doubtnut
India's Number 1 Education App

PHYSICS

BOOKS - CENGAGE PHYSICS (ENGLISH)

CENGAGE PHYSICS DPP

Subjective type

1. Do "work done by the battery" and "the thermal energy developed"represent two names of the same physical quantity?

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2. In the following equations, the distance x is in metres, the time t in seconds and the velocity v in $\frac{metres}{second}$. What are the SI units of the constants C_1 and C_2 ?

(a). $v^2 = 2C_1x$

(b). $x = C_1\cos C_2t$

(c). $v = C_1e^{-C_2t}$

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3. Force F and density d are related as $F = \frac{\alpha}{\beta + \sqrt{d}}$,

Then find the dimensions of α and β

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4. A particle of mass m is located in a region where its potential energy $[U(x)]$ depends on the position x as potential Energy $[U(x)] = \frac{a}{x^2} - \frac{b}{x}$ here a and b are positive constants...

(i) Write dimensional formula of a and b

(ii) If the time perios of oscillation which is calculated from above formula is stated by a student as $T = 4\pi a\sqrt{\frac{ma}{b^2}}$, Check whether his answer is dimensionally correct.

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5. Time for 20 oscillations of a pendulum is measured as $t_1 = 39.6s, t_2 = 39.9$ and $t_3 = 39.5s$. What is the precision in the measurements ? What is the accuracy of the measurement ?

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6. A physical eqantity X is related to four measurable quantities a, b, c and d as follows $X = a^2 b^3 c^{5/2} d^{-2}$. The percentage error in the measurement of a, b, c and d are $1\%, 2\%, 3\%,$ and 4%, respectively. What is the percentage error in quantity X? If the value of X

calculated on the basis of the above ralation is 2.763, to what value should you round off the result.

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7. Find the value of $\sin\left(105^\circ\right)$

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8. compute $\tan 22\frac{1}{2}^\circ$

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9. Solve the equation $\sin^2 x - \cos^2 x = \frac{1}{2}$

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10. Evaluate $\sqrt{26}$ correct upto two place of decimal

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11. Given that acceleration due to gravity varies inversely as the square of the distance from the center of earth, find its value at a height of 64 km from the earth's surface , if the value at the surface be $9.81ms^{-2}$. Radis of earth $= 6400km$.

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12. Integrate:

(a) $\frac{3}{2}\sqrt{3}$

(b) $\frac{3}{2\sqrt{x}}$

(c) $\sqrt{x} + \frac{1}{\sqrt{x}}$

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13. Integrate the following: $\int(2t - 4)^{-4}dt$

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14. Sketch the region whose area is represented by the definite integral and eveluate the integral using an appropriate formula form geometry

(a) $\int_1^2 2dx$

(b) $\int_{-1}^2 (x+2)dx$

(c) $\int_0^2 (x-1)dx$

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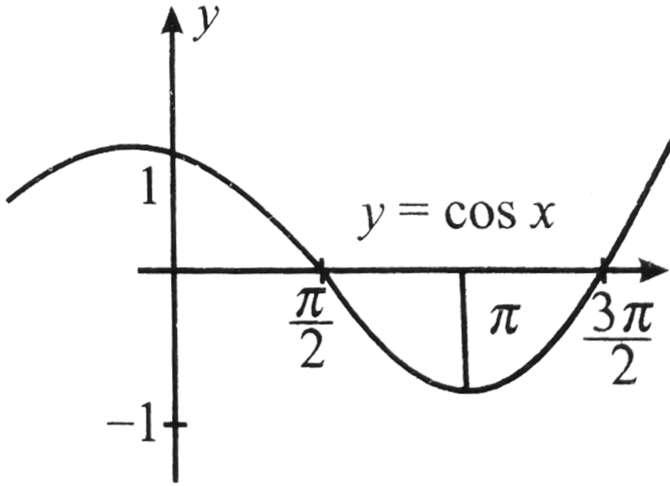
15. 

Find the area under the curve $y = \cos x$ over the interval

(a) $\left[0, \frac{\pi}{2}\right]$

(b) $[0, \pi]$

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16. A radius vector of point A relative to the origin varies with time t as $\vec{r} = at\hat{i} - bt^2\hat{j}$ where a and b are constant. The equation of point's trajectory is.

