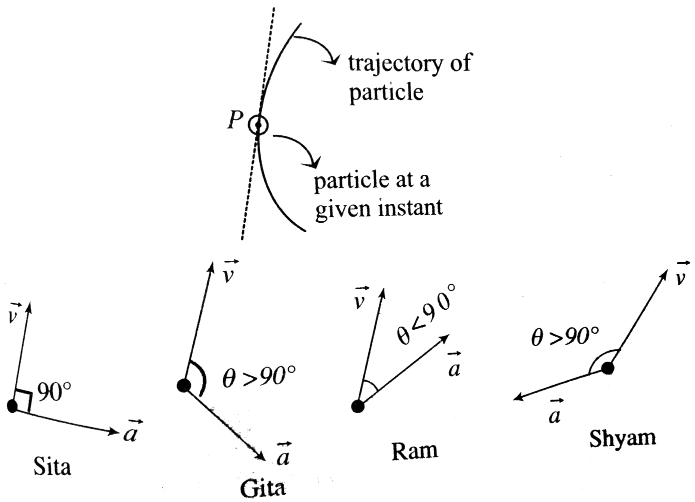
PHYSICS

BOOKS - CENGAGE PHYSICS (ENGLISH)

MISCELLANEOUS VOLUME 2

Scq Type

1. Figure shows a path followed by a particle and position of a particle at any instant. Four different students have represented the velocity vectors and acceleration vectors at the given instant. Which vector diagram cannot be true in any situation? (In each figure, velocity is tangential to the trajectory).



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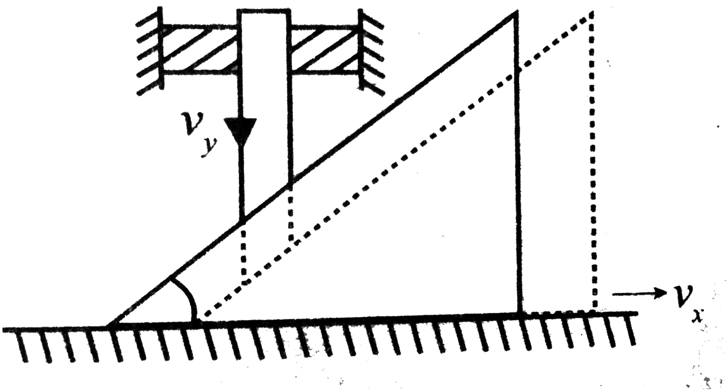
2. Two students analysed two different problems off mechanics involving constraint motion. Symbols have their usual meaning.

Student *A*



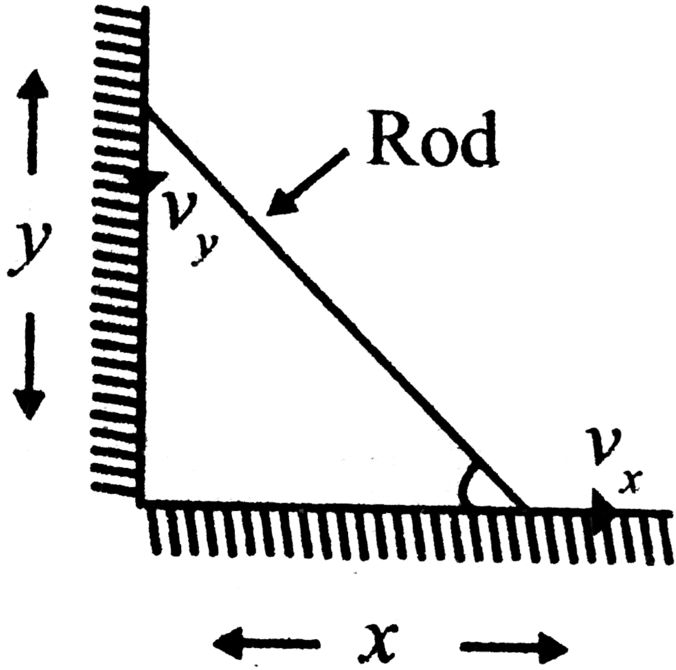
The vertical rod can move only vertically and the wedge can move only horizontally.

$$\frac{y}{x}=\tan\theta,\ y=x\tan\theta,\ v_y=v_x\tan\theta$$

Student B.

The ends of the rods are slipping on the ground and the wall, respectively

$$\frac{y}{x}=\tan\theta,\ y=x\tan\theta,\ vy=vx\tan\theta$$



A. Student A is correct B is wrong

B. Student A is wrong B is correct

C. Both are correct

D. Both are wrong

Answer: A

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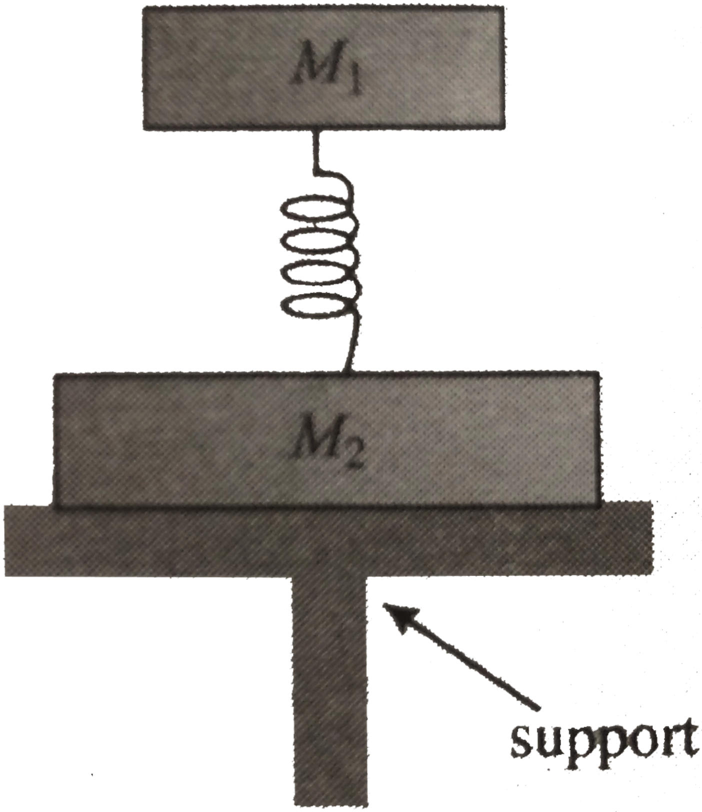
3. The system of two weights with masses M_1 and M_2 are connected with weightless spring as shown in fig. The system is resting on the support S. Find the acceleration of each of the weights just after the support S is quickly removed.



A. $a_1 = 0,\ a_2 = \dfrac{(m_1 + m_2)g}{m_2}$

B. $a_1 = 0,\ a_2 = \dfrac{(m_1 + m_2)g}{m_1}$

C. $a_1 = \dfrac{(m_1 + m_2)g}{m_1},\ a_2 = 0$

D. $a_1 = 0, \frac{(m_1 + m_2)g}{m_1, a_2} = 0$

Answer: A

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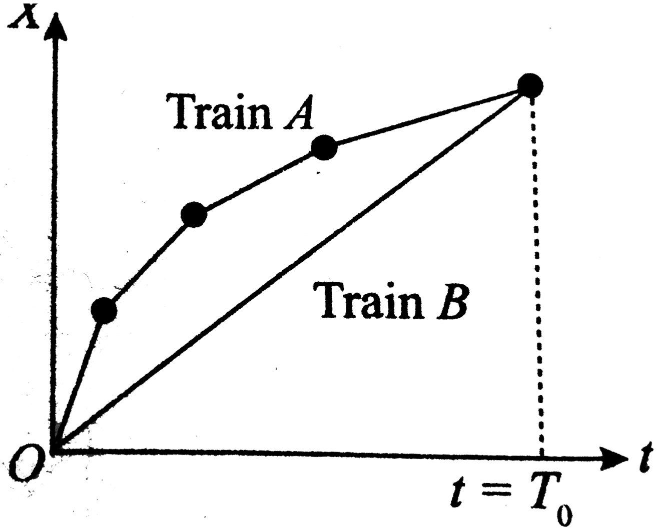
4. The plot shows the position (x) as a function of time (t) for two trains that run on a parallel track. Train A is next to train B at

$t = 0$ and at $t = T_0$.



A. At T_0 both the trains have the same velocity.

B. Both the trains speed up all the times.

C. Both trains have the same velocity at some time before T_0.

D. At T_0 the trains have covered different distances

Answer: C

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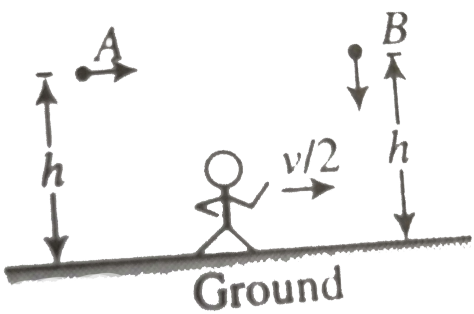
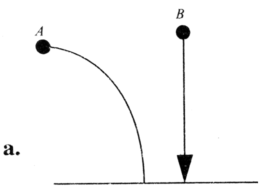
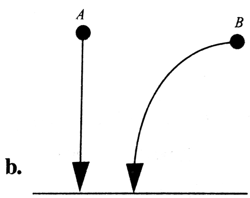
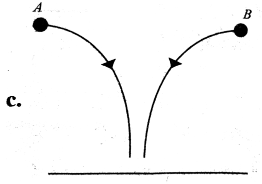
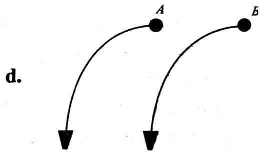
5. Two identical balls are set into motion simultaneously from equal height h. While the ball A is thrown horizontally with velocity v, the ball B is just released to fall by itself. Choose the alternative that best represents the motion of A and B with respect to an observer who moves with velocity $v/2$ with respect to the ground as shown in figure.



A. 

B. 

C. 

D. 

Answer: C

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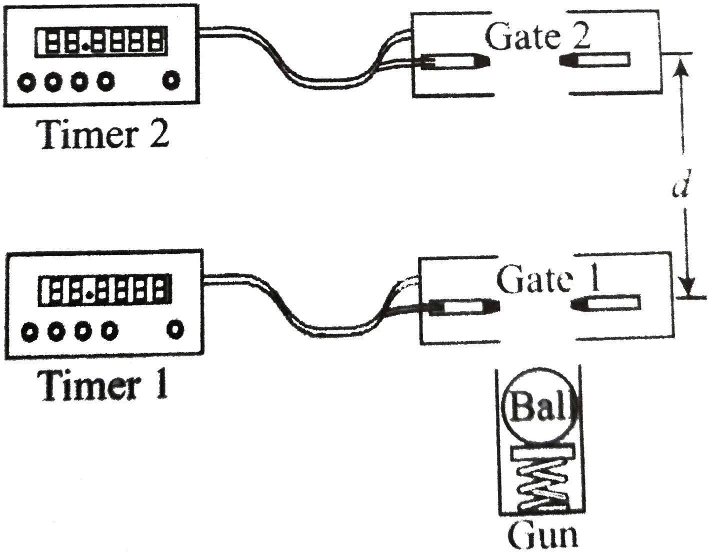
6. Measuring g

The figure shows a method for measuring the acceleration due to gravity. The ball is projected upward by a "gun". The ball passes electronic "gates" 1 and 2 as it rises and again as it falls. Each gate is connected to a separate timer. The first passage of the ball through each gate starts the corresponding timer, and the second passage through the same gate stops the timer. and the second passage through the same gate stops the timer. The time intervals Δt_1 and Δt_2 are thus measured. The vertical distance between the two gates is d. If d = 5m, $\Delta t_1 = 3s$, $\Delta t_2 = 2s$, find the measured value of acceleration due to gravity ($\in ms^{-2}$).



A. $8ms^{-2}$

B. $4ms^{-2}$

C. $2ms^{-2}$

D. $1ms^{-2}$

Answer: A

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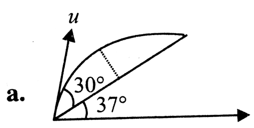
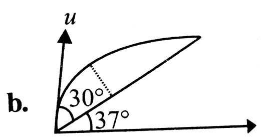
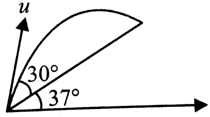
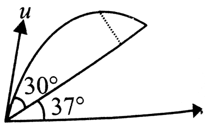
7. A particle is projected with velocity 30° above on an inclined plane, inclination of which from horizontal is 37°. Choose the appropriate path (air resistance is negligible)

A. 

B. 

C. 

D. 

Answer: D

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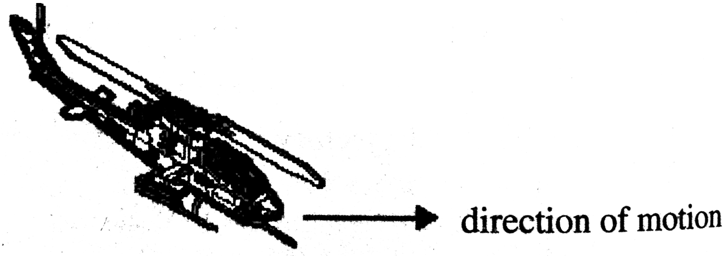
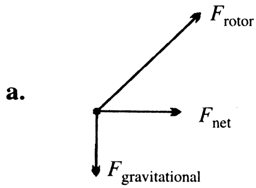
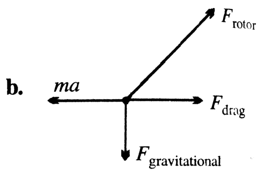
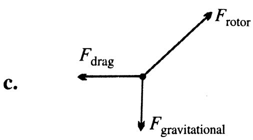
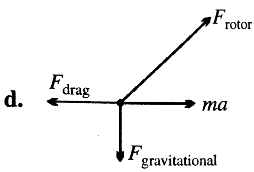
8. A helicopter is moving to the right at a constant horizontal velocity. It experiences thre forces $\overrightarrow{F}_{\text{gravitational}}, \overrightarrow{F}_{\text{drag}}$ force on it caused by rotor $\overrightarrow{F}_{\text{rotor}}$. Which of the following diagrams can be a correct free body diagram represents forces on the helicopter?



A.


B.


C.


D.


Answer: C

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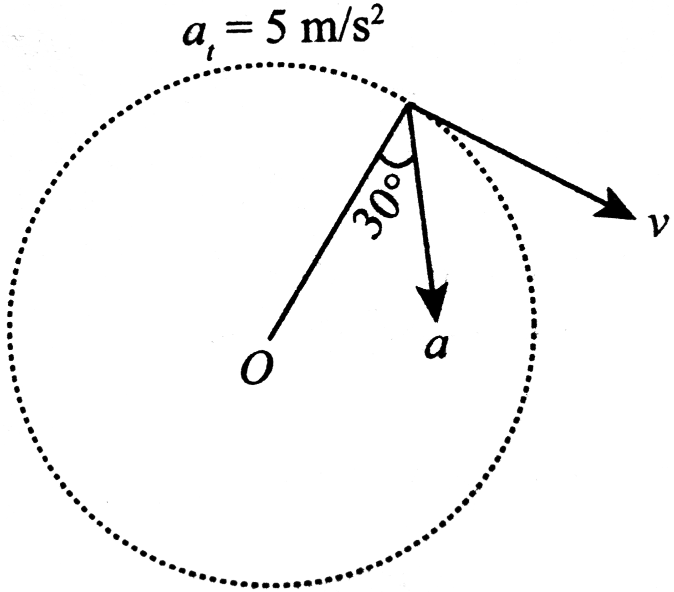
9. Figure shows the direction of the total acceleration and velocity of a particle moving clockwise in a circle radius m at an instant of time. Tangential acceleration this instant is $5m/s^2$. Which of the following statements is not correct?



A. The centripetal aceleration is $5\sqrt{3}ms^{-2}$

B. Particle is speeding up.

C. The net acceleration is $10ms^{-2}$

D. The particle is slowing down.

Answer: D

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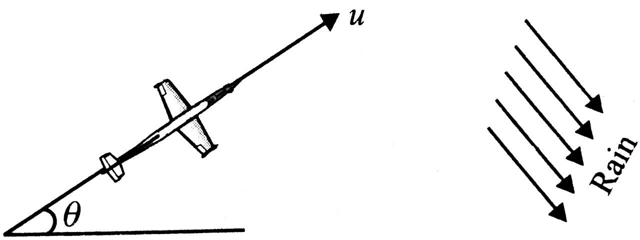
10. Rain is falling with a sped of $12\sqrt{2}m/s$ at an angle 45° with the vertical line. A man in a glider going at a speed of u at an angle of 37° with respect to the ground. Find the speed of the glider so that rain appears to him falling vertically. Consider the motion of the glider and rain drops in the same vertical plane.



A. $15ms^{-1}$

B. $30ms^{-1}$

C. $10ms^{-1}$

D. $25ms^{-1}$

Answer: A

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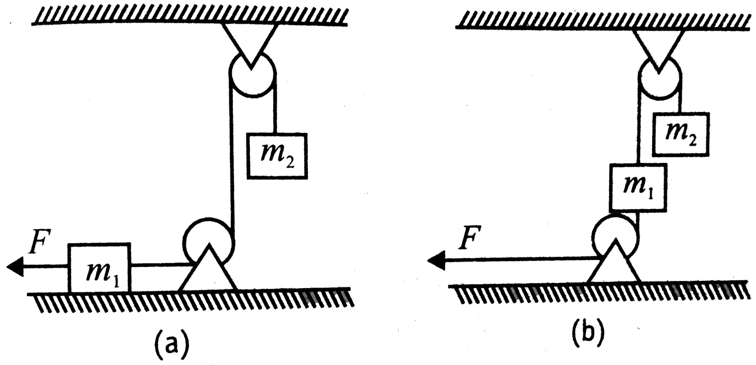
11. The ratio of tensions in the string connected to the block of mass m_2 in figure, respectively, is (friction is absent everywhere): $[m_1 = 50kg, m_2 = 80kg$ and $F = 1000N]$



A. $7:2$

B. $2:7$

C. $3:4$

D. $4:3$

Answer: C

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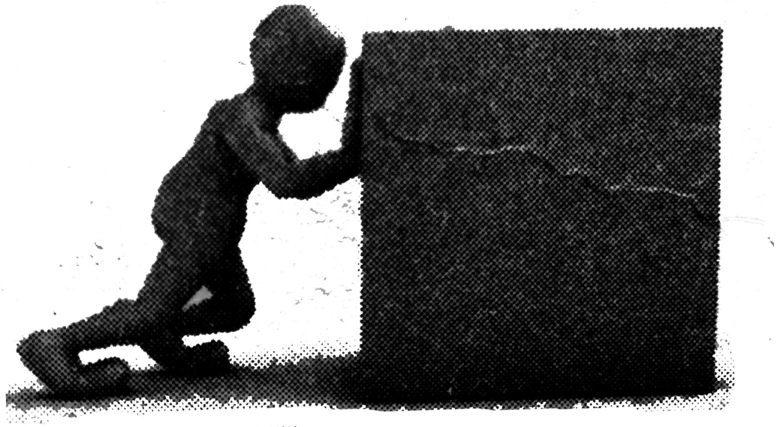
12. A man of mass $75kg$ is pushing a heavy box on a flat floor. The coefficient of kinetic and static friction between the floor and the box is 0.20, and the coefficient of static friction between the man's shoes and the floor is 0.80. If the man pushes horizontally, what is the maximum values (in kg) of the box he can



move?

