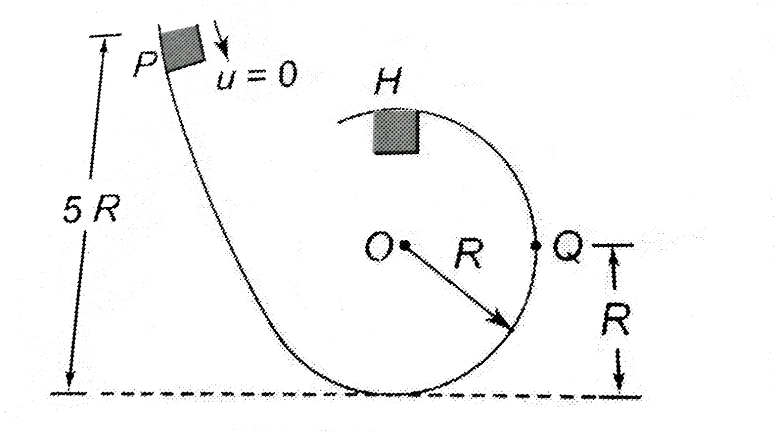
53. A small block of mass m slides along a smooth frictionless track as shown.

(a) If it starts from rest at P, what is the resultant force acting on it at Q?

(b) At what height above the bottom should the block be released so that the force it exerts against the track at the top of the loop equals its weight?



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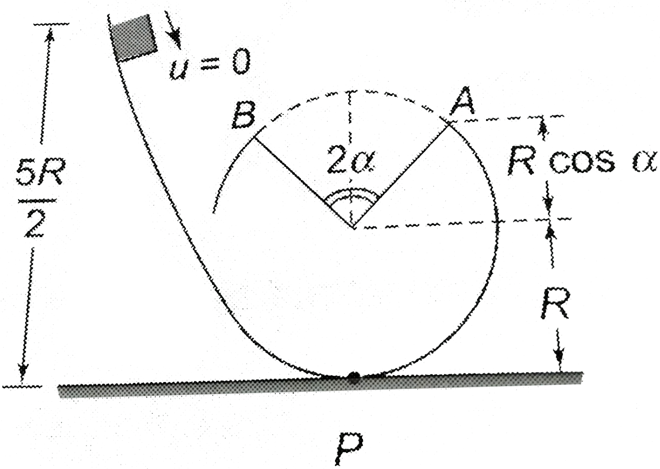
54. A small object slides without friction from the height $5R/2$ and then loops of the verticle loop of radius R from which a symmetrical section of angle 2α has been removed. Find angle α such that after losing contact at A and flying through the air, the object will reach point B.



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55. A particle is released from the top of a smooth hemisphere.find the angle rotated by the radius through the particle, when it loses contract with the hemisphere. Also sketch variation of normal contact force with $\cos\theta$, where θ is an angle rotated by the radius through the particle.

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56. A particle of mass m is released from the top of a smooth hemisphere of radius R with the horizontal speed μ. Calculate the angle with verticle where it loses contact with the hemisphere.

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57. A particle of mass m is released on a fixed. Smooth sphere of radius R at a position, where the radius through the particle makes an angle of α with the verticle. What is the angle made by radius through the particle when the particle loses contact with sphere? $(\cos\alpha = 3/4)$

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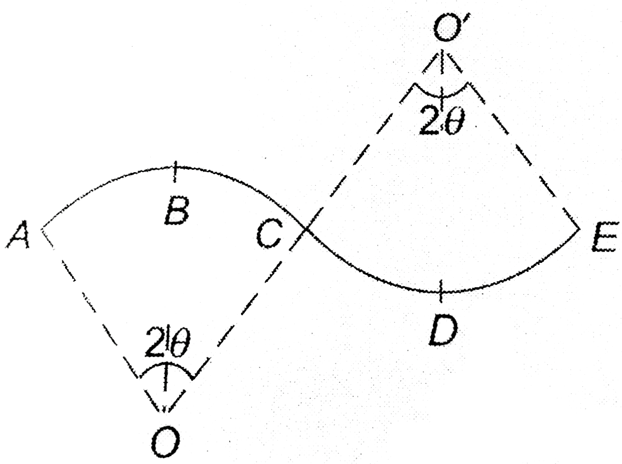
58. A track consists of two circular parts ABC and CDE of equal radius R and joined smoothly as shown. Each part subtends an angle 2θ at center. A vehicle of mass m travels with constant force by the road on the vehicle when it is at (i) B (ii) D (iii) just before C and (iv) just after C. (b) find the friction by the track on the vehicle when it is at B, C and D. (c) what should be the minimum friction coefficient between the road and the vehicle, which will ensure that cyclist can move with constant speed.



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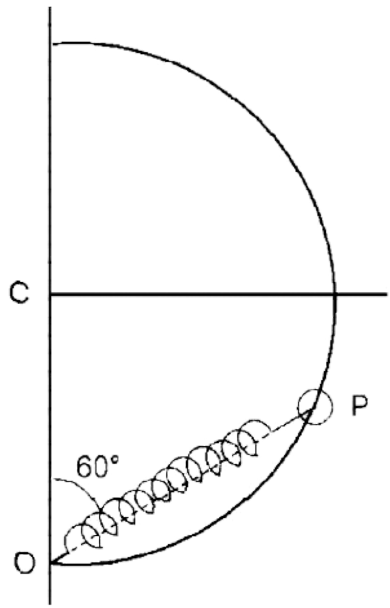
59. A smooth semicircular wire-track of radius R is fixed in a vertical plane. One end of a massless spring of natural length $3R/4$ is attached to the lowest point O of the wire-track. A small ring of mass m, which can slide on the track, is attached to the other end of the spring. The ring is held staionary at point P such that the spring makes an angle of 60° with the vertical. The spring constant $K = mg/R$. Consider the instant when the ring is released, and (i) draw the free body diagram of the ring, (ii) determine the tangential acceleration of the ring and the normal reaction.



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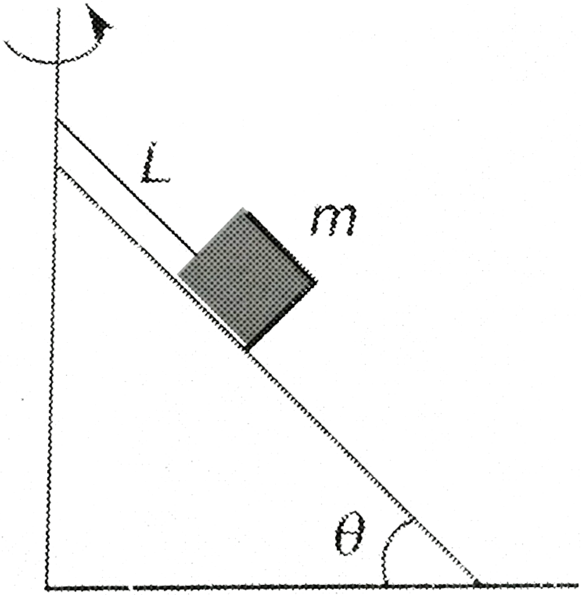
60. A small block of mass m is tied to the top of a smooth inclined plane with the help of a string of length L as shown in the figure. The inclined plane of inclination θ with horizontal is rotated with an angular velocity ω about a verticle axis passing through the end of the string fixed to the plane.