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17. The speed of a body moving on a straight trach varies according to $v = \frac{4}{5}t^2 + 3$ for $0 < t < 5$ sec and $v = 3t + 8$ for $t > 5$ sec. If dinstances are in meters, find the distance moved by a particle at the end of 10 sec.

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18. A particle moving along a straight line with a constant acceleration of -$4m/s^2$ passes through a point A on the line with a velocity of $+8m/s$ at some moment. Find the distance travelled by the particle in 5 seconds after that moment.

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19. A driver having a definite reaction time is capable of stopping his car over a distance of 30 m on seeing a red traffic signal, when the speed of the car is 72 km/hr andover a distance of 10 m when the speed is 36 km/hr. Find the distance over which he can stop the car if it were running at a speed of 54 km/hr. Assume that his reaction time and the deceleration of the car remains same in all the three cases.

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20. A boy throws a ball in air at 60° to the horizontal along a road with a speed of 10 m/s (36 km/h). Another boy sitting in a passing by car observes the ball. Sketch the motion of the ball as observed by the boy in the car, if car has a speed of (18km/h). Give explanation to support your diagram.

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21. A girl riding a bicycle with a speed of $5m/s$ to wards North direction, observes rain falling vertically down. If she increases her speed to $10m/s$, rain appeared to meet her at 45° to the vertical . What is the speed of the rain ?

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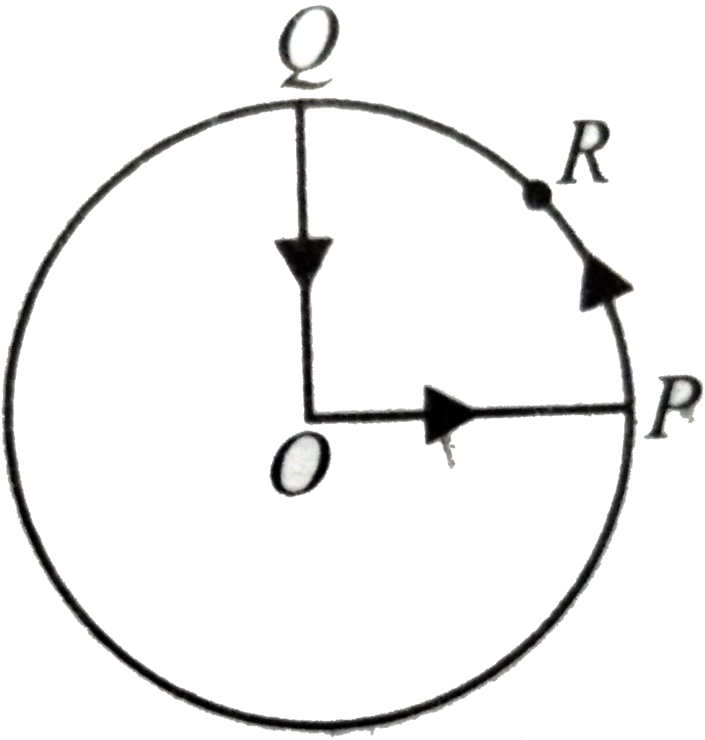
22. A cyclist starts from the centre O of a circular park of radius 1 km and moves along the path OPRQO as shown in figure. If he maintains constant speed of 10 m

s^{-1}, what is his acceleration at point R ?



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23.

A rod AB is moving on a fixed circle of radius R with constant velocity v as shown in figure. P is the point of intersection of the rod and the circle. At an instant the rod is at a distance $x = \frac{3R}{5}$ from centre of the circle. The velocity of the rod is perpendicular to the rod and the rod is always parallel to the diameter CD.

(i) Find the speed of point of intersection P.

(b) Find the angular speed of point of intersection P with respect to centre of the circle.

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24. A helicopter of mass 2000 kg rises with a vertical acceleration of $15 ms^{-2}$. The total mass of the crew and passengers is 500 kg. Choose the correct statements from the following. $\left(\text{Take g} = 10 ms^{-2}\right)$

(i) The force on the floor of the helicopter by the crew and passengers is $1.25 \times 10^4 N$ vertically downwards.