A. $300kg$

B. $60kg$

C. $900kg$

D. none of these

Answer: A

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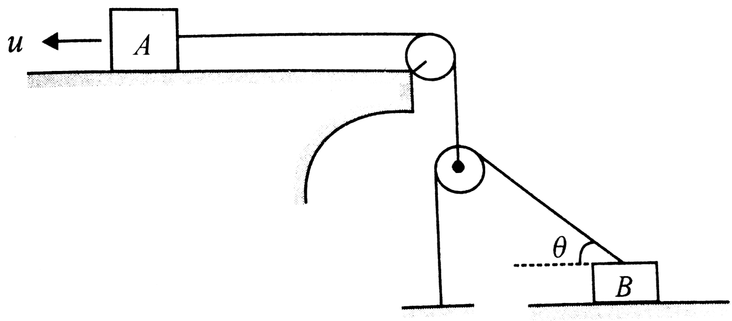
13. In the figure shown, the lower pulley is free to move in a vertical direction only. Block A is given a uniform velocity u as shown, what is the velocity of block B as a function of angle θ



?

A. $u \cos \theta$

B. $\frac{u}{\cos \theta}$

C. $\dfrac{u[1+\sin\theta]}{\cos\theta}$

D. $\dfrac{u[1+\cos\theta]}{\sin\theta}$

Answer: C

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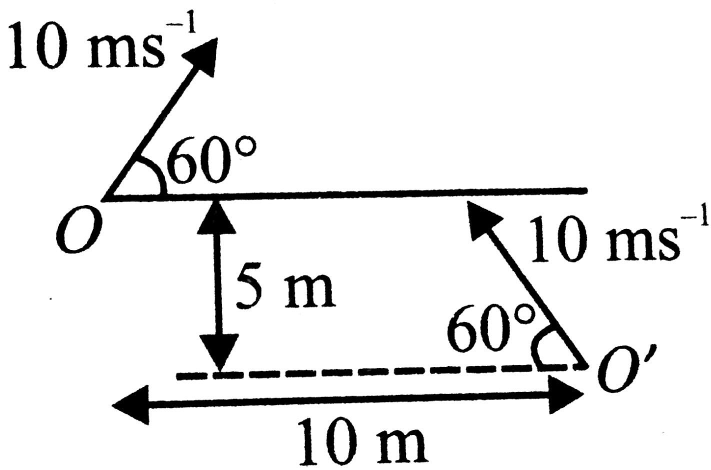
14. Two particles are projected simultaneously from two points O and O' such that $10m$ is the horizontal and $5m$ is the vertical distance between them as shown in the figure. They are projected at the same inclination 60° to the horizontal with the same velocit $10ms^{-1}$. The time after which their separation becomes minimum is



A. $2.5s$

B. $1s$

C. $5s$

D. $10s$

Answer: B

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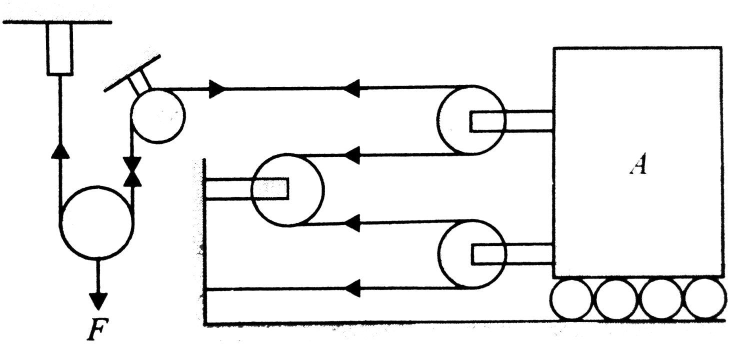
15. A force F is applied to a system of light pulleys to pull body A. If F is $10kN$ and block of mass A has a mass of $5 \times 10^3 kg$, what is the speed of A after $1s$ starting from rest?

Assume no friction.



A. (a)$4ms^{-1}$

B. (b)$8ms^{-1}$

C. (c)$6ms^{-1}$

D. (d)none of these

Answer: A

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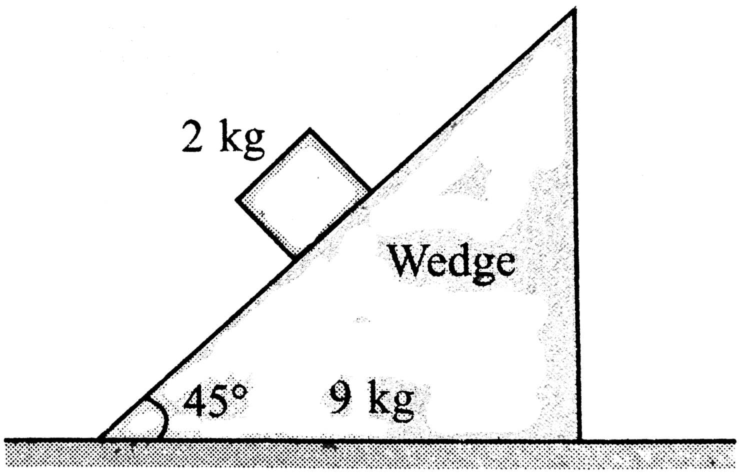
16. A block of mass $2kg$ slides down the face of a smooth 45° wedge of mass $9kg$ as shown in the figure. The wedge is placed on a frictionless horizontal surface. Determine the acceleration of the wedge.



A. $2ms^{-2}$

B. $\frac{11}{\sqrt{2}} ms^{-2}$

C. $1 ms^{-2}$

D. none of these

Answer: C

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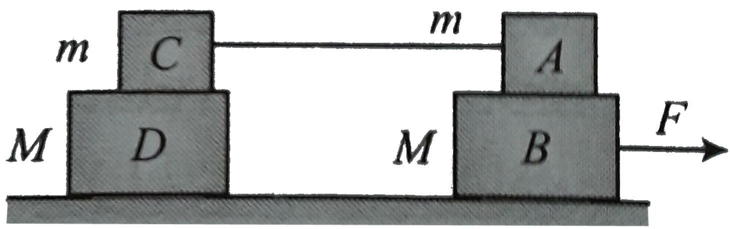
17. Four block are arranged on a smooth horizontal surface as shown in figure .The masses of the blocks are given (see the fig) The coefficient of static friction between the top and the bottom blocks is μ_s What is the maximum value of the horizontal force F applied to one of the bottom blocks as shown that makes all four block with the same acceleration ?



A. $F_{\max} = 2\mu_s mg\left(\frac{2m+M}{m+M}\right)$

B. $F_{\max} = \mu_s mg\left(\frac{m+M}{2m+M}\right)$

C. $F_{\max} = 2\mu_s mg\left(\frac{m+M}{2m+M}\right)$

D. $F_{\max} = \mu s mg\left(\frac{2m+M}{m+M}\right)$

Answer: C

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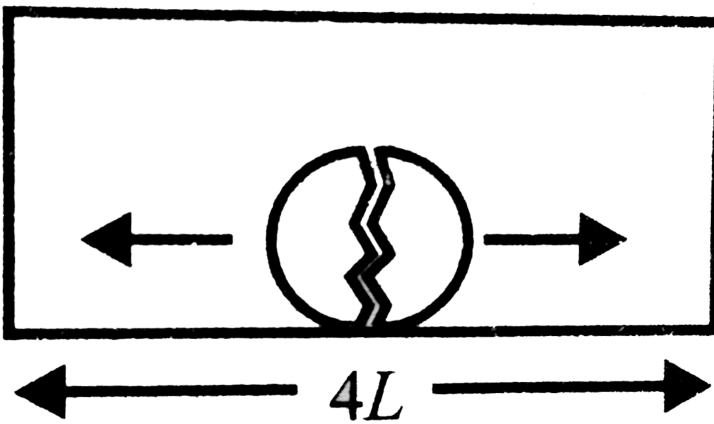
18. A bomb of mass $3m$ is kept inside a closed box of mass $3m$ and length $4L$ at its centre. It explodes in two parts of mass m and $2m$. The two parts move in opposite directions and stick to the opposite sides of the walls of box. The box is kept on a smooth horizontal surface. What is the distance moved by the box during this time interval.



A. 0

B. $\frac{L}{6}$

C. $\frac{L}{12}$

D. $\frac{L}{3}$

Answer: D

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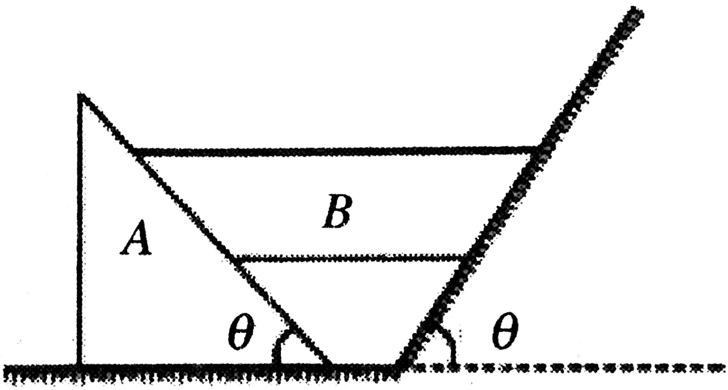
19. In the situation as shown in the figure if acceleration of B is a, then find the acceleration of A (B always remain horizintal),



A. (a)$a \sin \theta$

B. (b)$a \cot \theta$

C. (c)$2a\tan\theta$

D. (d)$2a\cos\theta$

Answer: D

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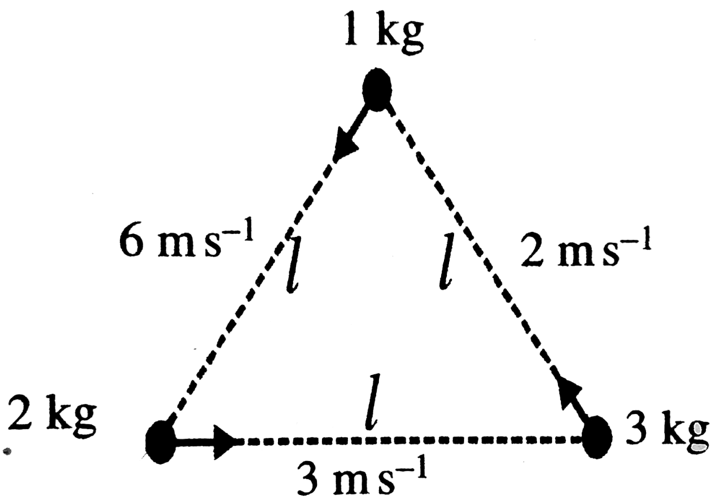
20. Three particles of masses $1kg$, $2kg$ and $3kg$ are situated at the corners of an equilateral triangle move at speed $6ms^{-1}$, $3ms^{-1}$ and $2ms^{-1}$ respectively. Each particle maintains a direction towards the particle at the next corner symmetrically. Find velocity of CM of the system at this instant



A. $3ms^{-1}$

B. $5ms^{-1}$

C. $6ms^{-1}$

D. zero

Answer: D

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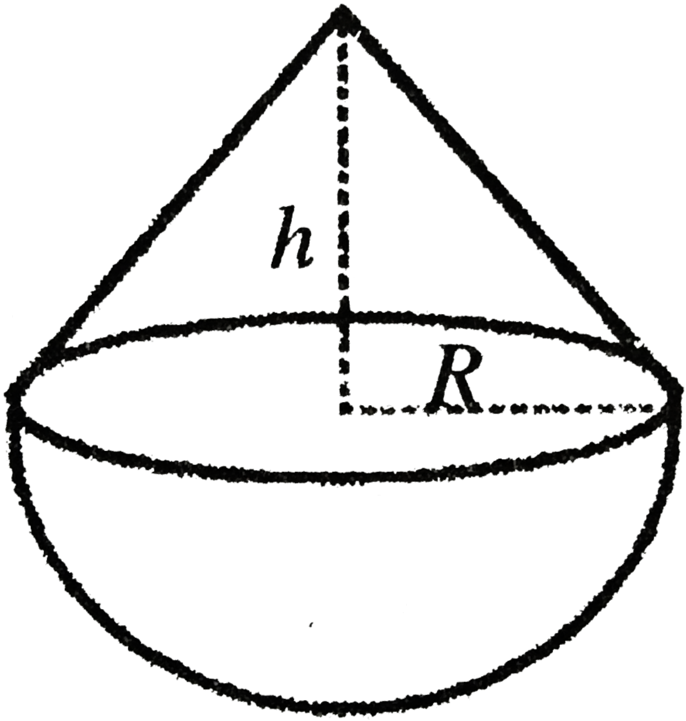
21. A uniform solid right circular cone of base radius R is joined to a uniform solid hemisphere of radius R and of the same density, as shown. The centre of mass of the composite solid lies at the centre of base of the cone. The height of the cone is



A. $1.5R$

B. $\sqrt{3}R$

C. $3R$

D. $2\sqrt{3}R$

Answer: B

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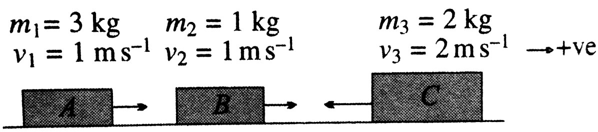
22. Three carts move on a frictionless track with masses and velocities as shown. The carts collide and stick together after successive collisions. Find the total magnitude of the impulse experienced by



A. $1Ns$

B. $2Ns$

C. $3Ns$

D. $4Ns$

Answer: C

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23. A rod of length L is held vertically on a smooth horizontal surface. The top end of the rod is given a gentle push. At a certain instant of time, when the rod makes an angle 37°

with horizontal the velocity of COM of the rod is $2ms^{-1}$. The velocity of the end of the rod in contact with the surface at that instant is:

A. $2ms^{-1}$

B. $1ms^{-1}$

C. $4ms^{-1}$

D. $1.5ms^{-1}$

Answer: D

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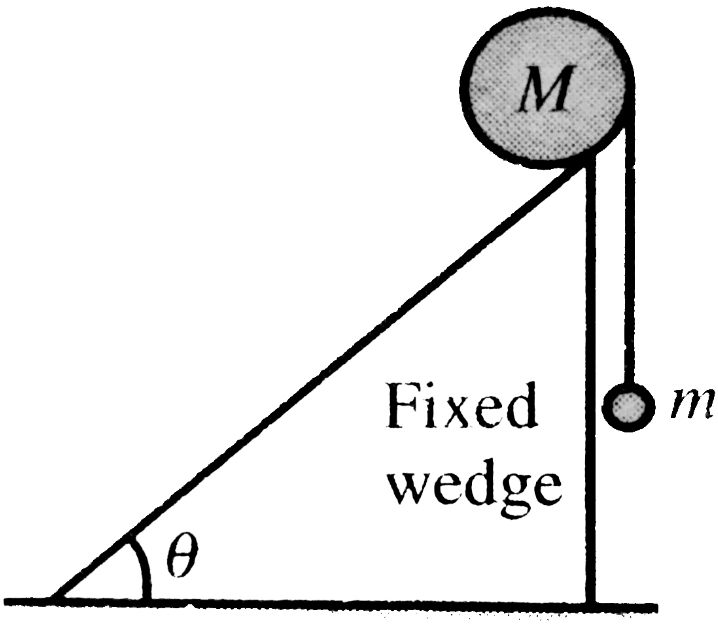
24. A uniform cylinder of mass M lies on a fixed plane inclined at an angle θ with horizontal. A light string is tied to the cylinder at the right most point, and a mass m hangs from the string, as shown. Assume that the coefficient of friction between the cylinder and the incline plane is sufficiently large to prevent slipping. For the cylinder the remain static, the value of m is



A. $\dfrac{M\sin\theta}{1-\sin\theta}$

B. $\dfrac{M\cos\theta}{1+\sin\theta}$

C. $\dfrac{M\sin\theta}{1+\sin\theta}$

D. $\dfrac{M\cos\theta}{1-\cos\theta}$

Answer: A

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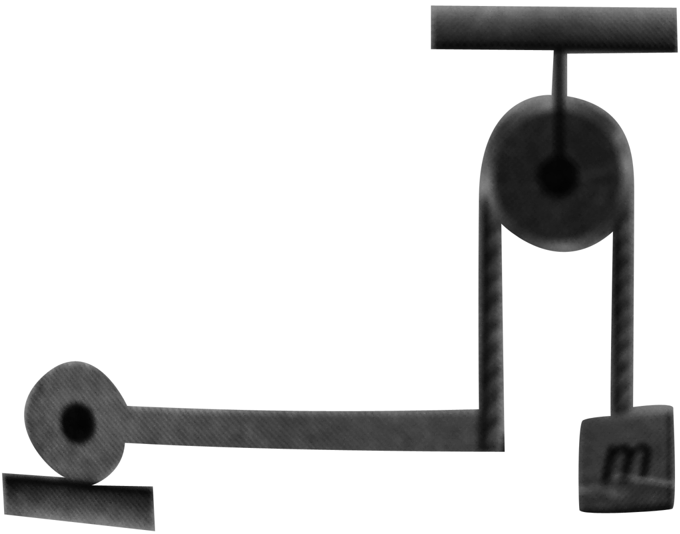
25. 

Uniform rod AB is hinged at end A in horizontal position as shown in the figure. The other end is connected to a block through a massless string as shown. The pulley is smooth and massless. Mass of block and rod is same and is equal to m Then acceleration of block just after release from this position is

A. $6g/13$

B. $g/4$

C. $3g/8$

D. none

Answer: C

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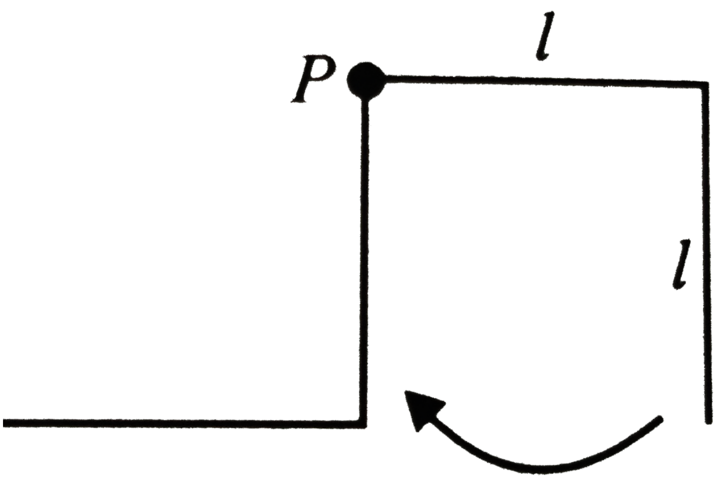
26. An L shaped thin uniform rod of total length $2l$ is free to rotate in a vertical plane about a horizontal axis a P as shown in the figure. The bas is released from rest. Neglect air and contact friction. The angular velociyt at the instant it has rotated through 90° and reached the dotted position shown is



A. zero

B. $\sqrt{\frac{6g}{5l}}$

C. $\sqrt{\frac{3g}{5l}}$

D. none

Answer: B

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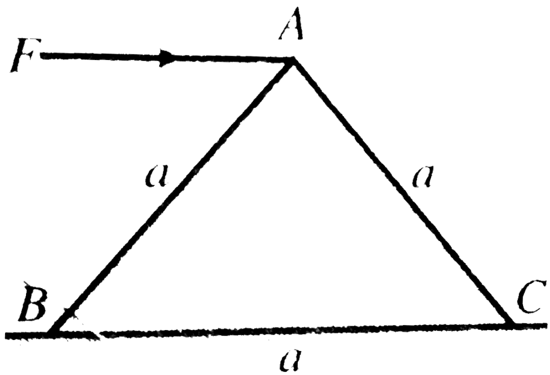
27. A horizontal force F is applied at the top of an equilateral triangular block having mass m. The minimum coefficient of friction required to topple the block before translation will be



A. $\frac{2}{\sqrt{3}}$

B. $\frac{1}{3}$

C. $\frac{1}{\sqrt{3}}$

D. $\frac{1}{2}$

Answer: C

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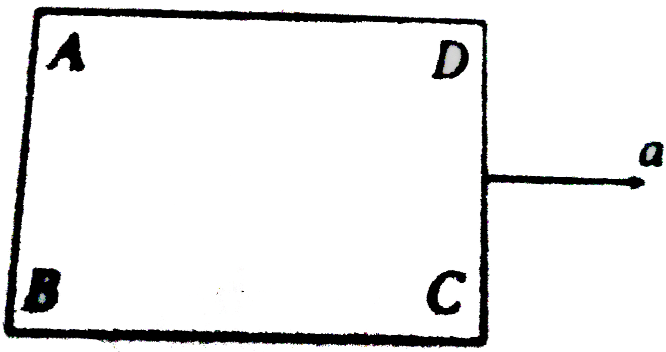
28. A closed rectangular tank is completely filled with water and is accelerated horizontally with an acceleration towards right. Pressure is



(i) maximum at, and (ii) minimum at

A. i. B ii D

B. i C ii D

C. i B ii C

D. i B ii A

Answer: A

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29. We have a vessel in shape of a cuboid partially filled with water. It base is square wilth an area of $4.5dm^2(1dm = 10cm)$ and a vessel contains water up to $2cm$ height. Then we place wooden cube inside water. The wood has mass $4kg$ and specific gavity 0.5. The base of the wooden cube is horizontal. Find the height of water level above the base of the wooden block.