(a) Find the maximum value of ω so that the block maintains contact with the inclined plane.

(b) Find the ratio of the tension in the string and the normal reaction between the block and the plane.



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61. A table with smooth horizontal surface is placed in a cabin which moves in a circle of a large radius R Figure. A smooth pulley of small radius is fastened to the table. Two masses m and 2m placed on te tableare connected through a string going over the pulley. Initially the masses are held by a personwith the strings aslong teh outward radius and then the system is released from rest (with respect to the cabin). Find the magnitude of the initial acceleration of the mases as seen from the cabin and the tension in the starting.

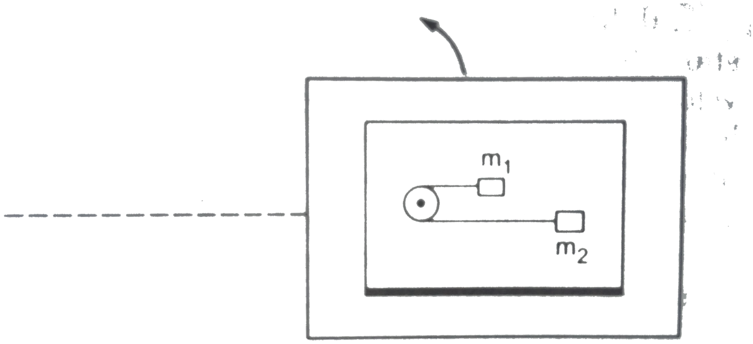

Figure 7-E5

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62. A tube of length L is filled completely with an incomeressible 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

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63. A rod of length L is pivoted at one end and is rotated with as uniform angular velocity in a horizontal plane. Let T_1 and T_2 be the tensions at the points L//4 and 3L//4 away from the pivoted ends.

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64. A uniform chain of mass m and length $l < \frac{\pi R}{2}$ is placed on a smooth hemisphere of radius R with on of its ends fixed at the top of the sphere.

(a) Find the gravitational potential energy of chain assuming base of hemisphere as reference.

(b) what will be the tangential acceleraion of the chain when it starts sliding down.

(c) If the chain slides down the sphere, find the kinetic energy of the chain when it has slipped through an angle β.

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Exercise

1. A particle revolves round a circular path with a constant speed.

(i) the velecity of the particle is along the tangent.

(ii) the acceleration of the particle of the particle is always towards center.

(iii) the magnetic of acceleration is constant.

(iv) The work done by the centripetal force is always zero.

A. $(i), (ii)$

B. $(i), (ii), (iii)$

C. $(ii), (iii), (iv)$

D. All options are correct

Answer: D

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2. A particle of mass m moves in a circle of radius R with a uniform speed v.

(i) the angular speed of particle is v / R.

(ii) the time period of revolution is $2\pi R / v$.

(iii) the acceleration of particle is v^2 / R.

(iv) the work done by the centripetal force in half revolution is $\left(mv^2 / R\right) \times \pi R$.

A. $(i), (ii)$

B. $(ii), (iii)$

C. $(ii), (ii), (iii)$

D. All options are correct

Answer: C

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3. 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. $15m/s^2$

C. $25m/s^2$

D. $36m/s^2$

Answer: A

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4. A body is whirled in a horizontal circle of radius $20cm$. It has an angular velocity of $10rad/s$. What is its linear velocity at any point on the circular path

A. $10m / s$

B. $2m / s$

C. $20m / s$

D. $\sqrt{2}m / s$

Answer: B

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5. A particle moves in a circular orbit under the action of a central attractive force inversely proportional to the distance r. The speed of the particle is

A. propotional to r^2

B. independent of r

C. propotional to r

D. propotional to $1/r$

Answer: B

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6. If a body moves with a constant speed in a circle

A. no work is done on it

B. no force acts on it

C. no acceleration is produced in it

D. its velocity remains constant

Answer: A

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7. A car runs at a constant speed on a circular track of radius 100m, taking 62.8s for every circular loop. The average velocity and average speed for each circular loop respectively is:

A. $10m/s, 10m/s$

B. $10m/s, 0$

C. $0, 0$

D. $0, 10m/s$

Answer: D

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8. The second's hand of a watch has length $3cm.$ The speed of the end point and magnitude of change in velocity at two perpendicular positions will be

A. $\frac{\pi}{10}$ and $\frac{\pi}{5} cm / s$

B. $\frac{\pi}{5}$ and $\sqrt{2}\pi \frac{)}{5} cm / s$

C. $\frac{\pi}{10}$ and $\frac{\pi}{5\sqrt{2}} cm / s$

D. $\frac{\pi}{5\sqrt{2} \text{ and } \frac{\pi}{5} cm / s}$

Answer: C

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9. For a particle in uniform circular motion , the acceleration $\overrightarrow{a}$ at a point $p(R, \theta)$ on the circle of radiu R is (Here θ is measured from the $x - a\xi s$)

A. $\frac{v^2}{R}\overrightarrow{i} + \frac{v^2}{R}\overrightarrow{j}$

B. $-\frac{v^2}{R}\cos\theta\overrightarrow{i} + \frac{v^2}{R}\sin\theta\overrightarrow{j}$

C. $-\frac{v^2}{R}\sin\theta\overrightarrow{i} + \frac{v^2}{R}\cos\theta\overrightarrow{j}$

D. $-\frac{v^2}{R}\cos\theta\overrightarrow{i} - \frac{v^2}{R}\sin\theta\overrightarrow{j}$

Answer: D

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10. What is the value of linear velocity, if $\vec{\omega} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{r} = \hat{i} + 2\hat{j} + 3\hat{k}$

A. $-5\vec{j} - 2\vec{j} + 3\vec{k}$

B. $2\vec{i} - 5\vec{j} + 3\vec{k}$

C. $6\vec{i} - 2\vec{j} + 3\vec{k}$

D. $3\vec{i} - 2\vec{j} + 5\vec{k}$

Answer: A

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

A. $-\left(8m/s^2\right)\overrightarrow{j}$

B. $-\left(8m/s^2\right)\overrightarrow{i}$

C. $-\left(4m/s^2\right)\overrightarrow{j}$

D. $-\left(4m/s^2\right)\overrightarrow{i}$

Answer: B

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12. An electric fan has blades of length $30cm$ as measured from the axis of rotation. If the fan is rotating at $1200r\pm$, find the acceleration of a point on the tip of a blade.