(ii)The action of the rotar of the helicopter on the surrounding air is 6.25×10^4 vertically downwards.

(iii) The force on the helicopter on the surrounding air is $6.25 \times 10^4 N$ vertically upwards.

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25.

Find all the normal reaction $N_{AG}, N_{BG}, N(AB)$ and the acceleration of A and B (All surfaces are friction less):

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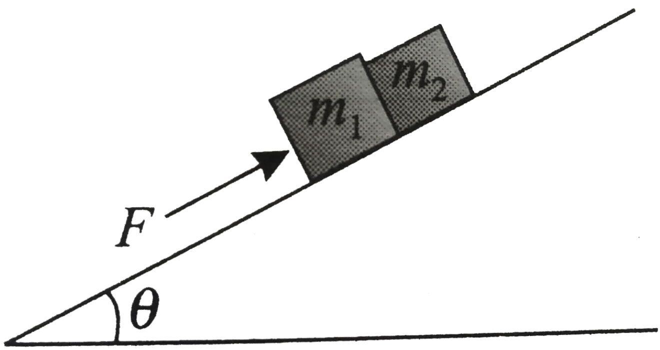
26. 

Two blocks are placed at rest on a smooth fixed inclined place. A force F acts on block of mass m_1 and is parallel to the inclined plane as shown in figure.

Both blocks move up the incline. Then

(i) Draw free body diagram blocks of mass m_1 and blocks mass m_2

(ii) Find acceleration of blocks of mass m_1 and blocks mass m_2

(iii) Find normal reaction between the blocks of mass m_1 and m_2

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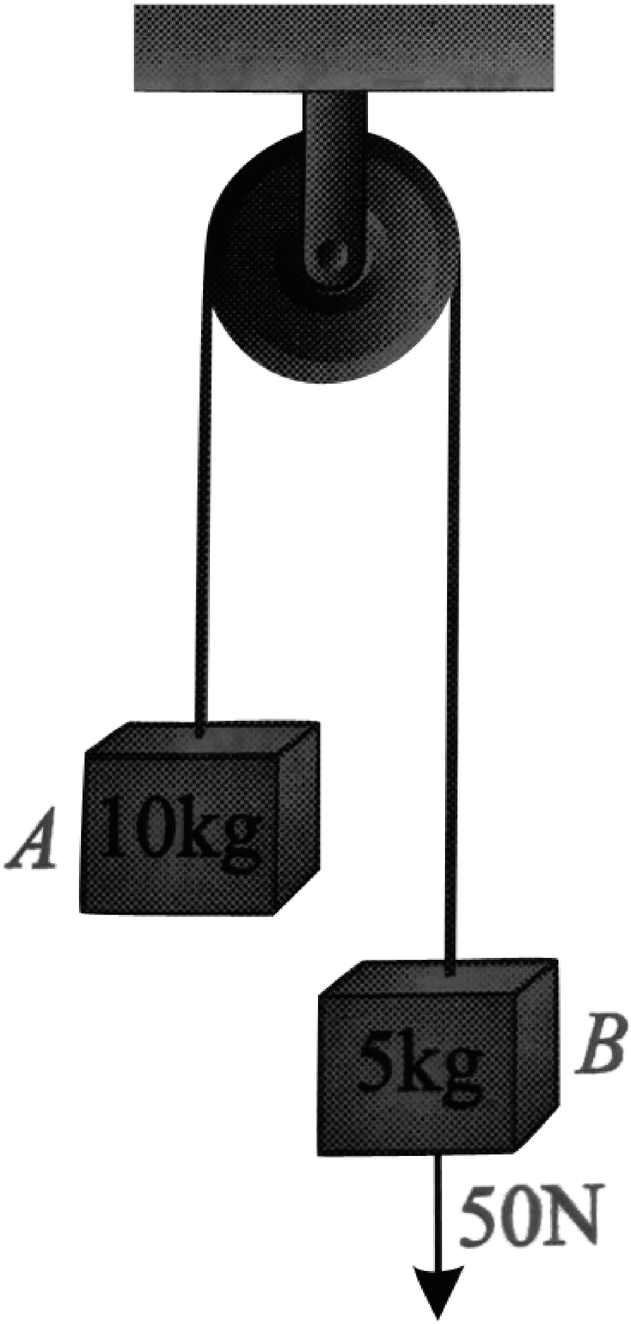

27.