A. (a)$10cm$

B. (b)$2cm$

C. (c)$15cm$

D. (d)$7cm$

Answer: A

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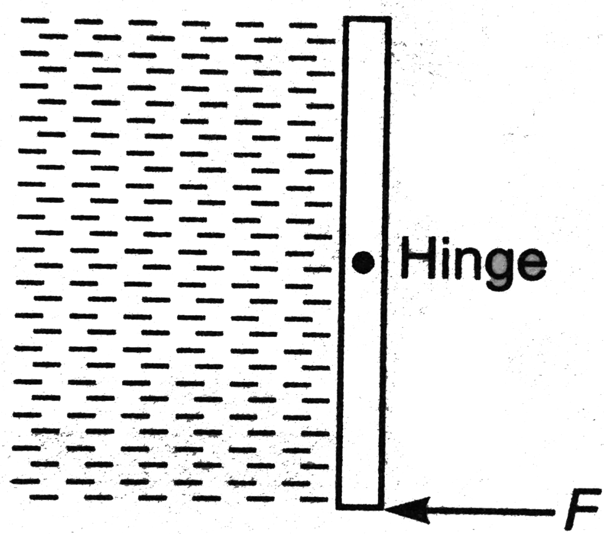
30. A square gate of size $1m \times 1m$ is hinged at its mid point. A fluid of density ρ fill the space to the left of the gate. The force F required to hold the gate stationary is



A. $\rho g/3$

B. $(1/2)\rho g$

C. $\rho g/6$

D. none of these

Answer: C

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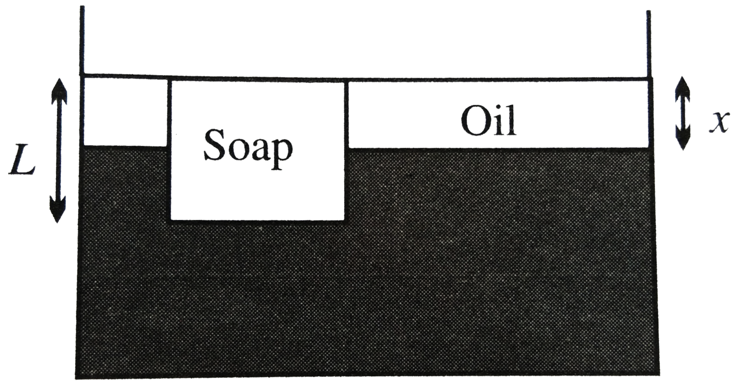
31. A rectangular bar of soap has density $800kg/m^3$ floats in water density $1000kg/m^3$. Oil of density $300kg/m^3$ is slowly added, forming a layer that does not mix with water. When the top surface of thhe oil is the some level as the top surface of the soap. What is the ratio of the oil layer thickness to the soap's thickness. x / L?



A. $\frac{3}{7}$

B. $\frac{2}{7}$

C. $\frac{3}{10}$

D. $\frac{3}{8}$

Answer: B

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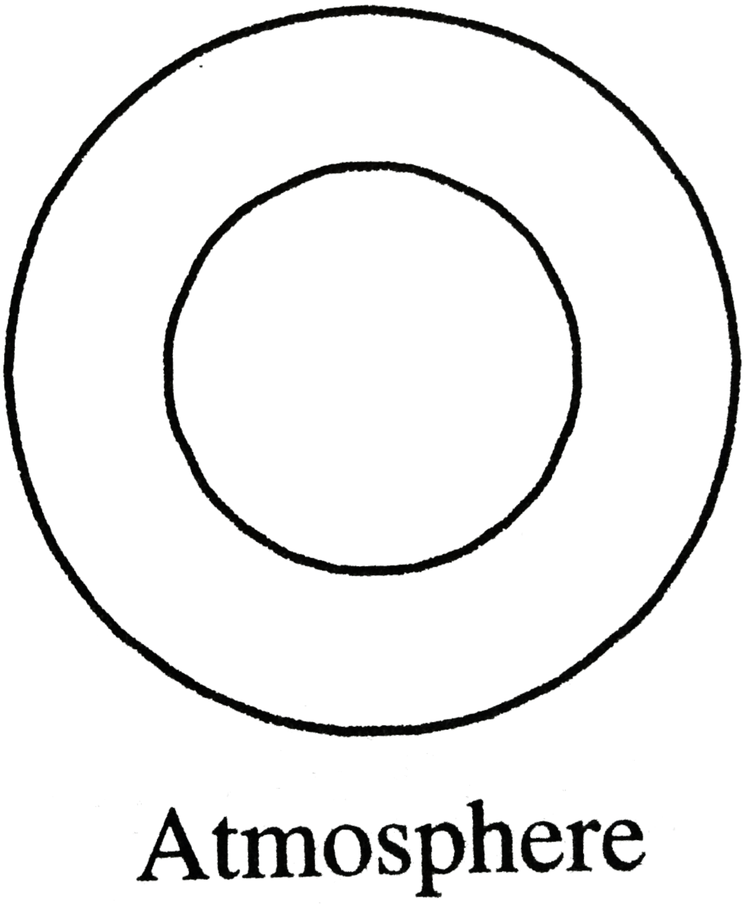
32. A soap bubble of raidus R is surrounded by another soap bubble of radius $2R$, as shown. Take surface tension $= S$. Then the pressure inside the smaller soap bubble, in excess of the atmosphere presure will be



A. $4S / R$

B. $3S / R$

C. $6S/R$

D. none of these

Answer: C

Watch Video Solution

33. A metal ball B_1 (density $3.2 gcm^{-3}$)is dropped in water while another metal ball B_2 (density 6.0 g cm^{-3})is dropped in aliquid of density $1.6 gcm^{-3}$. If both the balls have the same diameter and attain the same terminal velocity, the ratio of viscosity of water to that of the liquid is

A. 2.0

B. 0.5

C. 4.0

D. indeterminate due to insufficient data

Answer: B

Watch Video Solution

34. The vernier of a circular scale is divided into 30 divisons, which coincides with 29 main scale divisions. If each main scale division is $(1/2)^{\circ}$ the least count of the instrument is $(1^{\circ} = 60')$

A. (a)0.1

B. (b)$1'$

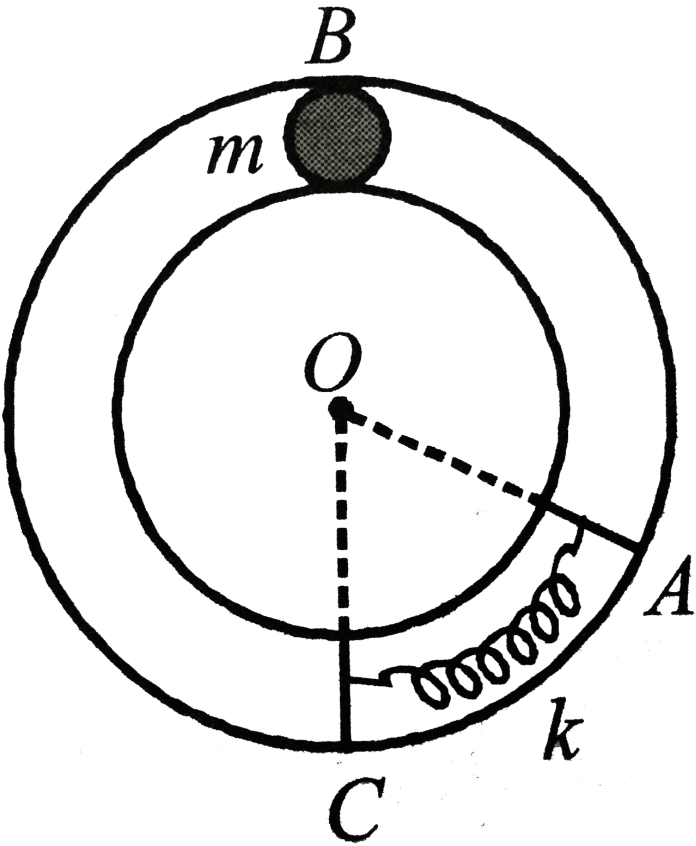
C. (c)$10'$

D. (d)$30'$

Answer: B

Watch Video Solution

35. In the figure shown, there is a smooth tube of radius R, fixed in the vertical plane. A ball B of mass m is released from the top of the tube. B slides down due to gravity and compresses the spring is fixed and end A is free., Initially, line OA makes an angle 60° with OC and finally it makes an angle of 30° after compression. Find the spring constant of the spring.



A. $\dfrac{12mg\left(2+\sqrt{3}\right)}{\pi^2 R}$

B. $\dfrac{36mg\left(2+\sqrt{3}\right)}{\pi^2 R}$

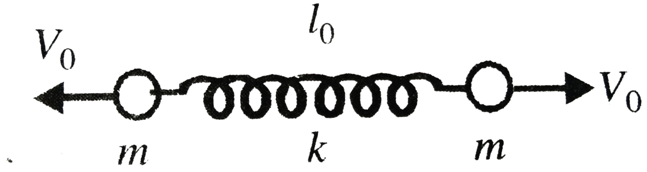
C. $\frac{16m}{\pi^2 g}$

D. none of these

Answer: B

Watch Video Solution

36. A system comprises of two small spheres with the same masses m. initially, the spring is non deformed. the spheres set in motion in a gravity space at the velocities as shown in the diagram.



The maximum elastic potential energy stored in the system is

A. $\frac{mv_0^2}{2\sqrt{2}}$

B. mv_0^2

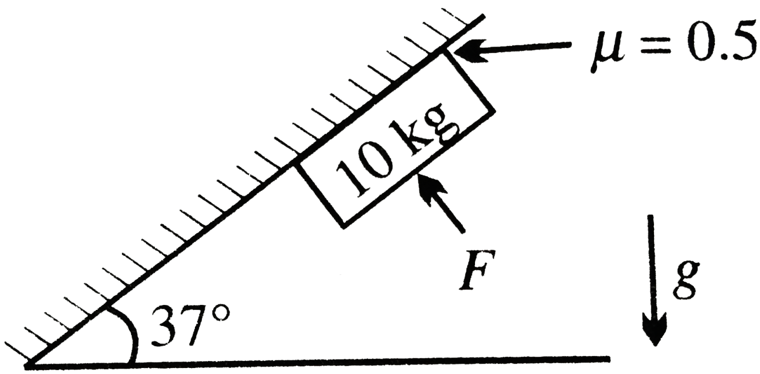
C. $\frac{1}{2}mv_0^2$

D. $2mv_0^2$

Answer: B

Watch Video Solution

37. In the figure shown, the minimum force F to be applied perpendicular to the incline so that the block does not slide is



A. $200N$

B. $40N$

C. $120N$

D. none

Answer: A

Watch Video Solution

38. A vernier caliper with a least count of of $0.01 cm$ was used to measure diameter of cylinder as $4 cm$ and a scale $(0 - 15 cm)$ with the least count of $1 mm$ was used to measue a length of $5 cm$. The $\%$ error in the measurement of volume of the cylinder is

A. 3.0

B. 4.0

C. 5.0

D. 2.5

Answer: D

Watch Video Solution

39. The angular momentum vector for a spinning wheel lies along its axle and is pointed north. To make this vector point east with chagin magnitude it is necessary to exert a force of constant magnitude on the north end of the axle in which direction?

A. always up

B. always down

C. at the initial moment in the east direction, but the force always remain perpendicular to the axle

D. always in the east direction

Answer: A

Watch Video Solution

40. A man whose mass is m kg jumps vertically into air from the sitting position in which his centre of mass is at a height h_1 from the ground. When his feet are just about to leave the ground his centre of mass is at height h_2 from the ground and finally centre of mass rises to h_3 above the ground when he is at the top of the jump. what is the average upward force exerted by the ground on him?

A. (a) $\dfrac{mg(h_3 - h_1)}{(h_3 - h_2)}$

B. (b) $\dfrac{mg(h_3 - h_1)}{h_3}$

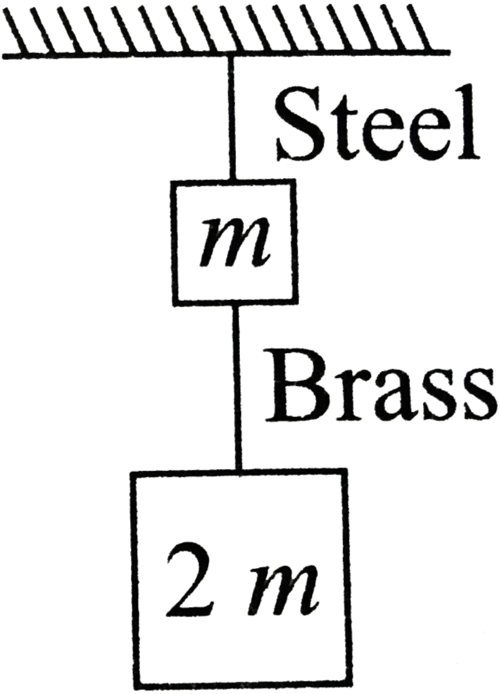
C. (c) $\dfrac{mg(h_3 - h_1)}{(h_2 - h_1)}$

D. (d)none of these

Answer: C

Watch Video Solution

41. If the ratio of lengths, radii and Young's moduli of steel and brass wires in the figure are a, b and c respectively then the corresponding ratio of increase in their lengths is



A. $\frac{2a^2c}{b}$

B. $\frac{3a}{2b^2c}$

C. $\frac{2ac}{b^2}$

D. $\frac{3c}{2ab^2}$

Answer: B

Watch Video Solution

42. An open capillary tube is lowered in vessel with mercury. The difference between the levels of the mecury in the vessel and in the capillary tube $\triangle h = 4.6mm$. What is the radius of curvature of the mercury meniscus in the capillary tube? Surface tension of mercury is $0.46N/m$, density of mercury is $13.6gm/\text{cc}$.

A. (a)$\frac{1}{340}m$

B. (b)$\frac{1}{680}m$

C. (c)$\frac{1}{1020}m$

D. (d)information insufficient

Answer: B

Watch Video Solution

43. A raind drop starts falling from a heigh of $2km$. If falls with a continuously decreasing acceleration and attains its terminal velocity at a height of $1km$. The ratio of the work done by the gravitational force in the first halt to that in the second half of the drops journey is

A. $1:1$ and the time of fall of the drop in the two halves is $a:1$ (where $a > 1$)

B. $1:1$ and the time of fall of the drop in the two halves is $a:1$ (where $a < 1$)

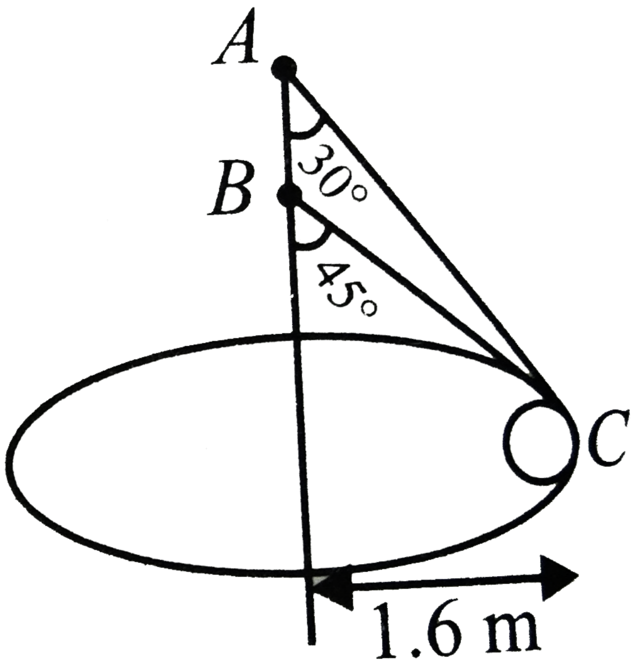
C. $a:1$ (where $a > 1$) and the time of fall of the drop in the two halves is $1:1$

D. $a:1$ (where $a < 1$) and the time of fall of the drop in the two halves is $1:1$

Answer: A

Watch Video Solution

44. Two wires AC and BC are tied at C of a small sphere of mass $5kg$, which revolves at a constant speed v in the horizontal speed v in the horizontal circle of radius $1.6m$. Find the minimum value of v



A. (a)$4ms^{-1}$

B. (b)$2ms^{-1}$

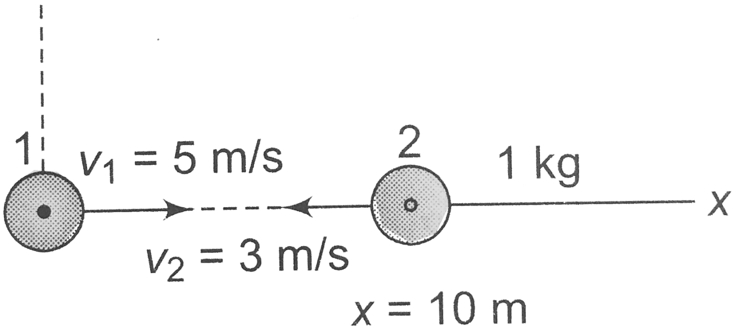
C. (c)$2.5ms^{-1}$

D. (d)none of these

Answer: A

Watch Video Solution

45. At $t = 0$, the positions and velocities of two particles are as shown in the figure. They are kept on a smooth surface and being mutually attracted by gravitational force. Find the position of centre of mass at $t = 2s$.



A. $X = 5m$

B. $X = 7m$

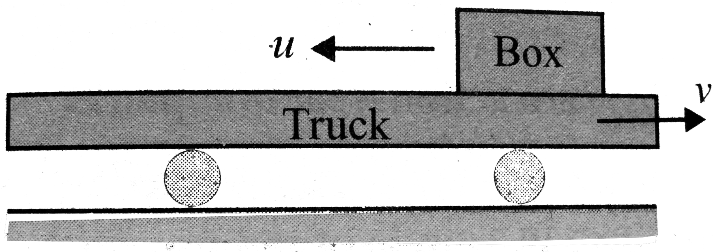
C. $X = 3m$

D. $X = 2m$

Answer: B

Watch Video Solution

46. A turck is moving on the ground with a velocity $v = 12m/s$ and a box is moving on the truck with respect to it with a velocity $u = 5m/s$ as shown in the figure. What is the velocity of the box with respect to the ground?