A. $1600m / s^2$

B. $4740m / s^2$

C. $2370m / s^2$

D. $5055m / s^2$

Answer: B

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13. Two bodies of mass $10kg$ and $5kg$ moving in concentric orbits of radii R and r such that their periods are the same. Then the ratio between their centipetal acceleration is

A. R / r

B. r / R

C. R^2 / r^2

D. r^2 / R^2

Answer: A

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14. Two cars of mass m_1 and m_2 are moving in circle 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. $m_1 r_1 : m_2 r_2$

B. $m_1 : m_2$

C. $r_1 : r_2$

D. $1 : 1$

Answer: C

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15. A particle is kept fixed on as turntable rotating uniformly. As seen from the ground the particle goes in a circle,its speed is 20 cm/s and acceleration is 20 cm/s^2 The particle is now shifted to a new positon to make the radius half of the original value. The new values of the speed and acceleration will be

A. $10cm/s, 10cm/s^2$

B. $10cm / s, 80cm / s^2$

C. $40cm / s, 10cm / s^2$

D. $40cm / s, 40cm / s^2$

Answer: A

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16. A particle is acted upon by a force of constant magnitude which is always perpendiculr to the velocity of the particle.

The motion of the particle takes place in a plane. It follows that

A. its velocity is constant

B. its acceleration is constant

C. its kinetic energy is constant

D. it moves in a straight line

Answer: C

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17. The position vector of a particle in a circular motion about the origin sweeps out equal area in equal time. Its

A. $(i), (ii)$

B. $(ii), (iiI)$

C. $(iii), (iv)$

D. $(ii), (iv)$

Answer: D

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18. Which of the following quantities may remain constant during the motion of an object along a curved path ?

(i) Velocity

(ii) Speed

(iii) Acceleration

(iv) Magnitude of acceleration

A. $(i), (ii)$

B. $(ii), (iii)$

C. $(i), (iv)$

D. $(ii), (iv)$

Answer: C

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19. When a body is acclerated : (i) its velocity always changes (ii) its speed always changes (iii) its direction always changes (iv) its speed may or may not change.

Which of the following is correct ?

A. $(i), (ii)$

B. $(i), (iv)$

C. $(ii), (ii)$

D. $(ii), (iii)$

Answer: B

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20. Which of the following statements is FALSE for a paricle moving in a circle with a constant angular sppeed?

A. The velocity vector is tangnet to the circle.

B. The acceleration vector is tangnet to the circle.

C. the acceleration vector points to the center of the circle.

D. the velocity and acceleration vectors are perpendicular to each other.

Answer: A

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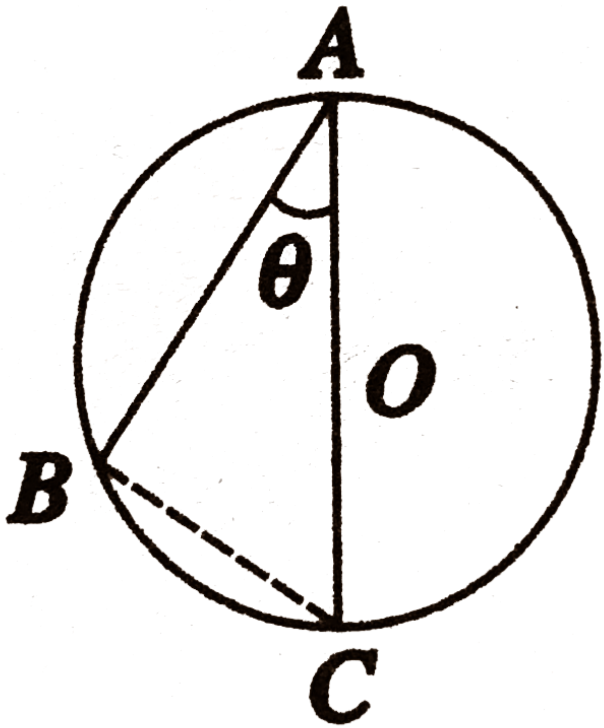
21. A bead is free to slide down on a smooth wire rightly stretched between points A and B on a vertical circle of radius $10m$. Find the time taken by the bead to reach point B, if the bead slides from rest from the highest point A on the circle.



A. $\dfrac{2\sqrt{gR}}{g\cos\theta}$

B. $2\sqrt{gR}.\ \dfrac{\cos\theta}{g}$

C. $2\dfrac{\sqrt{R}}{(g)}$

D. $\dfrac{gR}{\sqrt{g\cos\theta}}$

Answer: C

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22. A car is negotisting a curved road of radius R . The road is banked at an angle theta. The coefficient of friction between the tyres of the car and the road is μ_s . The maximum safe velocity on this road is:

A. μRg

B. $2\mu Rg$

C. $(\mu Rg)^{1/2}$

D. $(2\mu rg)^{1/2}$

Answer: C

Watch Video Solution

23. A gramphone record is revolving with an angular velocity omega. A coin is placed at a distance r from the centre of the record. The static coefficient of friction is mu. The coin will revolve with the record if.

A. $r \geq \frac{\mu g}{\omega^2}$

B. $r = \mu g \omega^2$

C. $r < \frac{\omega^2}{\mu g}$

D. $r \leq \frac{\mu g}{\omega^2}$

Answer: D

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24. A coin, placed on a rotating turntable slips, when it is placed at a distance of $9cm$ from the center. If the angular velocity of the turnable is tripled, it will just slip, If its distance from the center is

A. $27cm$

B. $9cm$

C. $3cm$

D. $1cm$

Answer: D

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

A. $\theta = \tan^{-1}\left(\frac{v^2}{rg}\right)$

B. $\theta = \tan^{-1}\left(\frac{v}{rg}\right)$

C. $\theta = \tan^{-1}\left(\frac{r^2}{rg}\right)$

D. $\theta = \tan^{-1}\left(\frac{v^2}{2rg}\right)$

Answer: A

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26. A car of mass $1000kg$ negotiates a banked curve of radius $90m$ on a fictionless road. If the banking angle is 45° the speed of the car is:

A. $20m/s$

B. $30m/s$

C. $5m/s$

D. $10m/s$

Answer: B

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27. The radius of the curved road on a national highway is R. The width of the road is b. The outer edge of the road is raised by h with respect to the inner edge so that a car with velocity v can pass safe over it. The value of h is

A. $\frac{v^2 b}{Rg}$

B. $\frac{v}{Rgb}$

C. $\frac{v^2 R}{g}$

D. $\frac{v^2 b}{R}$

Answer: A

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28. Keeping the angle of banking, if the radius of curvature is made four times, the percentage increase in the maximum speed with which a vehicle can travel on a circular road is

A. 25%

B. 50%

C. 75%

D. 100%

Answer: D

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29. A car is moving in a circular horizonta track of radius 10m with a constant speed of 10 m/s. A pendulum bob is suspended from the roof of the cat by a light rigid rod of length 1.00m. The angle made by the rod with track is

A. $zero$

B. 30°

C. 45°

D. 60°

Answer: C

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30. A particle of mass m is fixed to one end of a massless spring of spring constant k and natural length l_0. The system is rotated about the other end of the spring with an angular velocity ω ub gravity-free space. The final length of spring is

A. $\dfrac{m\omega^2 l_0}{k}$

B. $\dfrac{m\omega^2 l_0}{k - m\omega^2}$

C. $\dfrac{k l_0}{k - m\omega^2}$

D. $\dfrac{m\omega^2 l_0}{k + m\omega^2}$

Answer: C

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31. A hollow cylinder of radius R rotates about its axis which is vertical. A block remains in contact with the inner wall if the frequency of rotation is f hertz, but falls at lower frequaencies. The coefficient of friction between the block and the cylinder is

A. $\dfrac{g}{2\pi^2 f^2 R}$

B. $\dfrac{g}{4\pi^2 f^2 R}$

C. $\dfrac{g}{\pi^2 R}$

D. $\dfrac{2g}{\pi^2 f^2 R}$

Answer: B

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32. A ball of mass $0.25kg$ attached to the end of a string of length $1.96m$ moving in a horizontal circle. The string will break if the tension is more than $25N$. What is the maximum speed with which the ball can be moved.