Find out the acceleration of the blocks and tensions in the strings.

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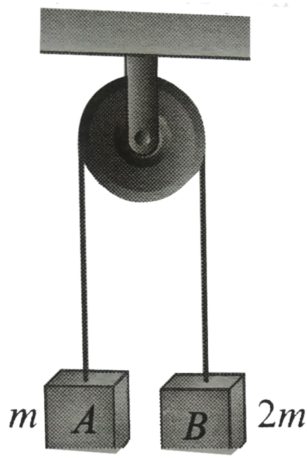
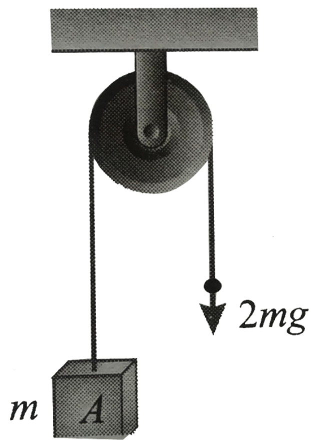
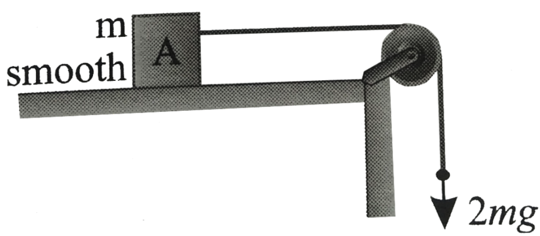
(i)



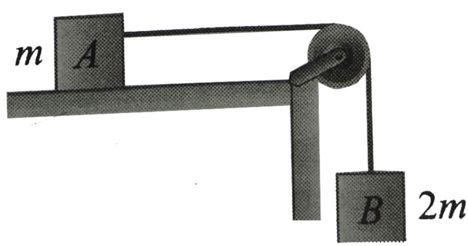
(ii)



(iii)



(iv)



28. In which of the following cases the magnitude of acceleration of the block A will be maximum (neglecting friction, mass of pulley and string)

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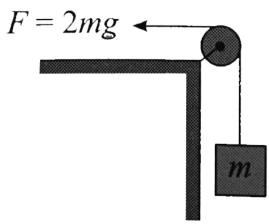

29. The block of mass m is being pulled by a horizontal force F = 2mg applied to a string as shown in figure (Take $g = 10\frac{m}{s^2}$). The pulley is massless and is fixed at the edge of an immovable table. What is the value of force exerted by the supporting table on the pulley (in Newton)

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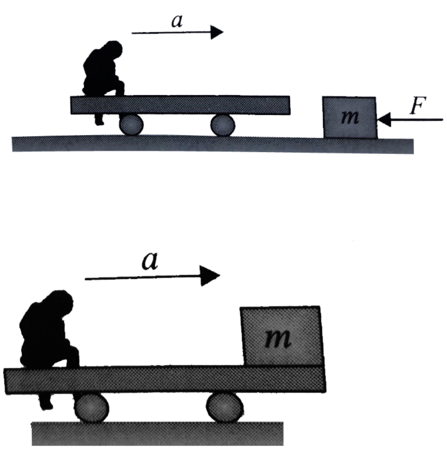
30. 

Suppose you are sitting on an accelrating trolley car.

(i) Find the pseudo force action on the block of mass m placed on the trolley car.

If the block is placed (or moved) outside the trolley car, and an external force F acts in horizontal direction.

(ii) Find the pseudo force acting on the block as viewed by the observer.

(iii) Find the acceleration of the block as seen by the obersever

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31. A man of mass m is standing on a lift which moves down with an upward acceleration a. Find the pseudo force acting on the man as observed by himself. Find the pseudo force acting on the man if the lift falls freely.