A. $5ms^{-1}$ towards right

B. $7ms^{-1}$ towards left

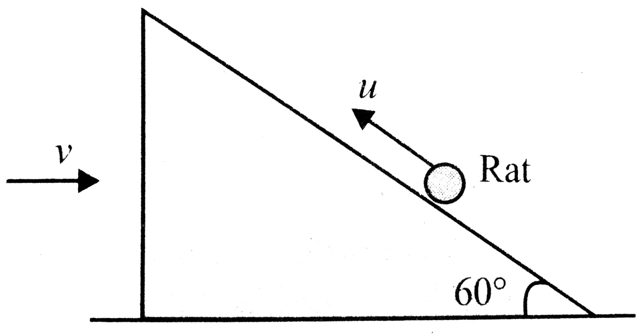
C. $7ms^{-1}$ towards right

D. $5ms^{-1}$ towards left

Answer: C

Watch Video Solution

47. A wedge is placed on a smooth horizontal plain and a rat runs on its sloping side. The velocity of the wedge is $v = 4ms^{-1}$ towards the right. What should be the velocity of the rat with respect to the wedge (u), so that the rat appears to ,move in the vertical direction to an observer stading on the ground?



A. (a)$2ms^{-1}$

B. (b)$4ms^{-1}$

C. (c)$8ms^{-1}$

D. (d)$4\sqrt{2}ms^{-1}$

Answer: C

Watch Video Solution

48. An annular disc of radius $r_1 = 10cm$ and $r_2 = 5cm$ is placed on a water surface. Find the surface tension force on the disc if we want to pull it from water surface. Take coefficient of surface tension as

$\sigma = 72dy \neq / cm, g = 10ms^{-2}$.

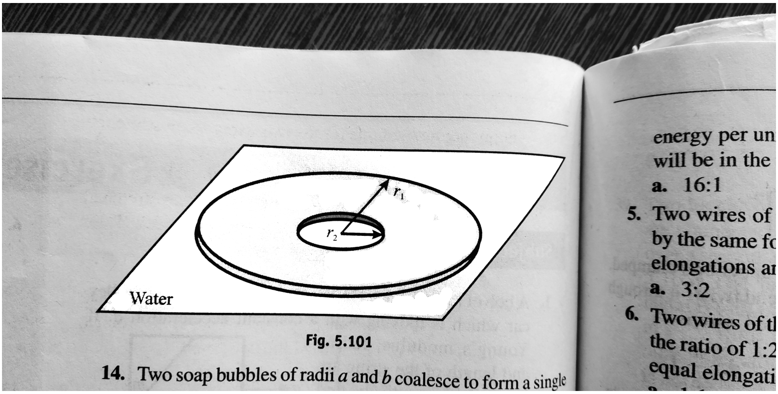


Fig. 5.101

14. Two soap bubbles of radii a and b coalesce to form a single

energy per un
will be in the
a. 16:1
5. Two wires of
by the same fo
elongations ar
a. 3:2
6. Two wires of th
the ratio of 1:2
equal elongati

A. 6782.4 dyne

B. 67.82 dyne

C. 678.24 dyne

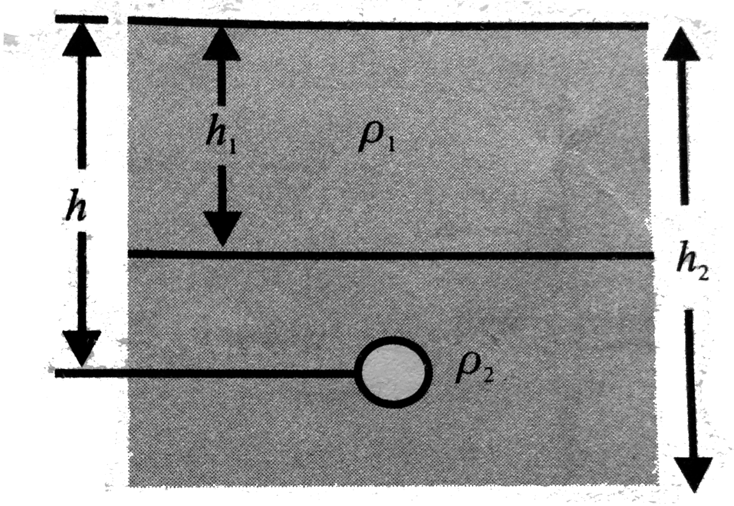
D. none of these

Answer: A

Watch Video Solution

49. Calculate the pressure inside a small air bubble of radus r situated at a depth h below the free surface of liquids of densities ρ_1 and ρ_2 and surface tennsions T_1 and T_2. The thickness of the first and second liquids are h_1 and h_2 respectively. Take atmosphere pressure

$= P_0.$



A. $P_0 + \rho_1 g h_1 + \rho_2 g(h - h_1) - \frac{2T_2}{r}$

B. $P_0 + \rho_1 g h_1 + \rho_2 g(h - h_1) + \frac{2T_2}{r}$

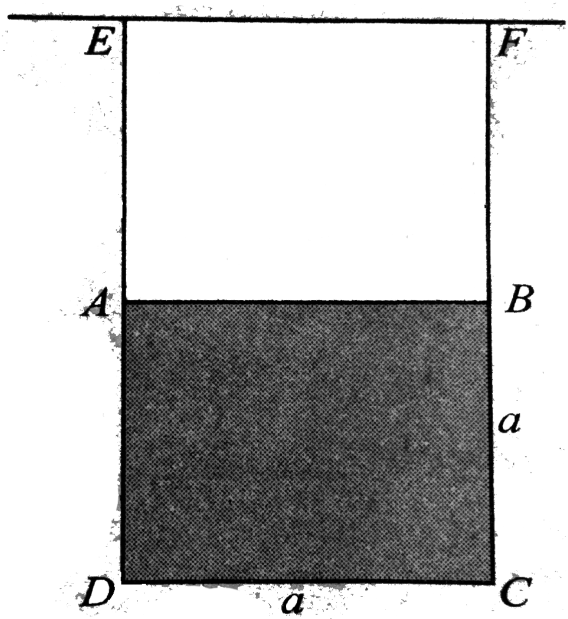
C. $P_0 - \rho_1 g h_2 + \rho_2 g(h - h_1) + \frac{2T_2}{r}$

D. none of these

Answer: B

Watch Video Solution

50. A thin uniform square plate $ABCD$ of side a and mass m is suspended in a vertical plane as shown in the figure. AE and BF are two massless inextensible strings. The line AB is horizontal. The tension in AE just after BF is cut will be



A. (a) $\frac{2mg}{5}$

B. (b) mg

C. (c) $\frac{2mg}{7}$

D. (d) $\frac{3mg}{5}$

Answer: A

Watch Video Solution

Mcq Type

1. Figure shows top view of an airplane blown off course by wind in various directions. Assume the magnitude of the velocity of the airplane relative to the wind and the magnitude of the velocity of the wind to be the same each case. $\overrightarrow{v}_{A/w}$ = velocity of the airplane relative to the wind, $\vec{v}_{w/g} =$

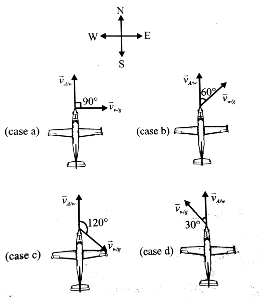
velocity of the wind in ground frame

A. Air plane travels fastest across the ground in case d

B. Airplane travels slowest across across the ground in case c

C. Airplane experiences in the maximum lateral displacement in case a in a given time.

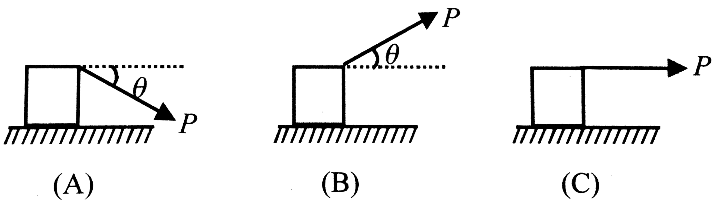
D. In none of thecases, the velocity of the wind with respect to the airplanes can be directed along south west



Answer: A::B::C::D

View Text Solution

2. Figure shows three blocks on a rough surface under the influene of a force P of the same magnitude in all the three cases. Coefficient of friction is the same between each block and the ground. What possile relation holds between the magnitudes of normal reaction and friction force?(Assume that the blocks do not overturn about edge.) Here f_A, f_B and f_C are frictional forces and N_A, N_B and N_C are reactions.



A. $N_A > N_C > N_B$

B. $f_A > f_C > f_B$

C. $f_C > f_A = f_B$

D. $N_C > N_A = N_B$

Answer: A::B::D

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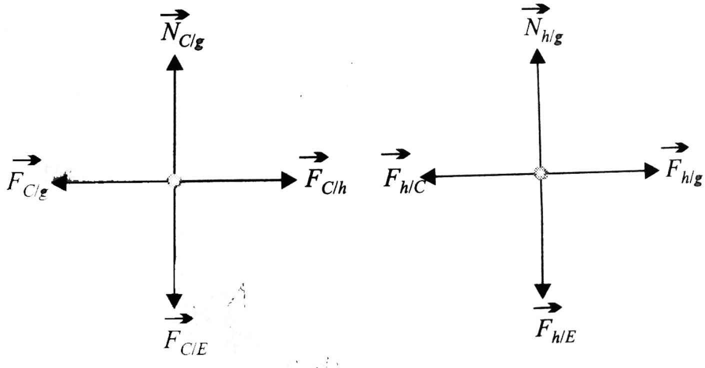
3.



Consider a cart being pulled by a horse with constant velocity. The horse exerts force $\vec{F}_{\frac{C}{h}}$ on the cart. (The subscript indicate the force on the cart due to horse.). The first subscript denotes the body on which force acts and second due to which it acts.

Choose the statements(s):

A. $\vec{f}_{C/g}, \vec{N}_{C/g}, \vec{N}_{h/g}$ are external force on a system consisting of a horse and a cart.

B. `vecf_(C//g)+vecf_(C//g) = 0

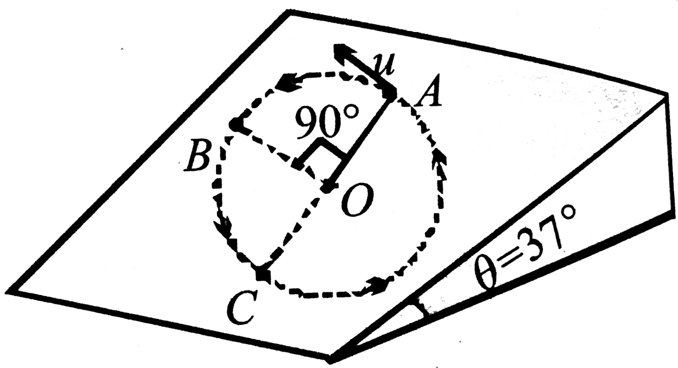
C. $\vec{N}_{C/g}$ and $\vec{F}_{C/E}$ are action reaction pairs.

D. $\vec{F}_{C/h}\vec{F}_{h/C}$ are action reaction pairs

Answer: A::B::C

Watch Video Solution

4. A small spehre of mass m is connected by a stirng to a nail at O and moves in a circle of radius r on the smooth plane inclined at an angle θ with the horizontal. If the sphere has a velocity u at the top position A. Mark the correct options.



A. Minimum velocity at A so that the string does not get slack instanntaneously is $\sqrt{\frac{3}{5}gr}$

B. Tension at B is $8mg/5$ if the sphere has the required velocity as in option a.

C. Tension C is $18mg/5$ in situation of option b.

D. none of these

Answer: A::C::D

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5. A man is standing on a plank which is placed on smooth horizontal surface. There is sufficient friction between feet of man and plank. Now man starts running over plank, correct statement is/are

A. Work done by friction on the man with respect to the ground is negative

B. Work done by friction on the man with respect to the ground is positive

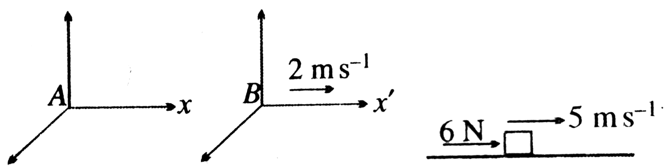
C. Work done by friction on the plank with respect to the ground is positive.

D. Work done by friction on the man with respect to the plank is zero.

Answer: A::C::D

Watch Video Solution

6. Consider a block of mass $10kg$. which rests on as smooth surface and is subjected to a horizontal force of $6N$. If observer A is in a fixed frame x.



A. The final speed of the block in $4s$ is $7.4m/s$ if it has an initial speed of $5m/s$ measured from the fixed frame.

B. The same speed will be observed by observer B Attached to the x axis that moves at a constant velocity of $2m/s$ relative to A.

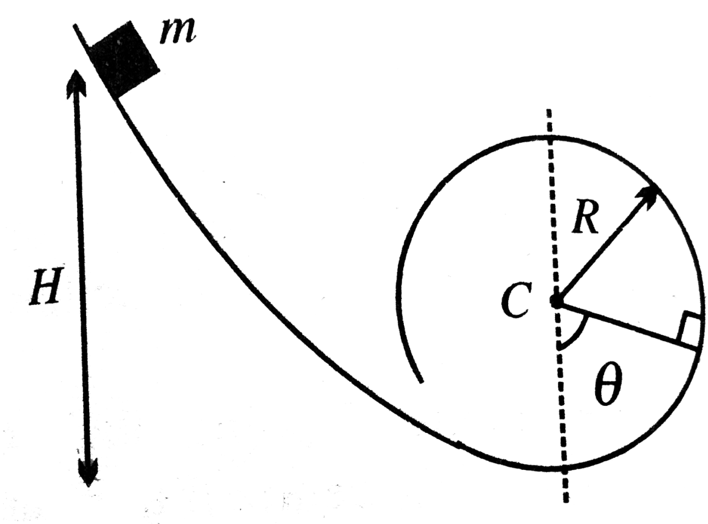
C. Principle of impulse and momentum is valid for observers in an inertial reference frame.

D. Momentum of a body is reference frame dependent.

Answer: B::D

Watch Video Solution

7. A particle of mass m is released from a height H on a smooth curved surface which ends into a vertical loop of radius R, as shown. Choose the correct alernative(s) if $H = 2R$.



A. The particles reaches the top of the loop with zero velocity

B. The particle cannot reach the top of the loop.

C. The particle breaks off at a height $h = R$ from the base of the loop.

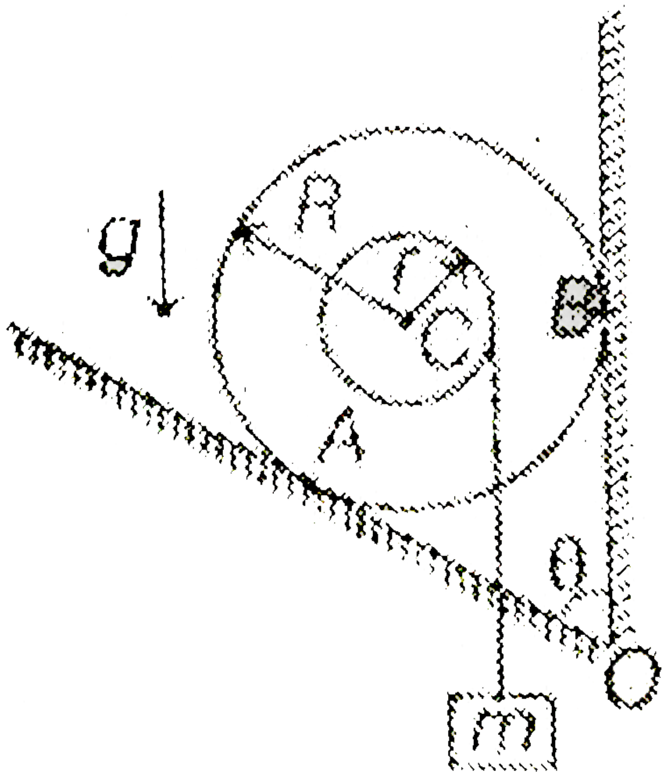
D. The particle breaks off at a height h from the base of the loop such that $R < h < 2R$

Answer: A::B::D

Watch Video Solution

8. A massles spool of inner radius r and other radius R is placed against vertical wall and tilted split floor as shown. A light inextensible thread is tightly wound around the spool through which a mass m is hanging. There exists no friction at point A, while the coefficient of friction between spool and point

B is μ. The angle between two surface is θ



A. The magnitude of the force on the spool

at B in order to maintain equilibrium is

$$mg\sqrt{\left(\frac{r}{R}\right)^2 + \left(1 - \frac{r}{R}\right)^2 \frac{1}{\tan^2 \theta}}$$

B. The magnitude of the force on the spool at B in order to maintain equilibrum is $mg\left(1-\frac{r}{R}\right)\frac{1}{\tan\theta}$

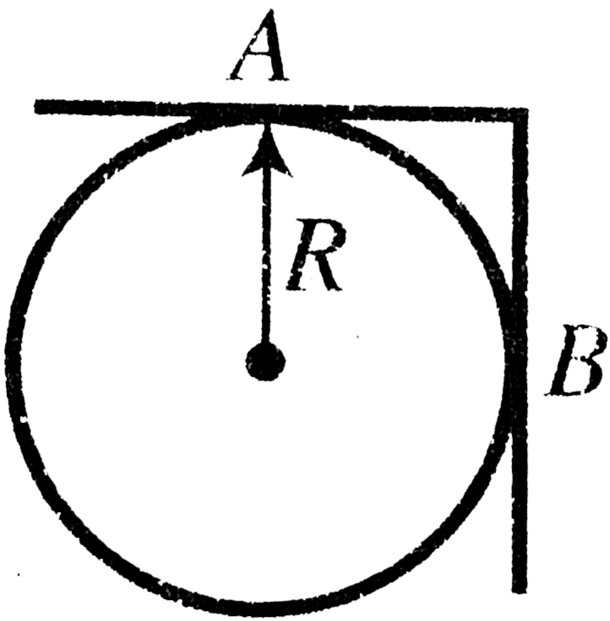
C. The minimum value of μ for the system to remain in equilibrium is $\frac{\cot\theta}{(R/r)-1}$

D. The minimum values of μ for the system to remain in equilibrium is $\frac{\tan\theta}{(R/r)-1}$

Answer: A::D

Watch Video Solution

9. A rod bent at right angle along its centre line, is placed on a rough horizontal fixed cylinder of radius B as shown in figure. Mass of rod is $2m$ and rod is in equilibrium. Assume that friction force on rod at A and B are equal in magnitude.



A. Normal force applied by the cyinder on the rod at A is $3mg/2$.

B. Normal force appplied by the cylinder on rod at B must be zero.

C. Friction force acting on rod at B is upwards

D. Normal force applied by the cyinder on rod at A is mg.

Answer: A::C

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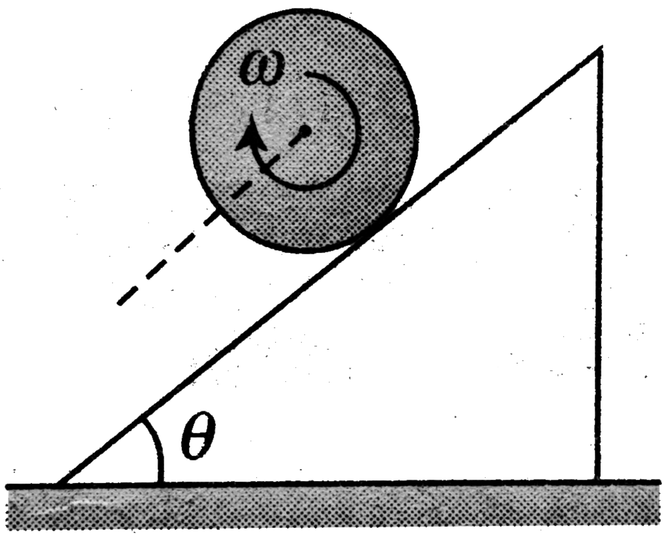
10. A solid sphere is given an angular velocity ω and kept on a rough fixed incline plane. Then choose the correct statement.