A. $14m/s$

B. $3m/s$

C. $3.92m/s$

D. $5m/s$

Answer: A

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33. A ball of mass $500g$ tied to one end of string is revolved in a horizontal circle of radius $10cm$ with a speed $1/\pi rev/s$ in gravity-free space, then the linear velocity, acceleration and tension in the string will be

A. $0.1m/s, 0.4m/s^2, 0.2N$

B. $0.1m/s, 04m/s^2, 0.1N$

C. $0.2m/s, 0.4m/s^2, 0.2N$

D. $0.2m/s, 0.3m/s^2, 0.2N$

Answer: C

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34. A mass is supported on a frictionless horizontal surface. It Is attached to a string and rotates about a fixed center at an angular velocity ω_0.If the length of the string and angular velocity both are doubled, the tension in the string which was initially T_0 is now

A. T_0

B. $T_0 / 2$

C. $4T_0$

D. $8T_0$

Answer: D

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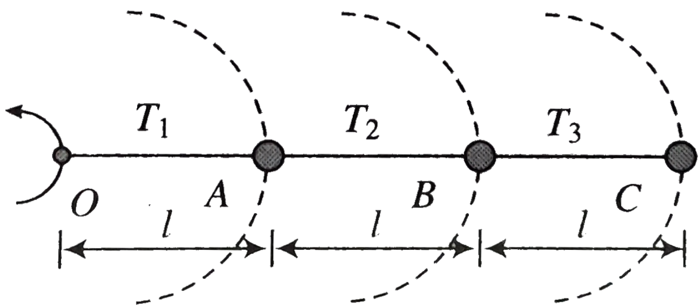
35. Three identical particles are joined together by a thread as shown in figure All the partical are moving in a horizontal plane If the vertical of the outermost particle is v_0 then the ratio of tension in the three sections of the string $(T_1 : T_2 : T_3 = ?)$ is



A. $3 : 5 : 6$

B. $3 : 4 : 5$

C. $6 : 9 : 10$

D. $7 : 6 : 11$

Answer: C

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36. A stone of mass m tied to a string of length l is rotated in a circle with the other end of the string as the centre. The speed of the stone is v. If the string breaks, the stone will move

A. towards the center

B. away from the center

C. along a tangent

D. willo stop

Answer: C

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37. A stone is moved in a horizontal circle of radius $4m$ by means of a string at a height of $20m$ above the ground the string breaks and the particle files off horizontally, striking the ground $10m$ away. The centripetal acceleration during circular motion is

A. $6.25m/s^2$

B. $12.5m/s^2$

C. $18.75m/s^2$

D. $25m/s^2$

Answer: A

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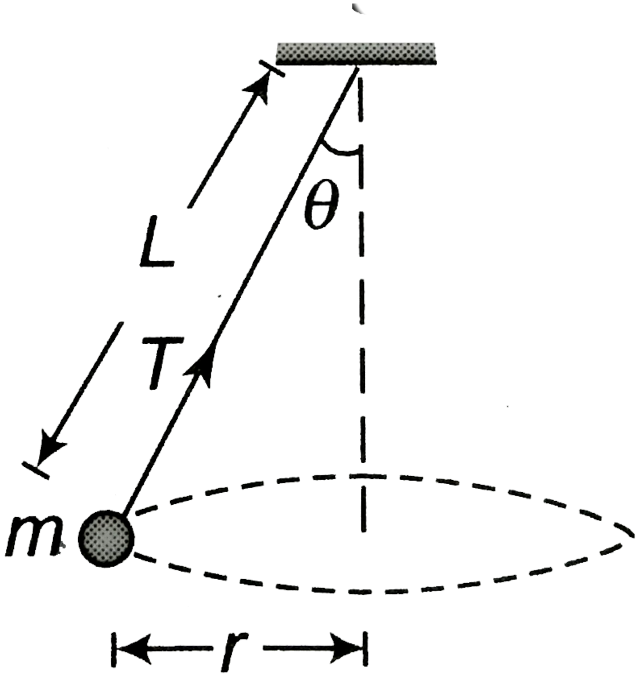
38. A paricle of mass m is tied to a light string of length L and moving in a horizontal circle of radius r with speed v as shown. The forces acting on the particle are



A. mg and T

B. $mg, T, \frac{mv^2}{r}$ directed in wards

C. $mg, T, \frac{mv^2}{r}$ directed outewards

D. $\frac{mv^2}{r}$ only

Answer: A

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39. In the previous problem if t is the time period of rotation

(i) $t = 2\pi\sqrt{\frac{L}{g}}$

(ii) $t = 2\pi\sqrt{\frac{L\cos\theta}{g}}$

(iii) $T = \frac{4\pi^2 mL}{t^2}$

(iv) The ball is in equilibrium

A. $(i), (ii)$

B. $(ii), (iii)$

C. $(i), (iv)$

D. $(ii), (iv)$

Answer: B

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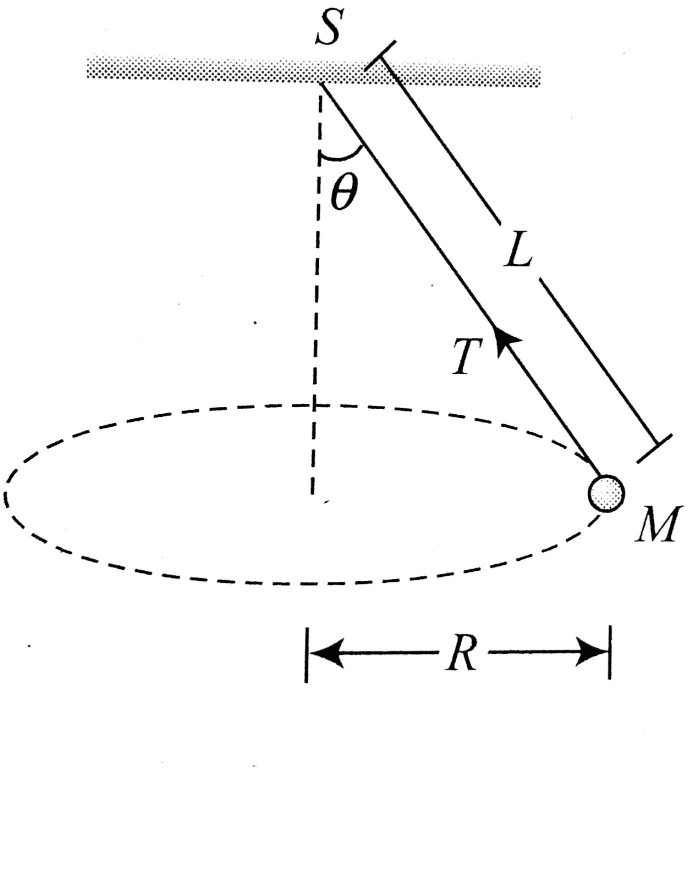
40. A string of length L is fixed at one end and carries a mass M at the other end. The string makes $2/\pi$ revolution per second around the vertical axis through the fixed end as shown in the figure, then tension in the string is.