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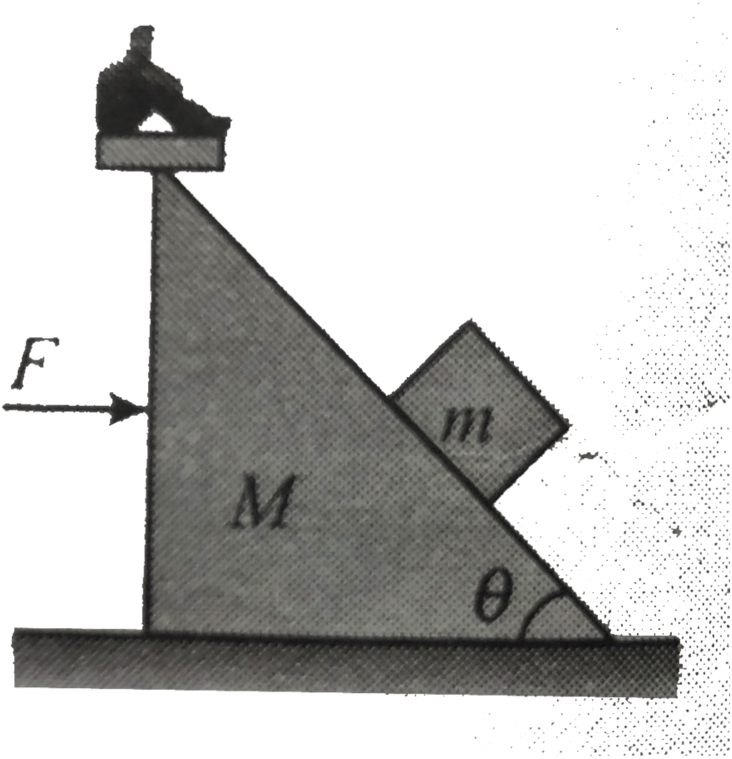
32. The block of mass m is in equilibrium relative to the smooth wedge of mass M which is pushed by a horizontal force F. Find pseudo force acting on (a) m, (b)M as viewed by the observer sitting on the wedge. Will these pseudo forces (c) equal and opposite, action reaction pairs? Explain.



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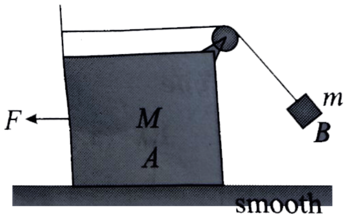

33.

A force F is applied on block A of mass M so that the tension in light string also becomes F when block B of mass m acquires an equilibrium state with respect to block A. find the force F. Give your answer in terms of m, M and g.

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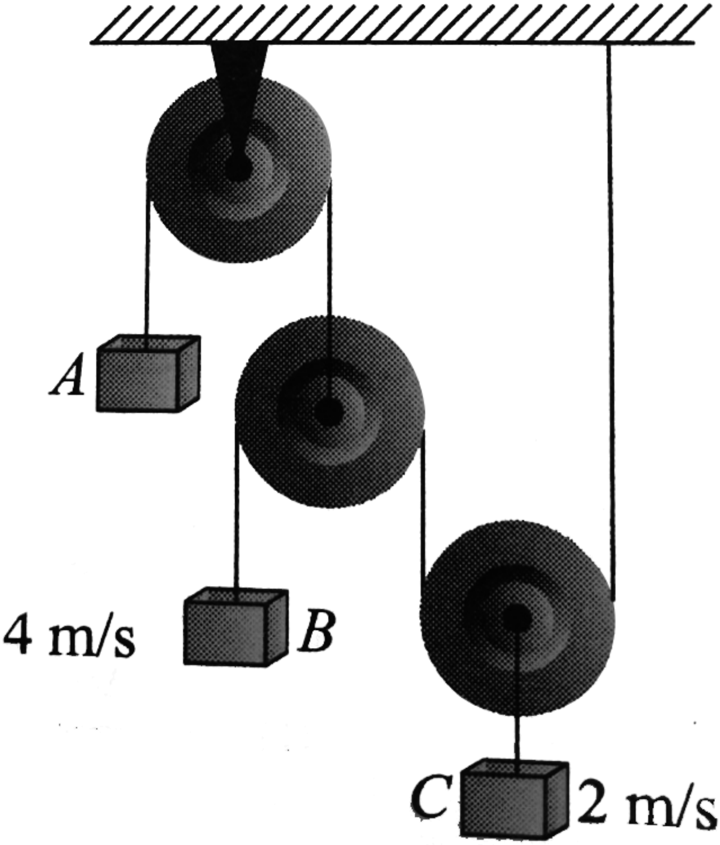

34.