A. If $\mu = \tan\theta$, then the sphere will be in

linear equilibrium for some time and

after that pure rolling down the plane will start

B. If $\mu = \tan\theta$, then sphere will move up the plane and frictional force acting all the time will be $2mg\sin\rho$.

C. If $\mu = \tan\theta/2$ there will never be pure rolling (consider inclined plane to be long enough).

D. If the incline plane is not fixed at it is on the smooth horizontal surface, then the linear momentum of the system (wedge and sphere) can be conserved in the horizontal direction.

Answer: A::D

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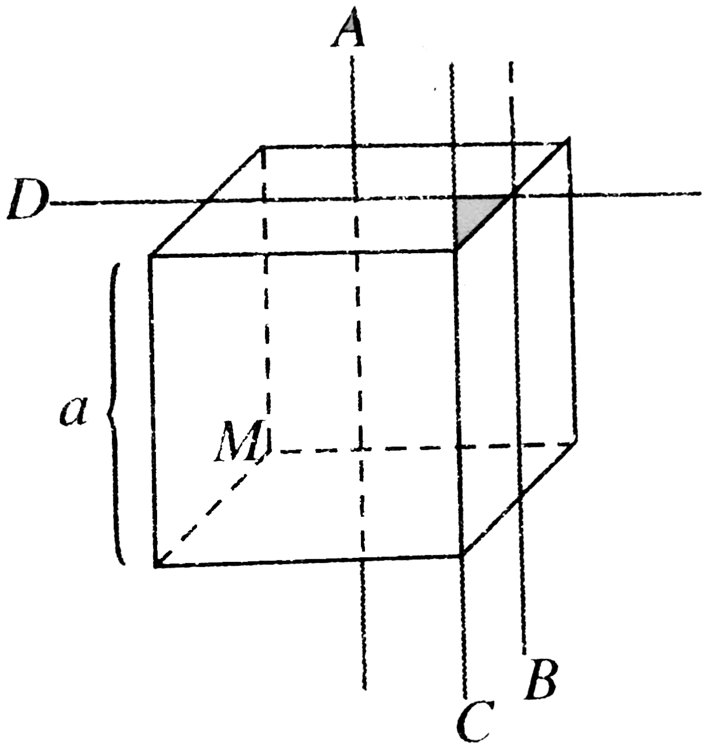
11. Illustrated below is a uniform cubical block of mass M and side a. Mark the correct statement(s).



A. The moment of inertia about axis A, passing through the centre of mass is

$$IA = \frac{1}{6}Ma^2$$

B. The moment of inertia about axis B, which bisects one of the cube faces is

$$IB = \frac{5}{12}Ma^2$$

C. The moment of in nertia about axis C, along one of the cube edges is

$$IC = \frac{2}{3}Ma^2.$$

D. The moment of inertia about axis D which bisects one of the horizontal cube faces is $\frac{7}{12}Ma^2$

Answer: A::B::C

Watch Video Solution

12. A body floats on water and then also on an oil of densily 1.25. Which of the following is/are true?

A. The body loses more weight in oil than in water.

B. The volume of water displaced is 1.25 times that of oil diplaced

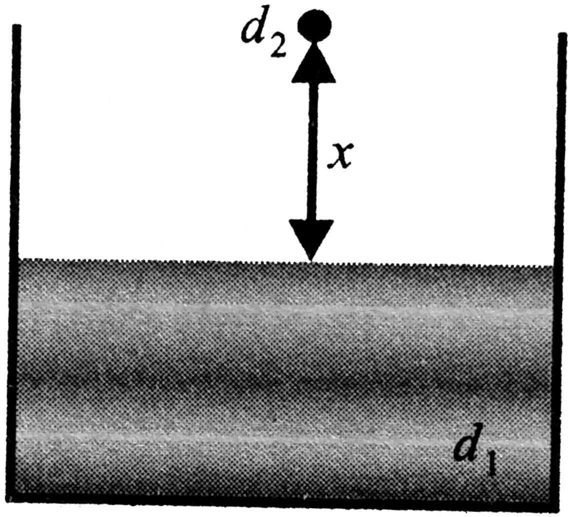
C. The body experiences equal upthrust form water and oil.

D. Apparent weight is zero in both cases.

Answer: B::C::D

Watch Video Solution

13. A body of density d_2 is dropped from rest at a height x into a beaker having a liquid of density $d_1 (d_2 > d_1)$. Which of the following is/are true?



A. The speed with which the body just enters the liquid is $\sqrt{2gx}$

B. The body has an acceleration of $g\left(1-\frac{d_1}{d_2}\right)$ downwards

C. The body does not come back to the surface of the liquid (observation made after a long time).

D. none

Answer: A::B::C

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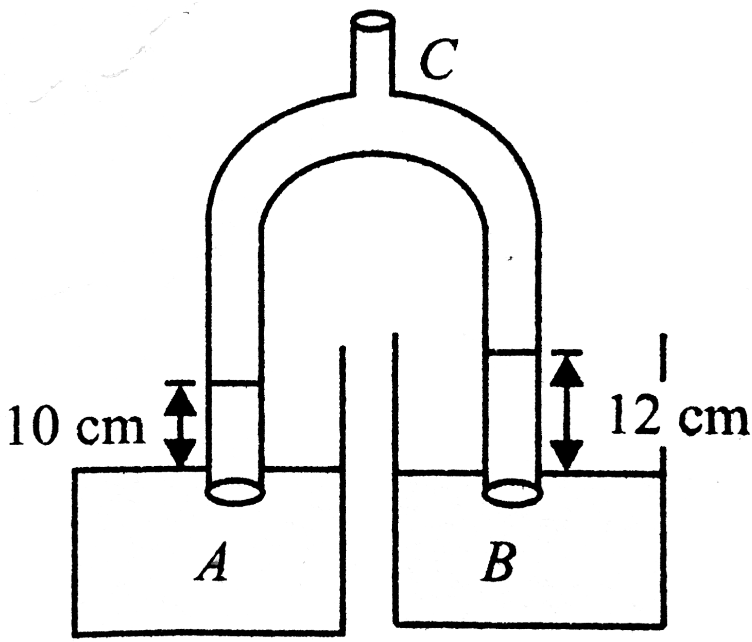
14. The limbs of a U-tube are lowerd into beakes A and B. A contains water and B some other liquid. Density of water is $1g/cm^3$.

Some air is pumped out from C and then this end is closed, as a result of this liquids rise by $10cm$ and $12cm$ respectively, on the left and right side. which of the following is/are correct?



A. (a)Density of the liquid in B is $0.83g/\mathrm{cc}$

B. (b)The heights raised by water and the other liquid in both the sides will change if beakers are kept at different heights

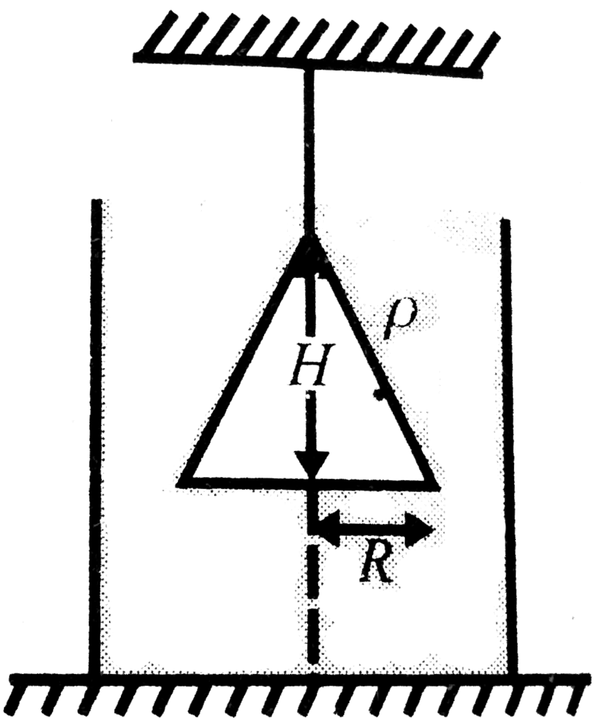
C. (c)The heights raised by water and the other liquid in both sides will be inependent of the positions of the beakers.

D. (d)Liquid in B in denser than water in A.

Answer: A::C

Watch Video Solution

15. The cone of radius R and height H is hanging inside a liquid of density by means of a string a shwon in the figure.



A. Net force on the cone by the liquid is equal to buoyancy force on the cone.

B. Force on the bottom surfae of the cone is more than buoyancy force on the cone.

C. Net force on the slant surface of the cone is more than buoyancy force on the cone.

D. Net force on the slant surface of the cone is less than buoyancy force on the cone.

Answer: A::B::C

Watch Video Solution

16. Two particles move on a circular path (one just inside and the other just outside) with the angular velocities ω and 5ω starting from the same point. Then

A. the cross each other at regular intervals of time $2\pi / 4\omega$ when their angular velocities are oppositely directed

B. they cross each other at point on the path subtending an angle of 60° at the centre if their angular velocities are oppositely directed

C. the cross at intervals of time $\pi / 3\omega$ if their angular velocities are oppositely directed

D. they cross each other at points on the path subtendingf 90 at the centre if their angular velocities are in the same sence

Answer: B::C::D

Watch Video Solution

17. A particle starts moving along a straight line path with a velocity $10ms^{-1}$. After 5 s, the distance of the particle from the starting point is 50 m. Which of the following statement about the nature of motion of the particle are correct?

A. The body may be speeding up with a constant positve acceleration.

B. The body may be moving with a constant velocity.

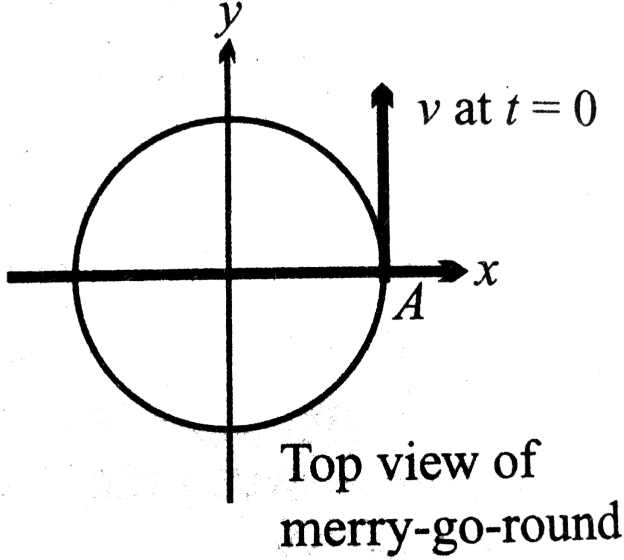
C. The body may have a constant negative acceleration.

D. The body may be first accelerated and then retarded.

Answer: B::C::D

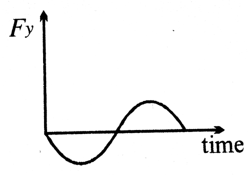
Watch Video Solution

18. A boy is sitting on a seat of merry-go-round moving with a constant angular velocity. A $t = 0$, the boy is at position A as shown in the figure

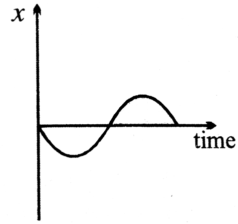


Which of the following graphs are correct? All graphs are sinusoidal.

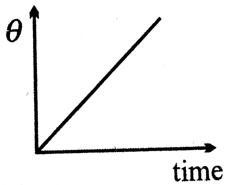
A. F_y is the y-component of the force keeping the boy moving in a circle.



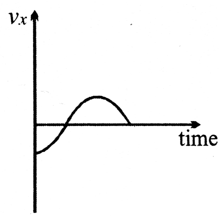
B. x is the x-component of the boy's position.



C. θ is the angle that the positoin vector of the boy makes with the positive x-axis.



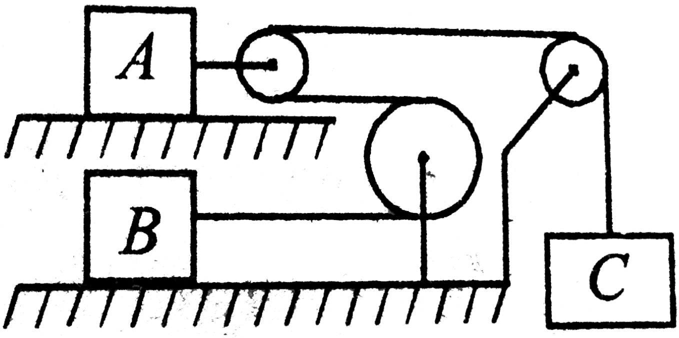
D. V_x is the x-component of the boy's velocity.



Answer: A::C

Watch Video Solution

19. Consider three masses A, B and C as shoon in the figure. Friction coefficient between all surfaces is 0.5. Pulleys are smooth. (Given $m_A = 1kg, m_B = 1kg)$ Mass of C may have any value



A. (a)is possible that both A and B remain at rest

B. (b) It is possible that both A and B accelerate.

C. (c) It is possible that both A accelerates but B does not accelerate

D. (d) If B accelearates, then A definitely accelarates

Answer: A::B::C::D

Watch Video Solution

20. A man of mass m walks from end A to the other end B of a boat of mass M and length l. The coefficient of friction between the man and the boat is μ an neglect any resistive force between the boat and the water.

A. (a)If the man runs at his maximum acceleration, the acceleration of the boat is $(m / M)\mu g$.

B. (b)The minimum time take by the man to reach the other end of the boat is $\sqrt{\frac{2MI}{(M+m)\mu g}}$

C. (c)If man runs at his maximum acceleration the acceleration of boat is $\frac{m}{m+M}\mu g$

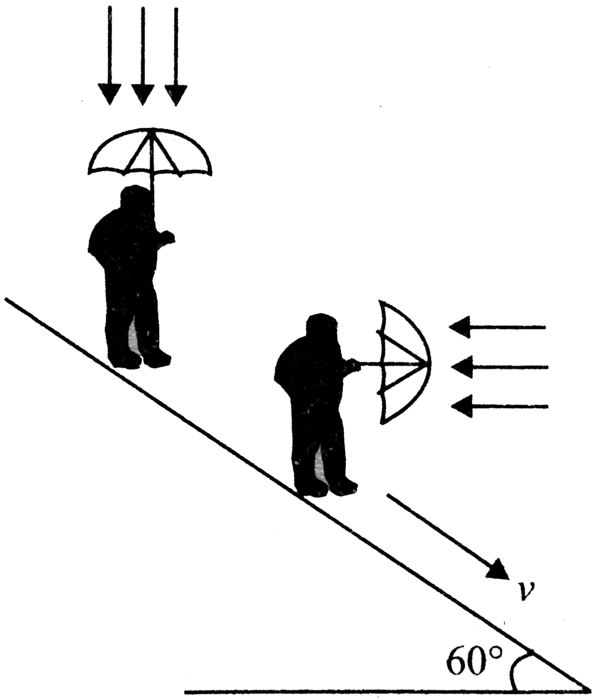
D. (d)The minimum time take by the man to reach the other end of the boat is $\sqrt{\frac{2ml}{(M+m)\mu g}}$

Answer: A::B

Watch Video Solution

Lc Type

1. A man standing on a inclined plain observes rain is falling verticaly. When he starts moving down the inclined plain with velocity $v = 6m/s$ observes rain hitting him horizontally.



The actual velocity of rain is

A. $3m/s$

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

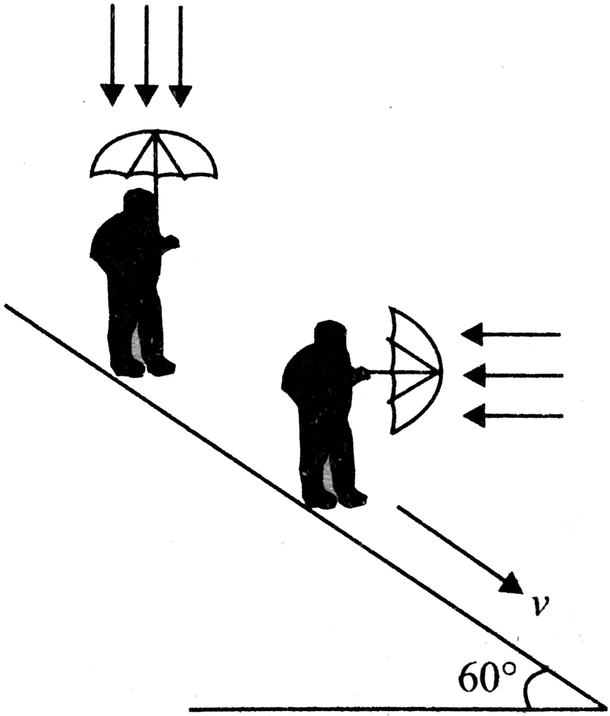
C. $4m/s$

D. none of these

Answer: B

Watch Video Solution

2. A man standing on a inclined plain observes rain is falling vertically. When he starts moving down the inclined plain with velocity $v = 6m/s$ observes rain hitting him horizontally.



The velocity of rain with respect to the man when he is moving down is

A. $3m/s$

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

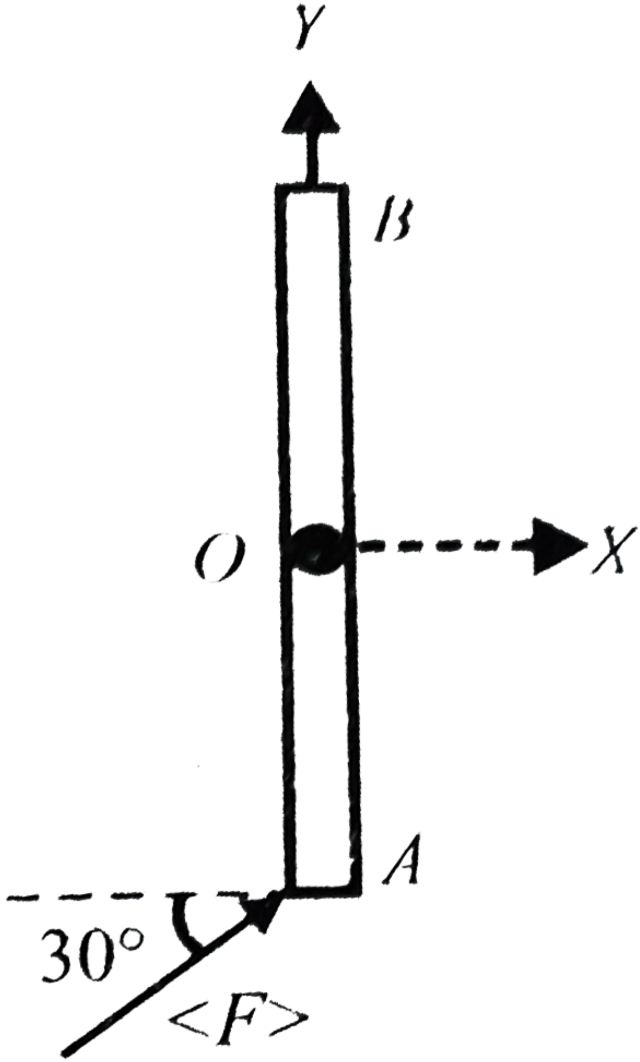
C. $4m/s$

D. none of these

Answer: A

Watch Video Solution

3. A straight rigid rod of mass M and length L lies on a smooth horizontal table. Taking the co-ordinate axes as shown in the figure and assuming an average force $< F >$ acting for a small time interval $(\triangle t)$, at the end A, making an angle 30° with the X-axis, Based on the above passege, answer the following questions.