A. ML

B. $2ML$

C. $4ML$

D. $16ML$

Answer: D

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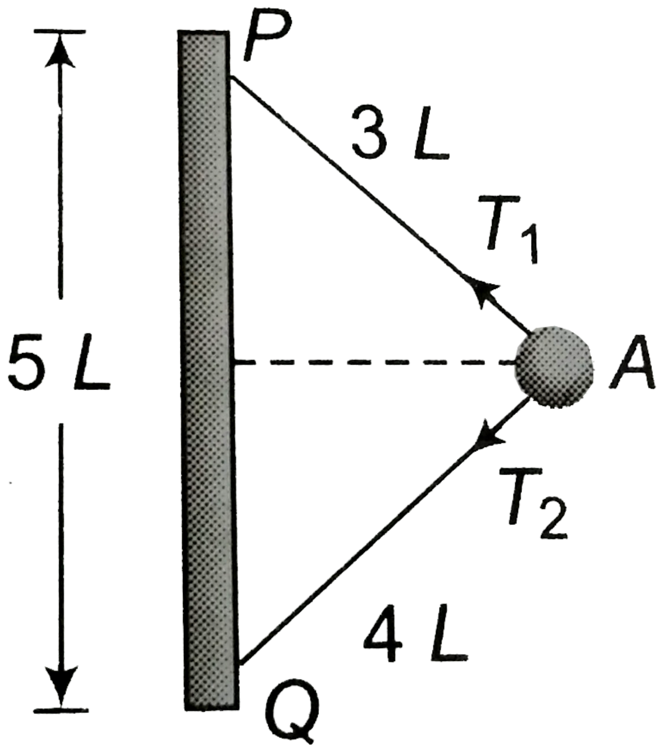
41. A particle A of mass m is attached to a vertical axis by two stings PA and QA of lengths $3L$ and $4L$, respectively. $PQ = 5L$. A rotates around the axis with an angular speed ω. The tension in the two strings are T_1 and T_2

.



(i) $T_1 = T_2$

(ii) $3T_1 - 4T_2 = 5mg$

(iii) $4T_1 + 3T_2 = 12m\omega^2 L$

A. (i)only

B. $(i), (ii)$

C. $(i), (iii)$

D. $(ii), (iii)$

Answer: D

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42. A tube of length L is filled completely with an incomeressible 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

A. $\frac{1}{2}M\omega^2L^2$

B. $M\omega^2L$

C. $\frac{1}{4}M\omega^2L$

D. $\frac{1}{2}M\omega^2L$

Answer: D

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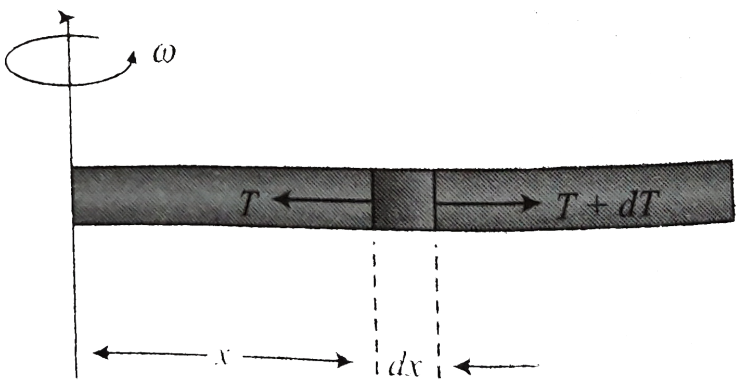
43. A thin uniform rod of length l and masses m rotates uniformly with an angularly velocity ω in a horizontal plane about a verticle axis passing through one of its ends determine the tension in the rot as a funtion of the distance x from the rotation axis



A. $\frac{1}{2}m\omega^2 x$

B. $\frac{1}{2}m\omega^2\left(\frac{x^2}{L}\right)$

C. $\frac{1}{2}m\omega^2 L\left(1-\frac{x}{L}\right)$

D. $\frac{1}{2}\frac{m\omega^2}{L}\left(L^2-x^2\right)$

Answer: D

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44. A rod of length L is pivoted at one end and is rotated with as uniform angular velocity in a horizontal plane. Let T_1 and T_2 be the tensions at the points L//4 and 3L//4 away from the pivoted ends.

A. $T_1 > T_2$

B. $T_2 > T_1$

C. $T_1 = T_2$

D. the realation between T_1 and T_2 depends on wheather the rod rotates clockwise or anticlockwise

Answer: A

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45. A ring of mass m and radius R is being rotated about its axis with constant angular velocity ω in the gravity free space. Find tension in the ring.

A. $zero$

B. $\frac{1}{2}m\omega^2r^2$

C. $m\omega^2r^2$

D. $mr\omega^2$

Answer: C

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46. If a_r and a_t respresent radial and tangential acceleration, the motion of a particle will be circular is

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 $a_t \neq 0$

Answer: C

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47. A car is moving on a circular road of radius $100m$. At some instant its speed is $20m/s$ and is increasing at the rate of $3m/s^2$. The magnitude of its acceleration is

A. $2m/s^2$

B. $3m/s^2$

C. $5m/s^2$

D. $4m/s^2$

Answer: C

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48. A particle moves in a circle of radius $30cm$. Its linear speed is given by $v = 2t$, where t in second and v in m/s. Find out its radial and tangential acceleration at $t = 3s$.

A. $220\frac{m}{s^2}, 50m/s^2$

B. $100m/s^2, 5m/s^2$

C. $120m/s^2$

D. $110m/s^2, 10m/s^2$

Answer: C

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49. A point 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. Find the angle α between the vector of the total acceleration and the vector of velocity as a function of s.