In pulley system shown in figure, block C is going up at $2\frac{m}{s}$ and block B is going up at $4\frac{m}{s}$. Find the velocity of block A.

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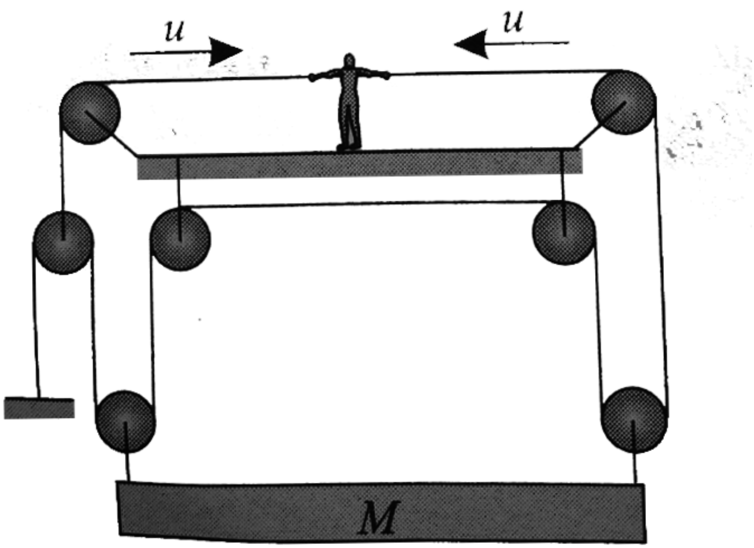
35.



System is shown in the figure and man is pulling the rope from both sides with constant speed u find the speed of the block.

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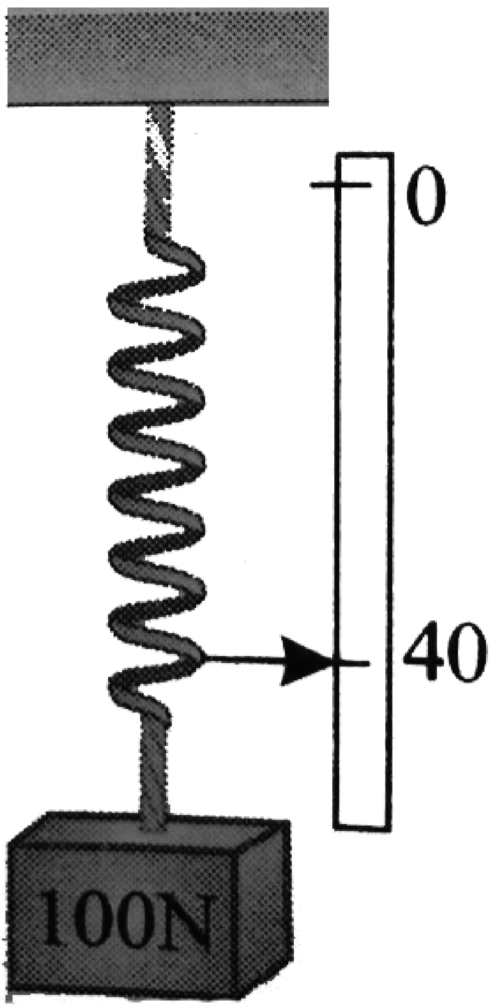

36.