The angular impulse, due to the force about O

, is

A. $\frac{\sqrt{5}}{4}F(\triangle t)L\hat{k}$

B. $\frac{\sqrt{5}}{2}F(\triangle t)L\hat{k}$

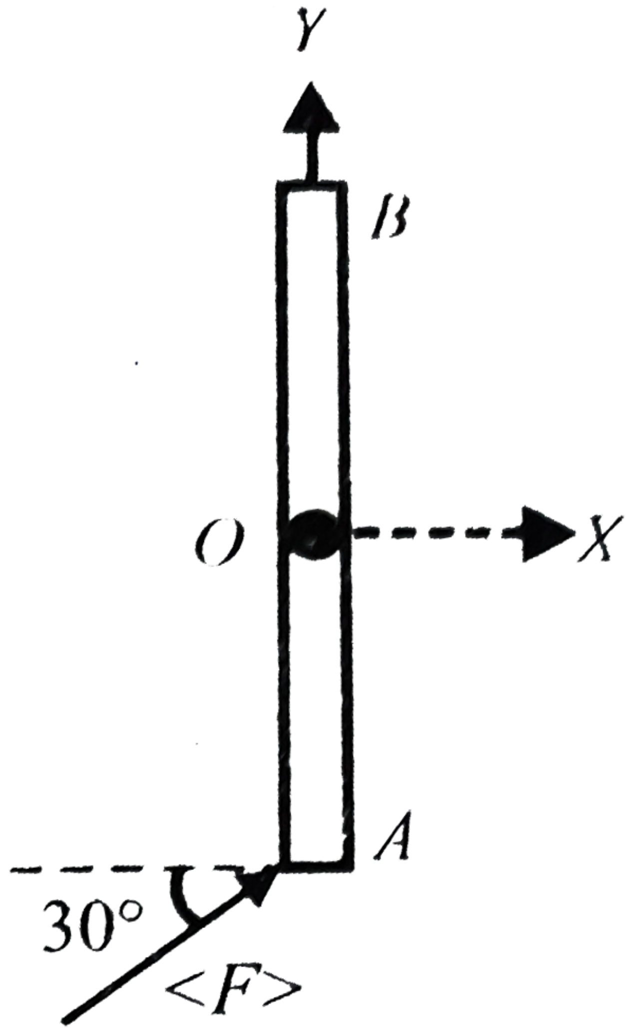
C. $\frac{\sqrt{3}}{4}F(\triangle t)L\hat{k}$

D. $\frac{\sqrt{3}}{2}F(\triangle t)L\hat{k}$

Answer: C

Watch Video Solution

4. A straight rigid rod of mass M and length L lies on a smooth horizontal table. Taking the co-ordinate axes as shown in the figure and assuming an average force $< F >$ acting for a small time interval ($\triangle t$), at the end A, making an angle 30° with the X-axis, Based on the above passege, answer the following questions.



Angular velocity of rod about O is

A. $\dfrac{3\sqrt{5} < F > (\triangle t)}{ML}$

B. $\frac{2\sqrt{5} < F > (\triangle t)}{ML}$

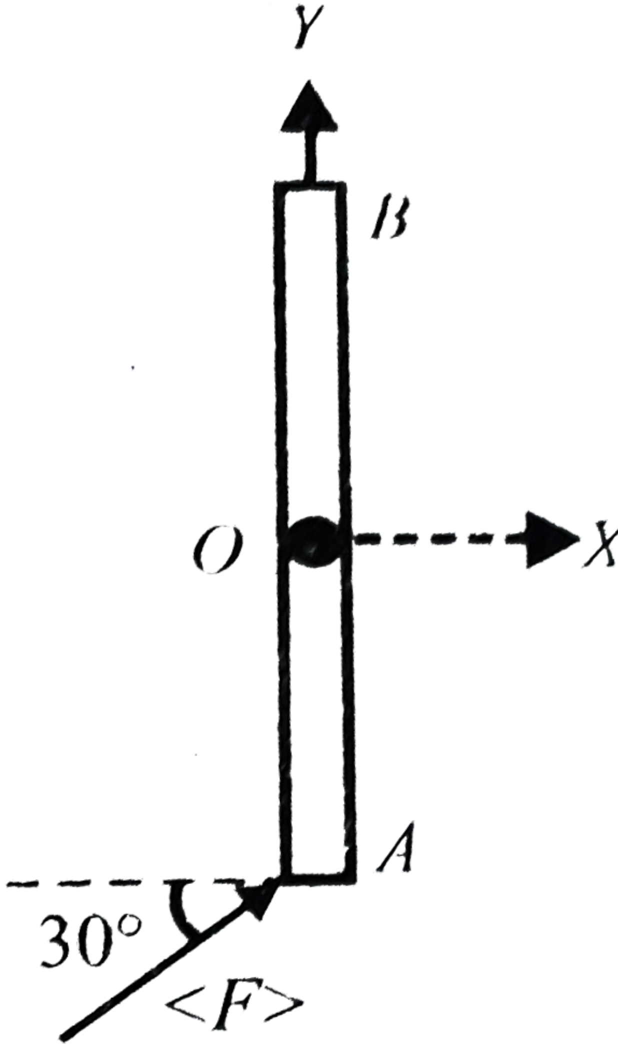
C. $\frac{2\sqrt{3} < F > (\triangle t)}{ML}$

D. $\frac{3\sqrt{3} < F > (\triangle t)}{ML}$

Answer: D

Watch Video Solution

5. A straight rigid rod of mass M and length L lies on a smooth horizontal table. Taking the co-ordinate axes as shown in the figure and assuming an average force $< F >$ acting for a small time interval $(\triangle t)$, at the end A, making an angle 30° with the X-axis, Based on the above passege, answer the following questions.



Linear velocity of the CM of rod is

A. $\frac{< F > (\triangle t)}{2m} / (2m)\left(\sqrt{3}\hat{i} + \hat{j}\right)$

B. $\frac{< F > (\triangle t)}{2m} / (2m)\left(\sqrt{5}\hat{i} + 2\hat{j}\right)$

C. $\frac{< F > (\triangle t)}{2m} / m\left(\sqrt{3}\hat{i} + \hat{j}\right)$

D. $\frac{< F > (\triangle t)}{2m} / m\left(\sqrt{5}\hat{i} + \hat{j}\right)$

Answer: A

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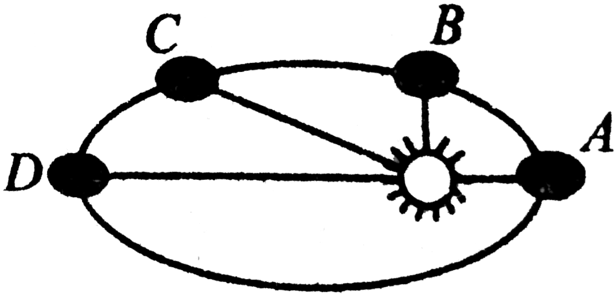
6. A planet is revolving around the sun in an elliptcal orbit. Its KE is different for different points and the total energy is negative. Its linear momentum is not conserved the eccentricity decides the shape of the orbit.



Velocity of the planet is minimum at

A. (a)C

B. (b)D

C. (c)A

D. (d)B

Answer: B

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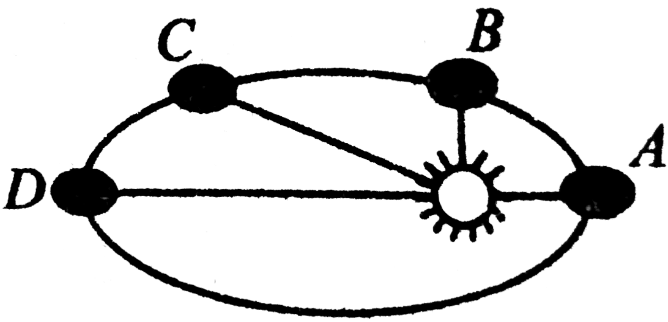
7. A planet is revolving around the sun in an elliptcal orbit. Its KE is different for different points and the total energy is negative. Its linear momentum is not conserved the eccentricity decides the shape of the orbit.



Net torque on the planet is

A. constant at all points

B. zero at all point

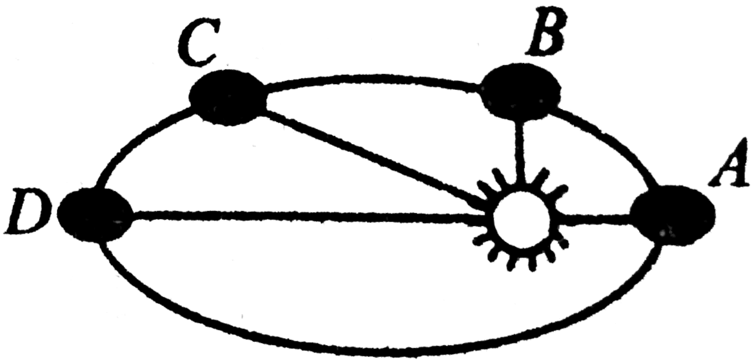
C. maximum at A

D. minimum at D

Answer: B

Watch Video Solution

8. A planet is revolving around the sun in an elliptcal orbit. Its KE is different for different points and the total energy is negative. Its linear momentum is not conserved the eccentricity decides the shape of the orbit.



Linear momentum of the planet is

A. different of different points of the orbit

B. conserved

C. non conserved

D. none of these

Answer: A::C

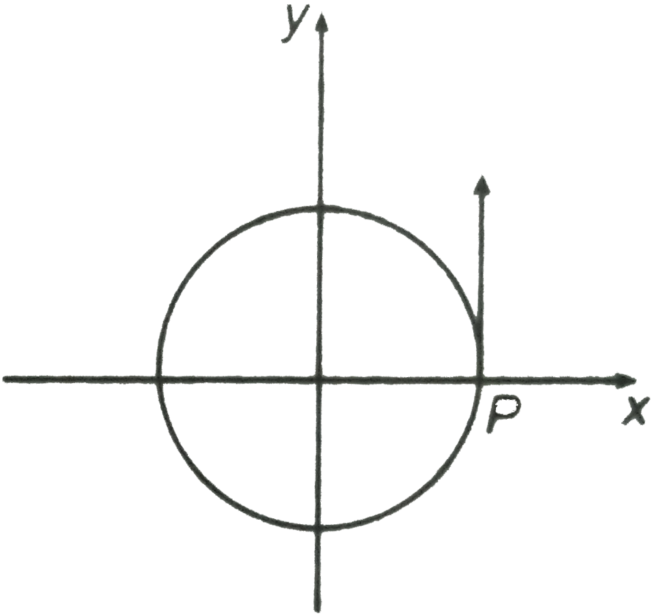
Watch Video Solution

9. A train is moving with a constant speed of $10m/s$ in a circle of radius $\frac{16}{\pi}$m. The plane of the circle lies in horizontal x-y plane. At time t = 0, train is at point P and moving in counter-clockwise direction. At this instant, a stone is thrown from the train with speed $10m/s$ relative to train towards negative x-axis at an angle of 37° with vertical z-axis . Find

(a) the velocity of particle relative to train at the highest point of its trajectory.

(b) the co-ordinates of points on the ground where it finally falls and that of the hightest point of its trajectory. (Take g

$= 10m / s^2, \sin 37^\circ = \frac{3}{5}$



A. $\left(-4\hat{i}10\hat{j}\right)$

B. $\left(4\hat{i} - 10\hat{j}\right)$

C. $\left(4\hat{i} + 10\hat{j}\right)$

D. $\left(-4\hat{i}-10\hat{j}\right)$

Answer: C

Watch Video Solution

10. A train is moving with a constant speed of $10m/s$ in a circle of radius $\frac{16}{\pi}$m. The plane of the circle lies in horizontal x-y plane. At time t = 0, train is at point P and moving in counter-clockwise direction. At this instant, a stone is thrown from the train with speed $10m/s$

relative to train towards negative x-axis at an angle of 37° with vertical z-axis . Find

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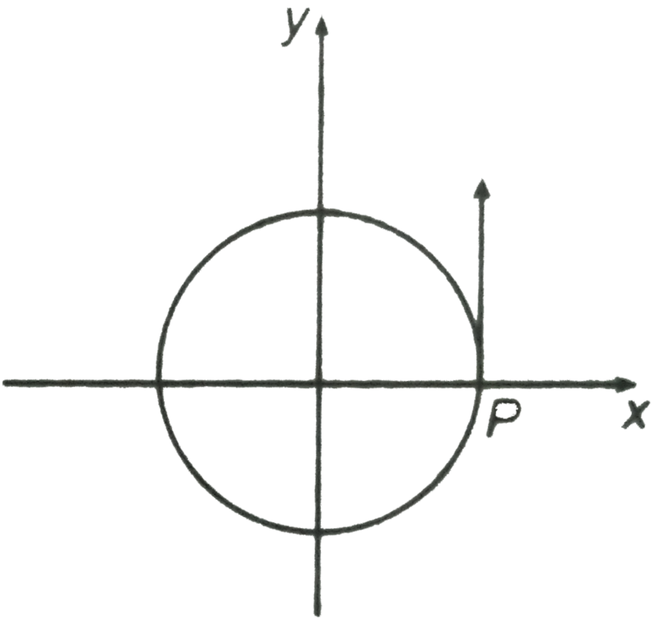

A. $\frac{\pi}{2}$

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

C. π

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

Answer: A

Watch Video Solution

11. A train is moving with a constant speed of $10m/s$ in a circle of radius $\frac{16}{\pi}$m. The plane of the circle lies in horizontal x-y plane. At time t = 0, train is at point P and moving in counter-clockwise direction. At this instant, a stone is thrown from the train with speed $10m/s$

relative to train towards negative x-axis at an angle of 37° with vertical z-axis . Find

(a) the velocity of particle relative to train at the highest point of its

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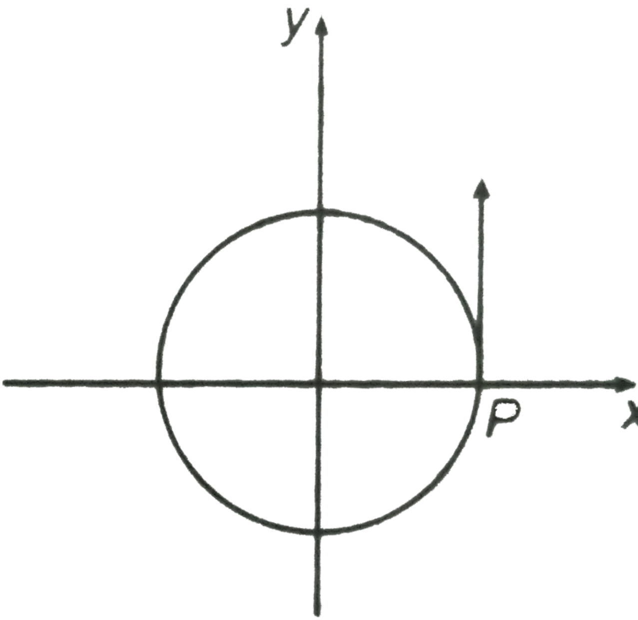
(b) the co-ordinates of points on the ground where it finally falls and that of the hightest point of its trajectory. (Take g

$= 10m/s^2, \sin 37^\circ = \frac{3}{5}$



A. $\left(-9.2\hat{i} - 8\hat{j}\right)$

B. $\left(9.2\hat{i} + 8\hat{j}\right)$

C. $\left(9.6\hat{i} - 16\hat{j}\right)$

D. $\left(- 9.6\hat{i} + 16\hat{j} \right)$

Answer: D

Watch Video Solution

12. A model rocket rests on a frictionless horizontal surface and is joined by a string of length l to a fixed point so that the rocket moves in a horizontal circular path of radius l. The string will break if its tensiion exceeds a value T. The rocket engine provides a thrust F

of constant magnitude along the rocket's direction of motion. the rocket has a mass m that does not change with time. Answer the following questions based on the above passage.

Starting from rest at $t = 0$ at what later time t_1 is the rocket travelling so fast that the string breaks. Ignnore any air resistance.

A. $\left(\frac{2mlT}{F^2}\right)^{1/2}$

B. $\left(\frac{mlT}{F^2}\right)^{1/2}$

C. $\left(\frac{mlT}{2F^2}\right)^{1/2}$

D. $\left(\frac{mlF}{T^2}\right)^{1/2}$

Answer: B

Watch Video Solution

13. A model rocket rests on a frictionless horizontal surface and is joined by a string of length l to a fixed point so that the rocket moves in a horizontal circular path of radius l. The string will break if its tensiion exceeds a value T. The rocket engine provides a thrust F

of constant magnitude along the rocket's direction of motion. the rocket has a mass m that does not change with time. Answer the following questions based on the above passage.

What was the magnitude of instantaneous net acceleration at time $t_1 / 2$? Obtain answer in terms of F, T and m.

A. $\frac{\left[T^2+8F^2\right]^{1/2}}{m}$

B. $\frac{\left[T+4F^2\right]^{1/2}}{2m}$

C. $\frac{\left[T^2+16F^2\right]^{1/2}}{4m}$

D. none of these

Answer: C

Watch Video Solution

14. A model rocket rests on a frictionless horizontal surface and is joined by a string of length l to a fixed point so that the rocket moves in a horizontal circular path of radius l. The string will break if its tensiion exceeds a value T. The rocket engine provides a thrust F

of constant magnitude along the rocket's direction of motion. the rocket has a mass m that does not change with time. Answer the following questions based on the above passage.

What distance does the rocket travel between the time t_1 when the string breaks and the time $2t_1$? The rocket engine continues of operate after the string breaks.

A. $\frac{3lT}{2F}$

B. $\frac{2lT}{3F}$

C. $\frac{lT}{2F}$

D. $\frac{2lT}{F}$

Answer: A

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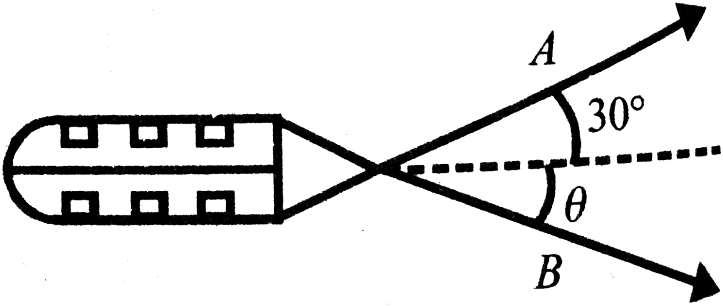
15. Two ropes are puling a large ship at rest of mass $1 \times 106kg$ into harbour. Rope A exerts a force of $40, 000N$ and rope B exerts a force of $30, 000N$.