A. $\tan^{-1}\left(\frac{s}{R}\right)$

B. $\tan^{-1}\left(\frac{2s}{R}\right)$

C. $\tan^{-1}\left(\frac{s}{2R}\right)$

D. $\tan^{-1}\left(\frac{R}{s}\right)$

Answer: B

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50. The kinetic energy K of a particle moving along a circle of radius R depends upon the distance s as $K = as^2$. The force acting on the particle is

A. $\frac{2as^2}{R}$

B. $2a\left[1+\left(\frac{s^2}{R^2}\right]^{1/2}s$

C. $2as$

D. $2a\left[\frac{R^2}{s}\right]^{1/2}$

Answer: B

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51. A particle of mass in is moving in a circular with of constant radius r such that its contripetal accelenation a_c is varying with time t as $a_c = K^2rt^2$ where K` is a constant . The power delivered to the particles by the force action on it is

A. $2\pi mk^2r^2t$

B. mk^2r^2t

C. $\frac{mk^4r^2t^5}{3}$

D. $zero$

Answer: B

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52. For a particle in a non-uniform accelerated circular motion:

(i) Velocity is radial and acceleration is transverse only

(ii) Velocity is transverse and acceleration is radial only

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

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

A. velocity is radial and accleration is transverse only

B. velocity is radial and acceleration is radial only

C. velocity is radial and acceleration has both radial and transverse components

D. velocity is transverse and acceleration has both radial and transverse and acceleration has radial and transverse components

Answer: D

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53. A body moves on a horizontal circular road of radius r, with a tangential acceleration a_t. The coefficient of friction between the body and the road surface Is μ. It begins to slip when its speed is v.

(i) $v^2 = \mu r g$

(ii) $\mu g = \left(\frac{v^4}{r92}\right) + a_t \Big)$

(iii) $\mu^2 g^2 = \Bigg(\frac{v^4}{r^2 + a_t^2}$

(iv) The force of friction makes an angle $\tan^{-1}\left(v^2 / a_t r\right)$ with the direction of motion at the point of slipping.

A. $(i), (ii)$

B. $(ii), (iii)$

C. $(i), (iv)$

D. $(iii), (iv)$

Answer: D

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54. A car of maas M is moving on a horizontal circular path of radius r. At an instant its speed is v and is increasing at a rate a.

A. $(i), (ii)$

B. $(ii), (iii)$

C. $(i), (iv)$

D. $(iii), (iv)$

Answer: B

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55. A circular road of radius r is banked for a speed v=40 km/hr. A car of mass m attempts to go on the circular road. The frIction coefficient between the tyre and the road is negligible.

A. $(i), (ii)$

B. $(ii), (iii)$

C. $(i), (iv)$

D. $(ii), (iv)$

Answer: D

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56. A curved section of a road is banked for a speed v. If there is no friction between the road and the tyres then.

A. a car moving with speed v will not slip on the road

B. a car is more likely to slip on the road at speeds higher than v, than at speeds lower than v

C. a car is more likely to slip on the road at speeds lower than v, than at speeds higer than v

D. a car can remain stationary on the road without slipping

Answer: A

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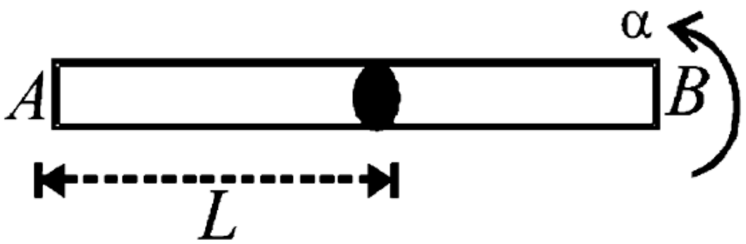
57. A long horizontal rod has a bead which can slide along its length and initially placed at a



distance L from one end A of the rod. The rod is set in angular motion about A with constant angular acceleration α. if the coefficient of friction between the rod and the bead is μ, and gravity is neglected, then the time after which the bead starts slipping is

A. $\sqrt{\frac{\mu}{\alpha}}$

B. $\frac{\mu}{\sqrt{\alpha}}$

C. $\frac{1}{\sqrt{\mu\alpha}}$

D. `infinitesimal

Answer: A

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

A. top of the circle

B. bottom of the circle

C. half way down

D. none of the above

Answer: A

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59. A body is moving in a verticle of radius r such that the string is just taut at its highest point.

(i) The speed of the body at the highest point is $\sqrt{gr}$

(ii) The speed of the body at the lowest point is $\sqrt{5gr}$

(iii) The speed of the body when the string is horizontal is $\sqrt{3gr}$

(iv) The tension in the string is maximum when the body is in the lowest position.

A. $(i), (ii)$

B. $(i), (ii), (iii)$

C. $(i), (ii), (iv)$

D. `all option are correct

Answer: D

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

A. $6g$

B. $3g$

C. $2g$

D. g

Answer: B

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61. In the previous problem, tension in the string at the lowest position of the body is

A. $3mg$

B. $4mg$

C. $5mg$

D. $6mg$

Answer: D

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62. A heavy mass is attached to a thin wire and is whirled in a vertical circle. The wire is most likely to break

A. when the mass is at the most likely to break

B. when the mass is at the lowest point of the circle

C. when the wire is horizontal

D. at an angle of $\cos^{-1}(1/3)$from the upward verticle

Answer: B

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63. A weightless thread can support tension up to $30N$. A particle of mass $0.5kg$ is tied to it and is revolved in a circle of radius $2m$ in a verticle plane. If $g = 10m/s^2$, then the maximum angular velocity of the stone will be

A. $5rad/s$

B. $\sqrt{30}rad/s$

C. $\sqrt{60} rad / s$

D. $10 rad / s$

Answer: A

Watch Video Solution

64. 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°

Answer: D

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65. If in the previous problem, the breaking strength of the string is $2mg$, then the minimum tension in the string will be

A. mg

B. $\frac{mg}{4}$

C. $\frac{3mg}{4}$

D. $\frac{mg}{2}$

Answer: D

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66. In a simple pendulum, the breaking strength of the string is double the weight of the bob. The bob is released from rest when the string is horizontal. The string breaks when it makes an angle θ with the vertical.

A. $\theta = \cos^{-1}(1/3)$

B. $\theta = 60^\circ$

C. $\theta = \cos^{-1}(2/3)$

D. $\theta = 0$

Answer: C

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67. A particle of maas m is attched to a light string of length l, the other end of which is fixed. Initially the string is kept horizontal and the particle is given an upwrd velocity v. The particle is just able to complete a circle

A. $(i), (ii)$

B. $(ii), (iii)$

C. $(i), (iv)$

D. (ii), (iv)

Answer: C

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68. A stone tied to a string of length L is whirled in a vertical circle with the other end of the string at the centre. At a certain instant of time the stone is at lowest position and has a speed u . Find the magnitude of the change in its velocity as it reaches a position, where the string is horizontal.

A. $\sqrt{\mu^2 - 2gL}$

B. $\sqrt{(2gl)}$

C. $\sqrt{u - gL}$

D. $\sqrt{2(u^2 - gL)}$

Answer: D

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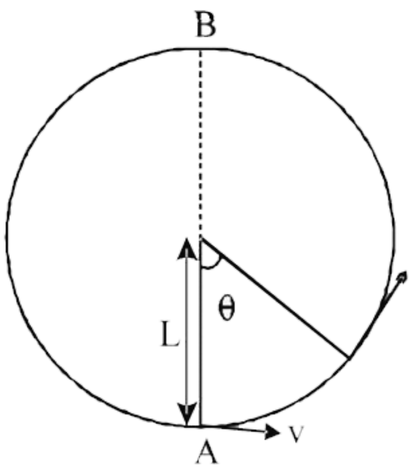
69. A bob of mass M is suspended by a massless string of length L. The horizonta velocity v at position A is just sufficient to make it reach the point B. The angle θ at which the speed of the bob is half of that at A, satisfies



A. $\theta \frac{\pi}{4}$

B. $\frac{\pi}{4} < \theta < \frac{\pi}{4}$

C. $\frac{\pi}{2} < \theta < \frac{3\pi}{4}$

D. $\frac{3\pi}{4} < \theta < \pi$

Answer: C

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70. A stone of mass 1kg tied to a light inextensible sstring of length $L = 10m$ is whirling in a circular path of radius L in vertical plane. If the ratio of the maximum tension in the string to the minimmum tension in the string is 4 and if g is taken to be $10ms^{-2}$, the speed of the stone at the highest point of the circle is.

A. $20m/s$

B. $10\sqrt{3}m/s$

C. $5\sqrt{2}m/s$

D. $10m/s$

Answer: D

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71. A nail is located at a certain distance vertically below the point of suspension of a simple pendulum. The pendulum bob is released from a position where the string makes an angle of 60° with the vertical. Calculate the distance of nail from the point of suspension such that the bob will just perform revolutions with the nail as centre. Assume the length of the pendulum to be one meter.

A. $0.2m$

B. $0.4m$

C. $0.6m$

D. $0.8m$

Answer: D

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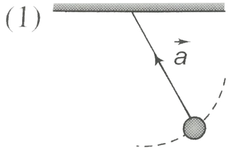
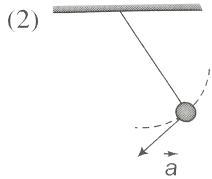
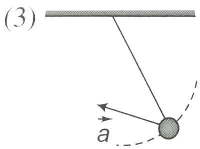
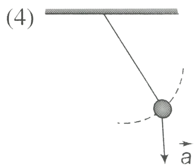
72. A simple pendulum is oscillating without damiping, When the displacement of the bob is less than maximum, its acceleration vector $\overrightarrow{a}$ is correctly show in:

A. 

B. 

C. 

D. 

Answer: C

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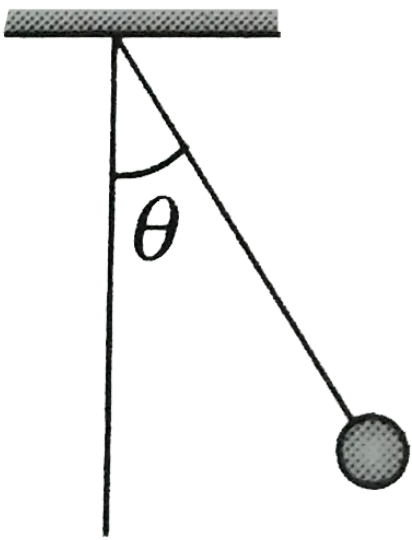
73. A simple pendulum is oscillating with an angular amplitude of 90° as shown in the figure. The value of θ for which the resulting acceleration of the bob is directed (i) vertically downward, (ii) vertically upward and (iii) horizontally is`



A. $90^\circ, 0^\circ, \sin^{-1}(1/\sqrt{3})$

B. $0^\circ, 90^\circ, \sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

C. $90^\circ, 0^\circ, \cos^{-1}(1/\sqrt{3})$

D. $0^\circ, 90^\circ, \cos^{-1}(1/\sqrt{3})$

Answer: C

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74. A simple pendulum having bob of maas m is suspended from the ceiling of a car used in a stunt film shooting. The car moves up along an inclined cliff at a speed v and makes a jump to leavwe the cliff and lands at some the top of the cliff. The tension in the string when the car is in air is

A. mg

B. $mg - \frac{mv^2}{R}$

C. $mg + \frac{mv^2}{R}$

D. $zero$

Answer: D

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75. A particle of mass m is fixed to one end of a light rigid rod of length l and rotated in a vertical circular path about its other end. The minimum speed of the particle at its highest point must be

A. $Zero$

B. $\sqrt{gL}$

C. $\sqrt{(1.5gL)}$

D. $\sqrt{2gL}$

Answer: A

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76. Figure shows a light rod of length l rigidly attached to a small heavy block at one end and a hook at the other end. The system is released from rest with the rod in a horizontal position. There is a fixed smooth ring at a depth h below the initial position of the hook and the hook gets into the ring as it reaches there. What should be the minimum value of h so that the block moves in a complete circle about the ring?

A. $h = L$

B. $h = 2L$

C. $h = 3L$

D. $h = 4L$

Answer: A

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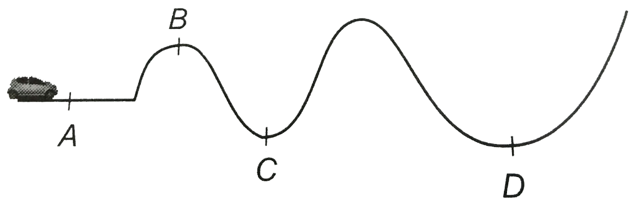
77. A car moves along an uneven horizontal surface with a constant speed at all points. The normal reaction of the road on the car is



ltbrrgt

A. $N_A = N_B = N_c = N(d)$

B. $N_c > N_D > N_A > N_B$

C. $N_B > N_C > N_A N_B$

D. $N_c > N_{D > N_B > NA}$

Answer: B

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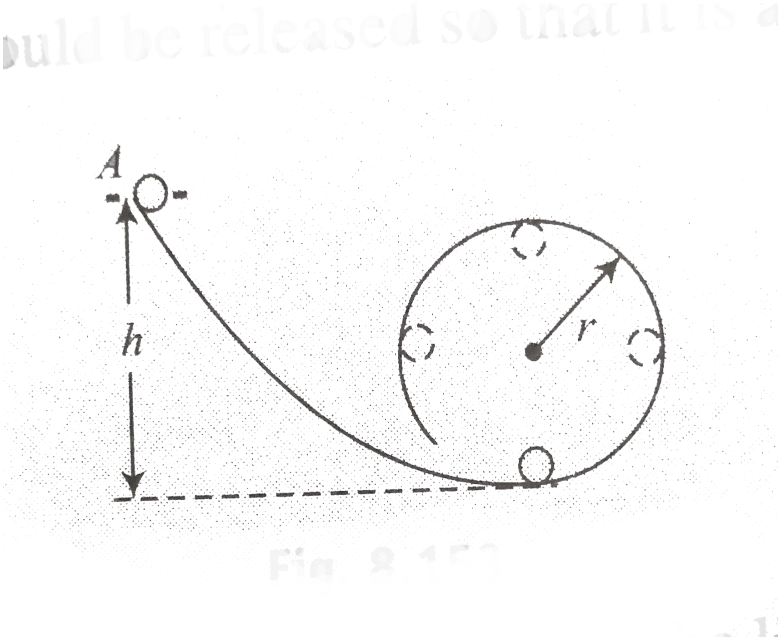
78. A block is released from rest at the top of an inclined plane which later curves into a circular track of radius r as shown in figure. Find the minimum height h from where it should be released so that it is able to complete the circle.