The angle θ if the slip is to move directly forward is

A. $\sin^{-1}\left(\frac{4}{9}\right)$

B. $\sin^{-1}\left(\frac{2}{3}\right)$

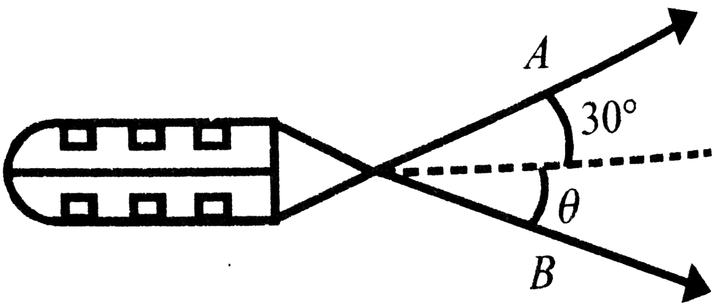
C. $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$

D. none of these

Answer: B

Watch Video Solution

16. Two ropes are puling a large ship at rest of mass $1 \times 106 kg$ into harbour. Rope A exerts a force of $40,000N$ and rope B exerts a force of $30,000N$. Also the value of sin inverse θ is $\frac{4}{5}$



If the acceleration of the ship is $0.03 ms^{-2}$, the magnitude of the resistive forces on the ship is

A. $40,000 \times 9.8N$

B. $30,000 \times 9.8N$

C. $27,000N$

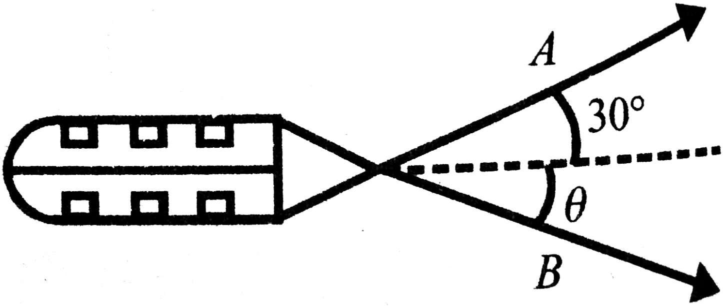
D. none of these

Answer: C

Watch Video Solution

17. Two ropes are puling a large ship at rest of mass $10^6 kg$ into harbour. Rope A exerts a force of $40,000N$ and rope B exerts a force of

$30,000N$.



The angle θ if the slip is to move directly forward is

A. 1 min $30s$

B. 1 min

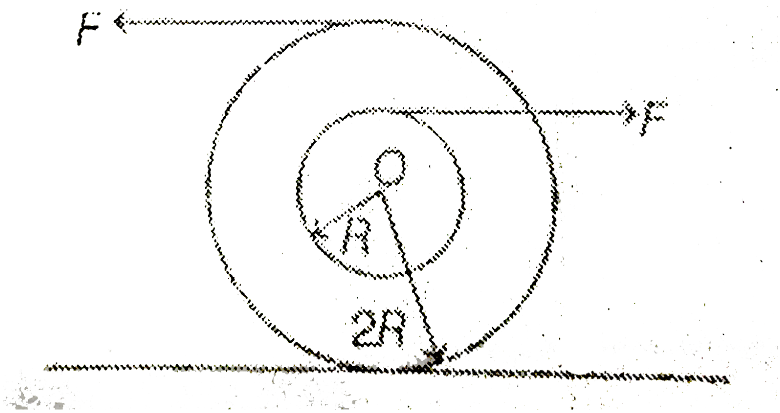
C. $40s$

D. $20s$

Answer: D

Watch Video Solution

18. In the given figure F=10N , R=1 m , mass of the body is 2 kg and moment of inertia of the body about an axis passing through O and perpendicular to plane of body is $4kg-m^2$ .O is the centre of mass of the body.



If the ground is smooth , what is total kinetic energy of the body after 2 s?

A. $100J$

B. $75J$

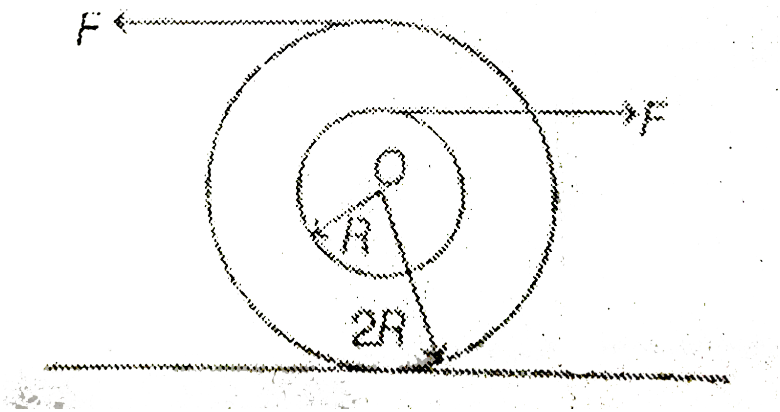
C. $50J$

D. $25J$

Answer: C

Watch Video Solution

19. In the given figure F=10N , R=1 m , mass of the body is 2 kg and moment of inertia of the body about an axis passing through O and perpendicular to plane of body is $4kg - m^2$ .O is the centre of mass of the body.



If ground is sufficiently rough , what is kinetic energy of the body now in the given time interval ?

A. $18.75J$

B. $16.67J$

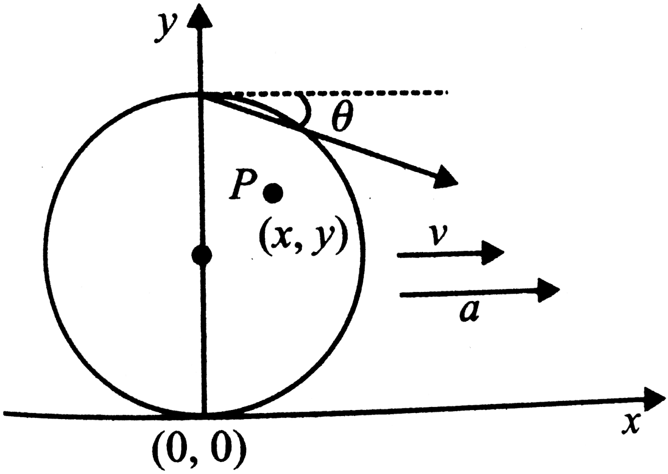
C. $5.55J$

D. cannot be found

Answer: B

Watch Video Solution

20. A disc having radius R is rolling without slipping on a horizontal $(x-z)$ plane. Centre of the disc has a velocity v and acceleration a as shown.



Speed of point P having coordinates (x, y) is

A. $\dfrac{v\sqrt{x^2+y^2}}{R}$

B. $\dfrac{v\sqrt{x^2+(y+R)^2}}{R}$

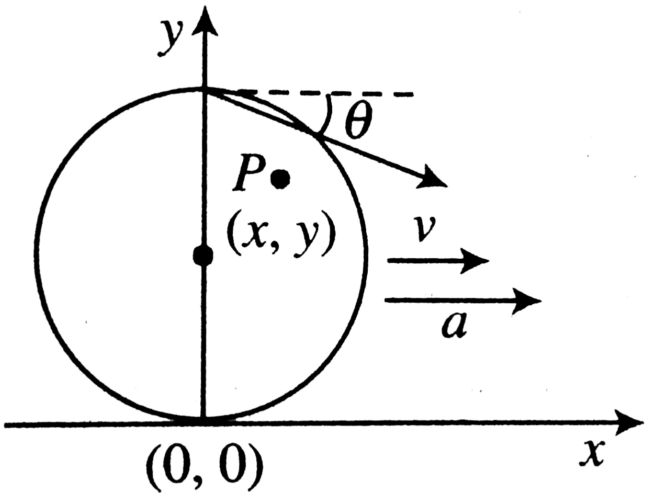
C. $\dfrac{v\sqrt{x^2-(y-R)^2}}{R}$

D. none

Answer: A

Watch Video Solution

21. A disc having radius R is rolling without slipping on a horizontal $(x - z)$ plane. Centre of the disc has a velocity v and acceleration a as shown.



If $v=\sqrt{2aR}$ the angle θ betweenn accelertion of the top most point and horizontal is

A. 0

B. 45°

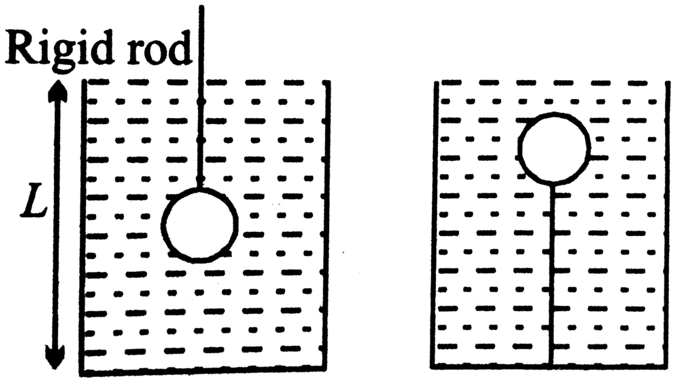
C. $\tan^{-1}(2)$

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

Answer: B

Watch Video Solution

22. A cylindrical container of length L is full to the brim with a liquid which has mass density ρ.it is placed on a weight -scale, the scale reading is W. A light ball of volume V and mass m which wold float on the liquid, if allowed to do so, is pushed gently downand held beneath the surface of the liquid with a rigid rod of negligible volume as shwon on the left.



What is the reading of the scale when the ball is fully immersed?

If instead of being pushed down by the rod, the ball is held in place by a thin string attached to the bottom of the containier as shown on the right.

A. $\rho g V$

B. m

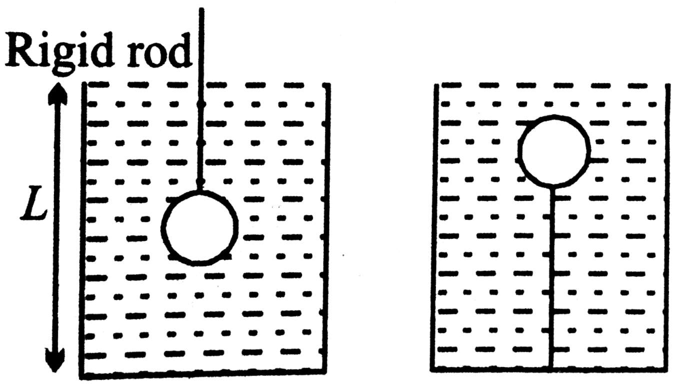
C. $m\rho - V$

D. none

Answer: A

Watch Video Solution

23. A cylindrical container of length L is full to the brim with a liquid which has mass density ρ.it is placed on a weight -scale, the scale reading is W. A light ball of volume V and mass m which wold float on the liquid, if allowed to do so, is pushed gently downand held beneath the surface of the liquid with a rigid rod of negligible volume as shwon on the



left.

What is the reading of the scale when the ball is fully immersed?

If instead of being pushed down by the rod, the ball is held in place by a thin string attached to the bottom of the containier as shown on the right.

A. $W - \rho V g$

B. W

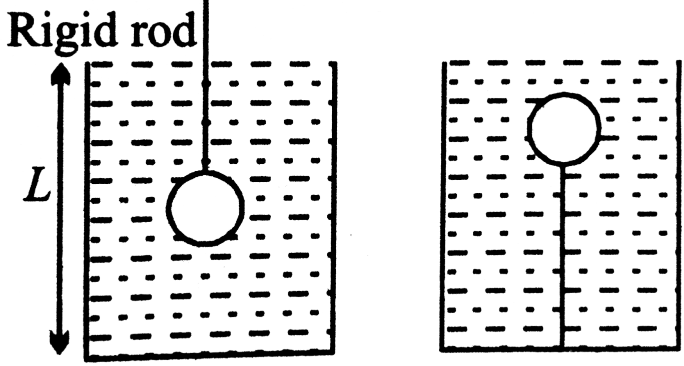
C. $W + mg - \rho V g$

D. none

Answer: B

Watch Video Solution

24. A cylindrical container of length L is full to the brim with a liquid which has mass density ρ.it is placed on a weight -scale, the scale reading is W. A light ball of volume V and mass m which woUld float on the liquid, if allowed to do so, is pushed gently downand held beneath the surface of the liquid with a rigid rod of negligible volume as shwon on the left.



What is the tension T in the string?

A. $(\rho V - m)g$

B. $\rho V g$

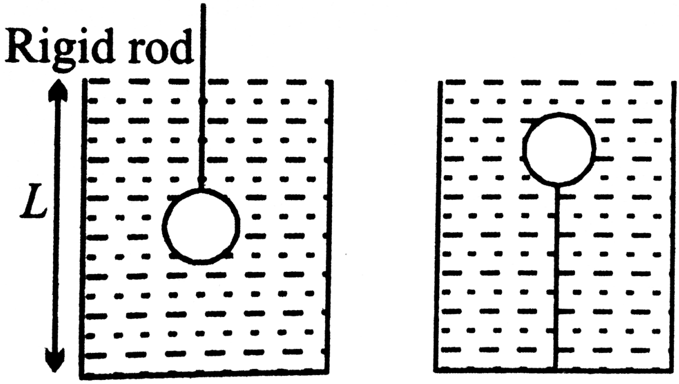
C. mg

D. none

Answer: A

Watch Video Solution

25. A cylindrical container of length L is full to the brim with a liquid which has mass density ρ.it is placed on a weight -scale, the scale reading is W. A light ball of volume V and mass m which wold float on the liquid, if allowed to do so, is pushed gently downand held beneath the surface of the liquid with a rigid rod of negligible volume as shwon on the



left.

What is the reading on the scale?

A. (a)$W - \rho V g$

B. (b)W

C. (c) $W + mg - \rho V g$

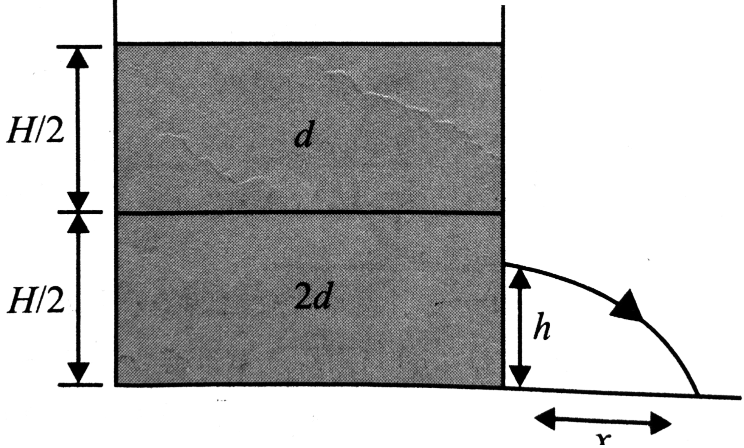
D. (d) none

Answer: C

Watch Video Solution

26. Fluids at rest exert a normal force to the walls of the container or to the sruface of the Body immersed in the fluid. The pressure exerted by this force at a point inside the liqid is the sum of atmospheric pressure and a factor which depends on the density of the liquid, the acceleration due to gravity and the height of the liquid, above that point. The upthrust acting on a body immersed in a stationary liquid is the net force acting on the body in the upward direction. A number of phenomenon of liquids in motion can be explain by Bernoulli's theorem which relates the pressure, flow speed and height for flow of an ideal incompressible fluid.

A container of large uniform corss sectional area. A resting on a horizontal surface holds two immiscible, non viscous and incompressile liquids of densities d and $2d$, each of height $H/2$ as shown in the figure. The lower density liquid is open to the atmosphere having pressure P_0.



Situation I:

A homogeneous solid cylinder of length $L(L < H/2)$. cross sectional area $A/5$ is immersed such that it floats with its axis vertical at liquid -liquid interface with lenght $L/4$ in the denser liquid.

The density of the solid is

A. $\dfrac{5d}{4}$

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

C. $\frac{2d}{4}$

D. $\frac{3d}{4}$

Answer: A

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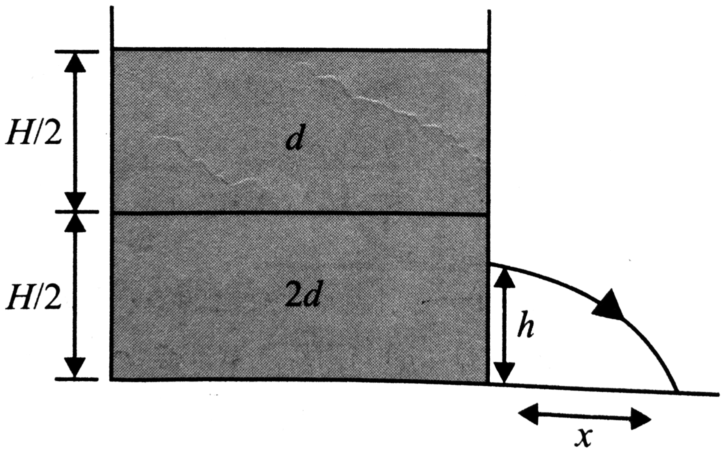
27. Fluids at rest exert a normal force to the walls of the container or to the sruface of the body immersed in the fluid. The pressure exerted by this force at a point inside the liqid is the sum of atmospheric pressure and a factor which depends on the density of the liquid, the acceleration due to gravity and the height of the liquid, above that point. The upthrust acting on a body immersed in a stationary liquid is the net force acting on the body in the upward direction. A number of phenomenon of liquids in motion can be explain by Bernoulli's theorem which relates the pressure, flow speed and height for flow of an ideal incompressible fluid.

A container of large uniform corss sectional area. A resting on a horizontal surface holds two immiscible, non viscous and incompressile liquids of densities d and $2d$, each of height $H/2$ as shown in the figure. The lower density liquid is open to the atmosphere having pressure P_0.



Situation I:

A homogeneous solid cylinder of length $L(L < H/2)$. cross sectional area $A/5$ is immersed such that it floats with its axis vertical at liquid -liquid interface with lenght $L/4$ in the denser liquid.

The total pressure at the bottom of the container is

A. $\left(\frac{H}{2}+\frac{L}{4}\right)dg$

B. $P_0+\left(\frac{3H}{2}+\frac{L}{2}\right)dg$

C. $P_0+\left(H+\frac{L}{4}\right)dg$

D. $P_0+\left(\frac{3H}{2}+\frac{L}{4}\right)dg$

Answer: D

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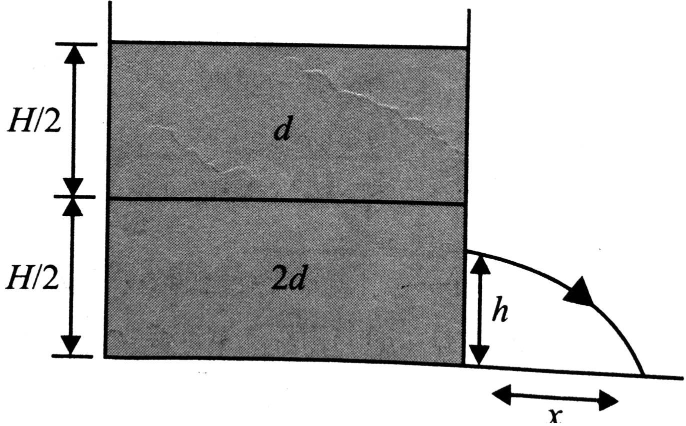
28. Fluids at rest exert a normal force to the walls of the container or to the sruface of the body immersed in the fluid. The pressure exerted by this force at a point inside the liqid is the sum of atmospheric pressure and a factor which depends on the density of the liquid, the acceleration due to gravity and the height of the liquid, above that point. The upthrust acting on a body immersed in a stationary liquid is the net force acting on the body in the upward direction. A number of phenomenon of liquids in motion can be explain by Bernoulli's theorem which relates the pressure, flow speed and height for flow of an ideal incompressible fluid.

A container of large uniform cross sectional area. A resting on a horizontal surface holds two immiscible, non viscous and incompressile liquids of densities d and $2d$, each of height $H/2$ as shown in the figure. The lower density liquid is open to the atmosphere having pressure P_0.