A. $\frac{R}{2}$

B. $\frac{3R}{2}$

C. $zero$

D. $\frac{5R}{2}$

Answer: D

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79. In the previous problem, if $h = 5R/2$, the speed of block at the highest point is

A. $\sqrt{2gR}$

B. $\sqrt{gR}$

C. $zero$

D. $\sqrt{\frac{gR}{2}}$

Answer: B

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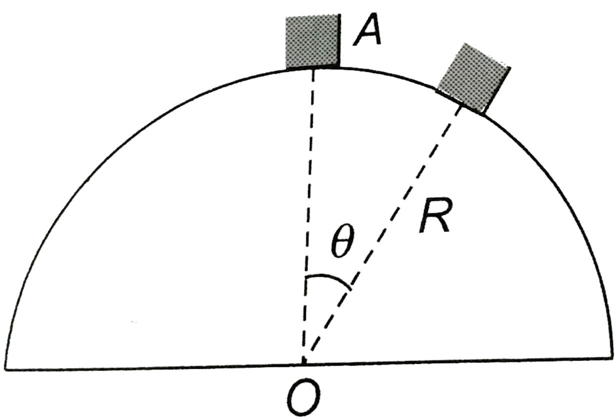
80. A particle is released from the top of the smooth hemisphere R as shown.

the normal contact between the particle and the hemisphere in position θ is



A. $mg(3-2\cos\theta)$

B. $mg(3\cos\theta-2)$

C. $mg(4\cos\theta-3)$

D. $mg(4-3\cos\theta)$

Answer: B

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81. In the previous problem

(i) At $\theta=\cos^{-1}\left(\frac{2}{3}\right)$, the particle will lwave the hemisphere

(ii) At depth $R/3$ below A, the particle will leave the hemisphere

(iii) At height $2R/3$ above O, the particle will leave the hemisphere

A. (i), (ii)

B. (ii), (iii)

C. (i), (iii)

D. (i), (ii), $(iiii)$

Answer: D

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82. A Particle is kept at rest at the top of a sphere of diameter $42m$.when disturbed slightly, it slides down. At what height h from the bottom, the particle will leave the sphere

A. $14m$

B. $28m$

C. $35m$

D. $7m$

Answer: C

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83. A small disc is on the top of a hemisphere of radius R. What is the smallest horizontal velocity v that should fbe 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. $v = \sqrt{g^2 R}$

Answer: B

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84. A bridge is in the form of a semicircle of radius $40m$. The greatest speed with which a motorcycle can cross the bridge without leaving the ground at the highest point (frictional force is negligibly small)

A. $40m / s$

B. $20m / s$

C. $30m / s$

D. $15m / s$

Answer: B

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85. 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. fluctutates

Answer: A

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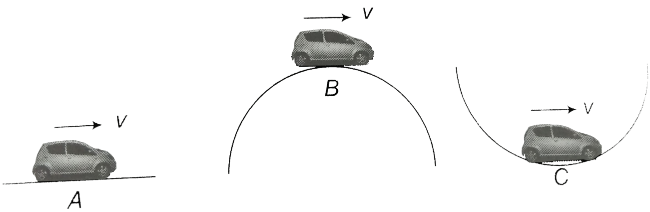
86. Consider a car moving on a horizontal road, convex bridge and concave bridge of same radius R. The speed of the car in each situation is same and equal to v, the mass of the car is m, then



A. (i), (ii)

B. (ii), (iii)

C. (i), (ii), (iii)

D. All options are correct

Answer: D

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87. A bucket tied at the end of a $1.6m$ long string is whirled in a verticle circle with constant speed. What should be the minimum speed so that the water from the bucket does not spill, when the bucket is at the highest position $(Take g = 10 m / s^2)$

A. $4 m / s$

B. $6.25 m / s$

C. $16 m / s$

D. none of the above

Answer: A

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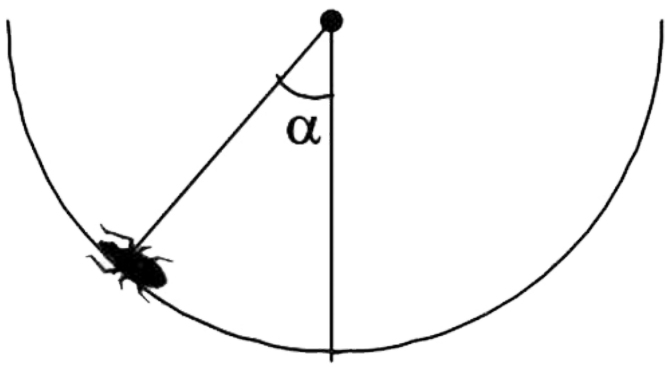
88. An insect craws up a hemispherical surface very slowly (see fig.). The coefficient of friction between the insect and the surface is $1/3$. If the line joining the center of the hemispherical surface to the insect makes an angle α with the vertical, the maximum possible value of α is given by



A. $\cot \alpha = 3$

B. $\tan \alpha = 3$

C. $\sec \alpha = 3$

D. $\cos ec\alpha = 3$

Answer: A

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89. A piece of wire is bent in the shape of a parabola $y = Kx^2$ (y - axis vorical) with a bead of mass m on it . The beat can side on the wire without friction , it stays the wire is now accleated parallel to the bead , where the bead can stay at rest with repect to the wire from the y - axis is

A. a/gk

B. $a/2gk$

C. $2a/gk$

D. $a/4gk$

Answer: B

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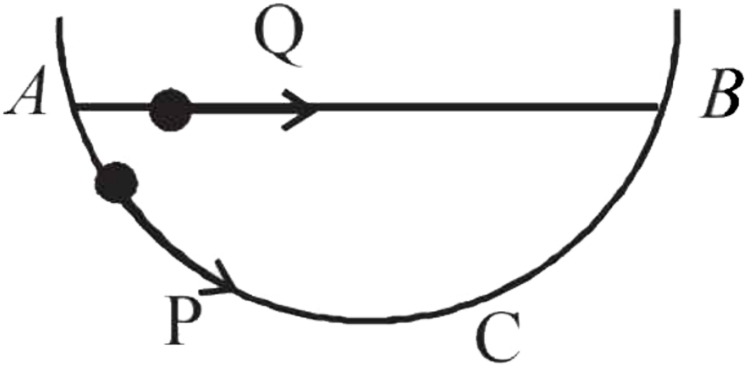
90. A particle P is sliding down a frictionless hemispherical bowl. It passes the point A at $t = 0$. At this instant of time, the horizontal component of its velocity is v. A bead Q of the same mass as P is ejected from A at $t = 0$ along the horizontal string AB, with the speed v. Friction between the bead and the string may be neglected. Let t_P and t_Q be the respective times taken by P and Q to reach the point B. Then:



A. $t_p < t_Q$

B. $t_p = t_Q$

C. $t_p > t_Q$

D. `all of these

Answer: A

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