Situation II:

A cyliner is removed and the original arrangement is restored.A tiny hole of area $s(s < < A)$ is punched on the veritical sideof the containier at a height $h(h < H/2)$ The initial speed of efflux of the liquid at the hole is

A. $\frac{\sqrt{(4H - 3h)g}}{2}$

B. $\frac{\sqrt{(3H-4h)g}}{2}$

C. $\left(\frac{\sqrt{(3H-3h)g}}{2}\right)$

D. $\sqrt{(3H-3h)\frac{g}{2}}$

Answer: D

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29. Fluids at rest exert a normal force to the walls of the container or to the sruface of the body immersed in the fluid. The pressure exerted by this force at a point inside the liqid is the sum of atmospheric pressure and a factor which depends on the density of the liquid, the acceleration due to gravity and the height of the liquid, above that point. The upthrust acting on a body immersed in a stationary liquid is the net force acting on the body in the upward direction. A number of phenomenon of liquids in motion can be explain by Bernoulli's theorem which relates the pressure, flow speed and height for flow of an ideal incompressible fluid.

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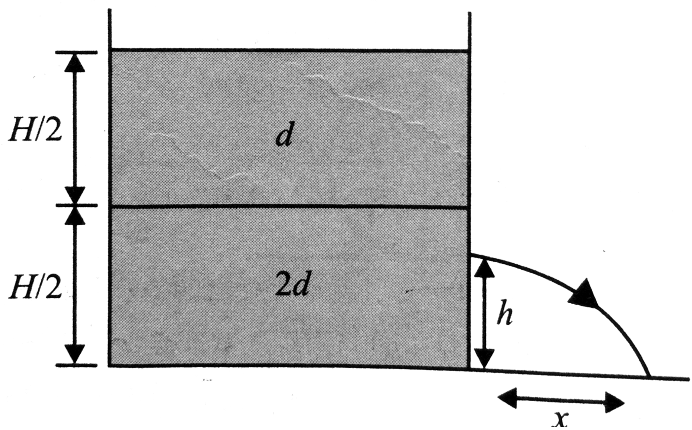

Situation II:

A cyliner is removed and the original arrangement is restoreed.A tiny hole of area $s(s << A)$ is punched on the veritical sideof the containier at a height $h(h < H/2)$

The horizontal distance x travelled by the liquid is

A. $\sqrt{(H - 3h)h}$

B. $\sqrt{3Hg}$

C. $\sqrt{(3H - 4h)h}$

D. $2h$

Answer: C

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30. Fluids at rest exert a normal force to the walls of the container or to the sruface of the body immersed in the fluid. The pressure exerted by this force at a point inside the liqid is the sum of atmospheric pressure and a factor which depends on the density of the liquid, the acceleration due to gravity and the height of the liquid, above that point. The upthrust acting on a body immersed in a stationary liquid is the net force acting on the body in the upward direction. A number of phenomenon of liquids in motion can be explain by Bernoulli's theorem which relates the pressure, flow speed and height for flow of an ideal incompressible fluid.

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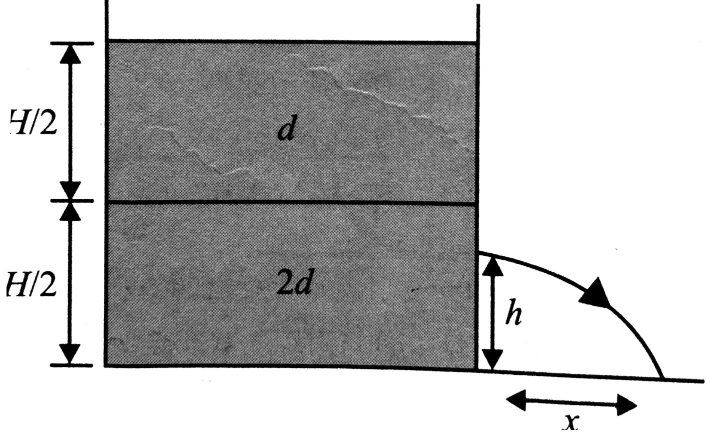

Situation II:

A cyliner is removed and the original arrangement is restoreed.A tiny hole of area $s(s < < A)$ is punched on the veritical side of the containier at a height $h(h < H/2)$

The height h_m at which the hole should be punched so that the liquid travels the maximum distance is

A. $\frac{2H}{3}$

B. $\frac{3H}{8}$

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

D. $\frac{4H}{3}$

Answer: B

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31. Fluids at rest exert a normal force to the walls of the container or to the sruface of the ody immersed in the fluid. The pressure exerted by this force at a point inside the liqid is the sum of atmospheric pressure and a factor which depends on the density of the liquid, the acceleration due to gravity and the height of the liquid, above that point. The upthrust acting on a body immersed in a stationary liquid is the net force acting on the body in the upward direction. A number of phenomenon of liquids in motion can be explain by Bernoulli's theorem which relates the pressure, flow speed and height for flow of an ideal incompressible fluid.

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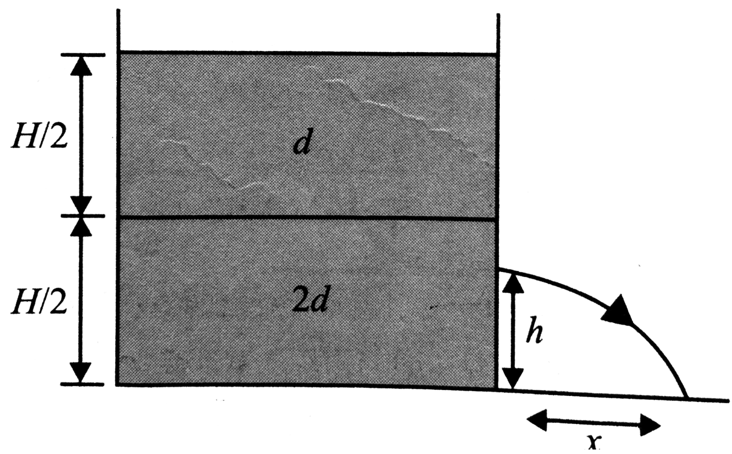

Situation II:

A cyliner is removed and the original

arrangement is restoreed.A tiny hole of area $s(s < < A)$ is punched on the veritical side of the container at a height $h(h < H/2)$

The maximum distance travelled x_m is

A. $\frac{3H}{4}$

B. $\frac{4H}{3}$

C. $\frac{2H}{3}$

D. $\frac{8H}{3}$

Answer: A

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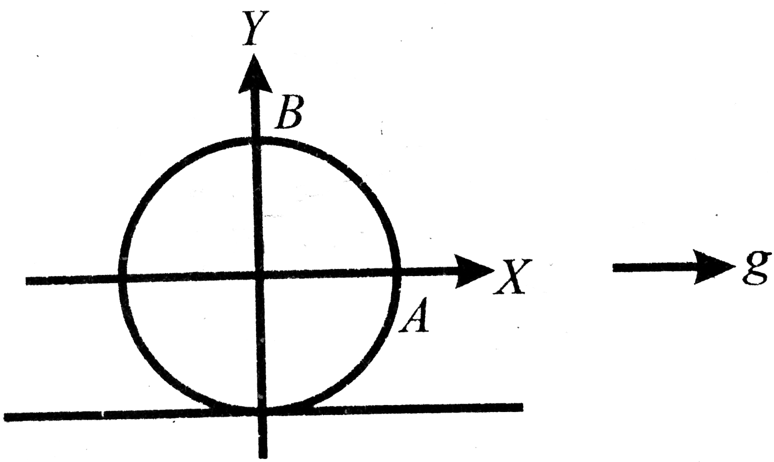
32. A hollow sphere is completely filled with a liquid having a density ρ. The radius of the sphere is R. Now the sphere is puloled with a constant horizontal acceleration of g on a horizontal surface. Take centre of sphere as origin of coordinate system as shwon in the figure.



Coordinate of the point having the minimum pressure is

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

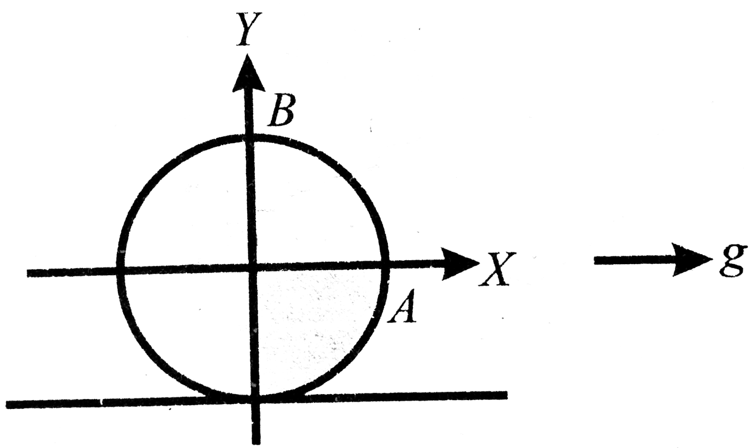
B. $\frac{R}{2}, \frac{R}{2}$

C. $\frac{-R}{\sqrt{2}}, \frac{-R}{\sqrt{2}}$

D. $\frac{-R}{2}, \frac{-R}{2}$

Answer: A

33. A hollow sphere is completely filled with a liquid having a density ρ. The radius of the sphere is R. Now the sphere is puloled with a constant horizontal acceleration of g on a horizontal surface. Take centre of sphere as origin of coordinate system as shown in the figure.



Coordinate of the point having the maximum pressure is

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

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

C. $\frac{-R}{\sqrt{2}}, \frac{-R}{\sqrt{2}}$

D. $\frac{-R}{2}, \frac{-R}{2}$

Answer: c

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34. A hollow sphere is completely filled with a liquid having a density ρ. The radius of the sphere is R. Now the sphere is puloled with a constant horizontal acceleration of g on a horizontal surface. Take centre of sphere as origin of coordinate system as shown in the

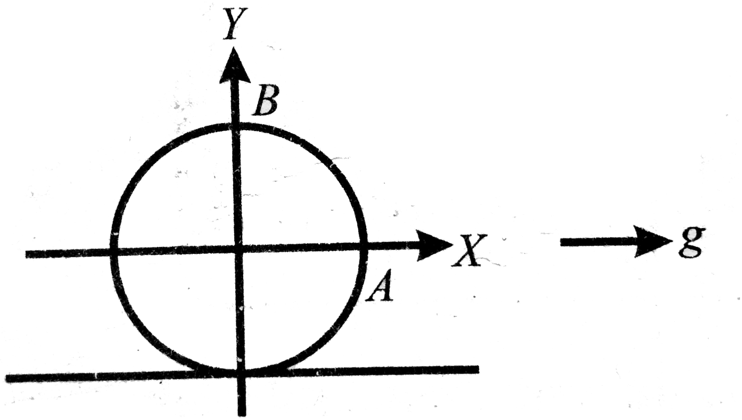

figure.

Consider points A and B as shown in the figure.

A. $P_A = P_B$

B. $P_A > P_B$

C. $P_B > P_A$

D. cannot say

Answer: a

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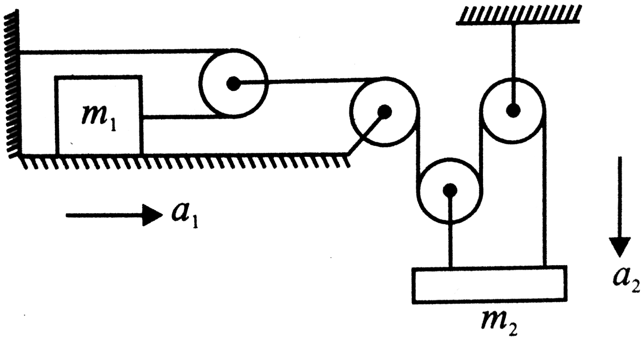
Integer Type

1. Two blocks are arranged as shown in figure. Find the ratio of a_1 / a_2. (a_1 is acceleration of

m_1 and a_2 that of m_2)



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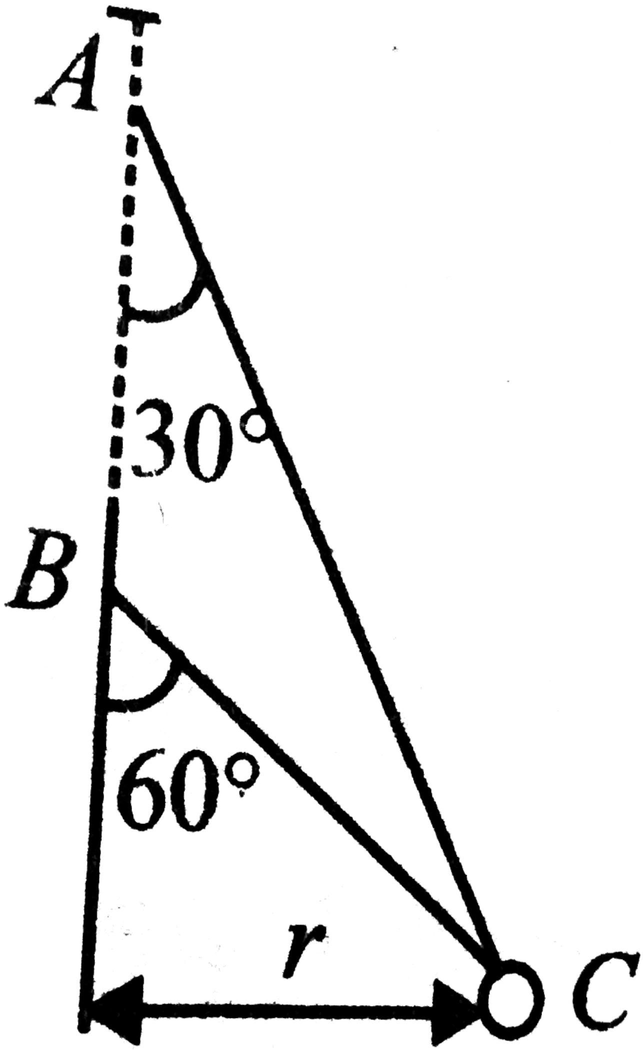
2. A single wire ACB passes through a smooth ring at C when revolves at a constant speed in the horizontal circle of radius $r = 6.4m$ as shown in the figure. Find the

speed (in m/s) of revolution of the ring.



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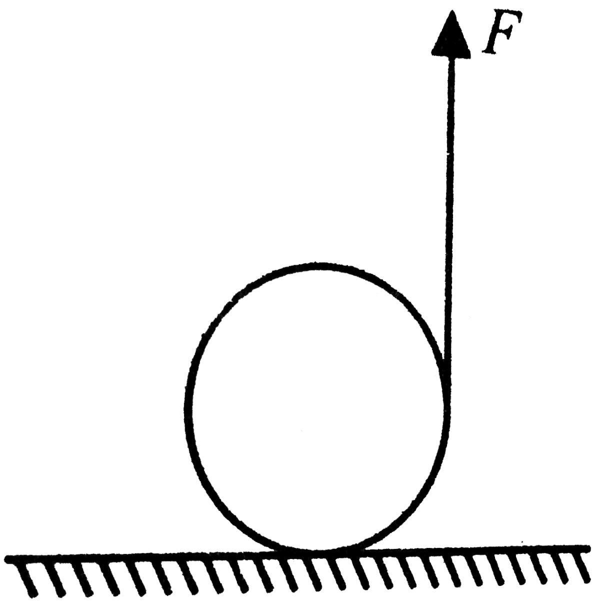
3. We apply a force of $10N$ on a cord wrapped around a cylinder of mass $2kg$. The cylinder rolls without slipping on the floor. What is the kinetic energy (in joule) when cylinder has moved by a distance of $3/5$ m?



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4. The bar shown in the figure is made of a single piece of material. It is fixed at one end. It consists of two segments of equal lengh $L/2$ each but different cross sectional area A and $2A$. Find the ratio of total elongation in the bar to the elongation produced in thicker segment under the action of an axial force F. Consider the shape of the joint to remain circular. (Given :Y is Young's modulus.

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5. A block of wood of density $500kg/m^3$ has mass m kg in air. A lead block which has apparent weight of $28kg$ in water is attached to the block of wood, and both of them are submerged in water. If their combined apparent weight in water is $20kg$, find the value of m. Take density of water $= 1000kg/m^3$

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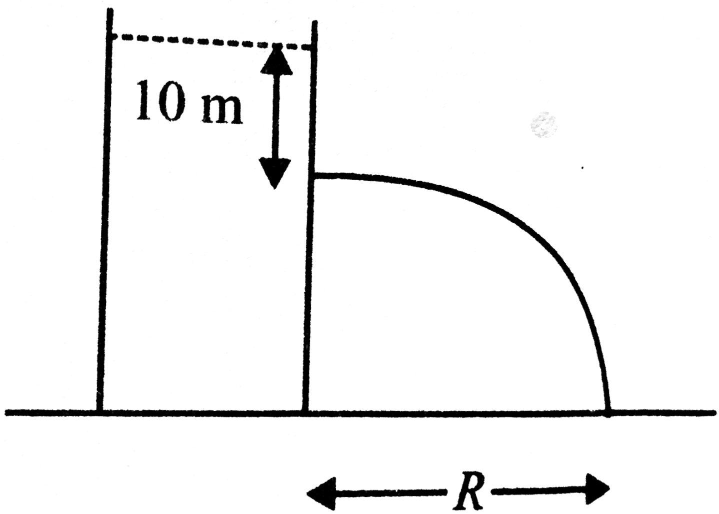
6. The range of water flowing out of a small hole made at a depth $10m$ below water surface in a large tank is R. Find the extra pressure (in atm) applied on the water surface so that range becomes $2R$. Take $1atm = 10^5 Pa$.



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7. An artificial satellite is moving in a circular orbit around the earth with a speed equal to half the magnitude of escape velocity from the surface of earth. (Radius of earth $= 6400 km$)

(a) Dentermine the height of the satellite above the earth's surface.

(b) If the satellite is stopped suddenly in its orbit and allowed to fall freely on the earth, find the speed with which it hits the surface of earth.

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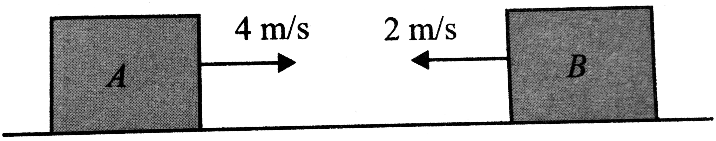
8. Blocks A and B each of mass $1kg$ are moving with $4m/s$ and $2m/s$ respectively as shown. The coefficient of friction for all surface is 0.10. Find the distance (in m) by which centre of mass will travell before coming to rest. Assume large distance between the blocks



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9. Two wheels, each marked with a dot on its rim, are mounted side by side. Initially the dots are alinged and wheels are at rest. One of the wheels is given a constant angular acceleration of $(\pi/2) rad/\sec^2$ and the other wheel is given a constant angular acceleration $(\pi/4) rad/\sec^2$. Both acceleration are in the same direction. Find the time (in s) after which the two dots will becomes alingned again for the first time.

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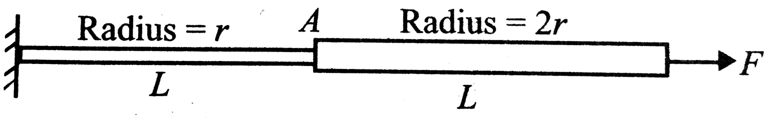
10. Two Steel wires of the same length but radii r and $2r$ are connected together end to end and tied to a wall as shown.



The force stretches the combination by $10mm$. How far does the midpoint A move? (in mm)

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