An ideal speing, with a pointer attached to its end, hangs next to a scale. With a 100 N weight attached and in equilibrium, the pointer indicates 40 on the scale as shown. Using a 200 N weight instead results in 60 on the scale. Using an unknown weight X instead results in 30 on the scale. Find the value of X is

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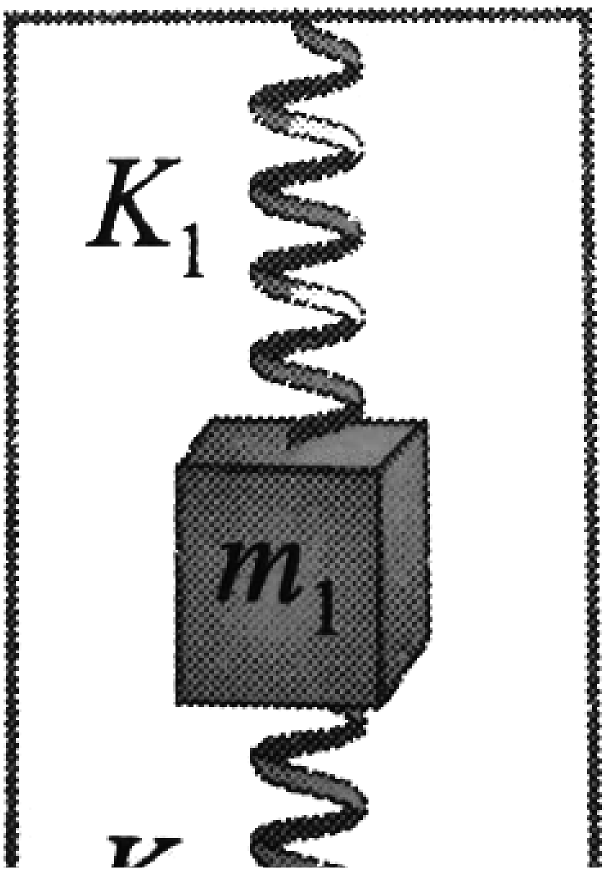

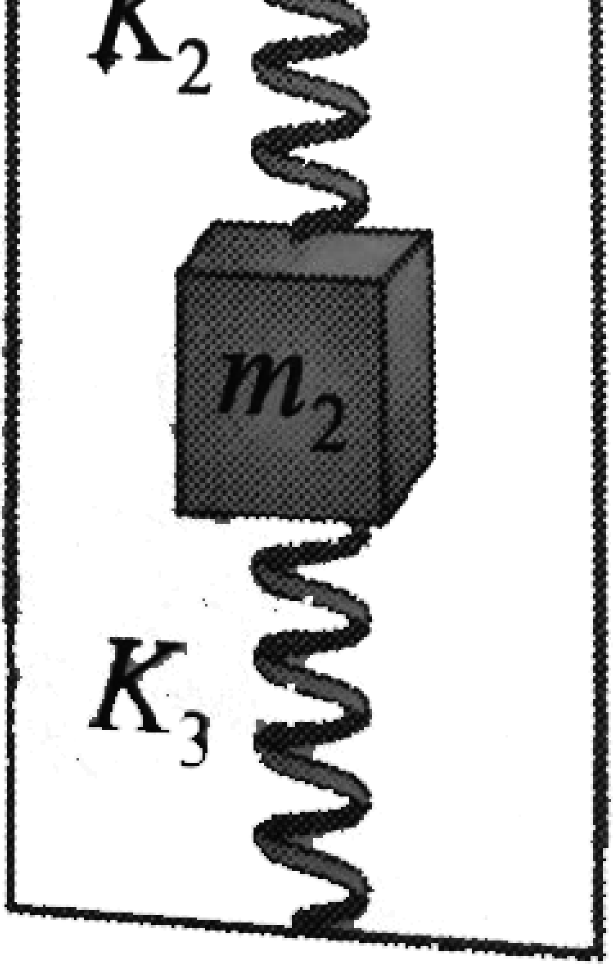

37.

In an elevator a system is arranged as shown in figure. Initially elevator is at rest and the system is in equilibrium with middle spring unstretched. When the elevator accelerated upwards, it was found that for the new equilibrium position (with respect to lift), the further extension i the top spring is 1.5 times that of the further compression in the bottom spring, irrespective of the value of acceleration

(a) Find the value of $\frac{m_1}{m_2}$ in terms of spring constants for this happen.

(b) if $k_1 = k_2 = k_3 = 500\frac{N}{m}$ and $m_1 = 2$ kg and acceleration of the elevator is $2.5\frac{m}{s^2}$, find the tension in the middle spring in the final equilibrium with respect to lift.

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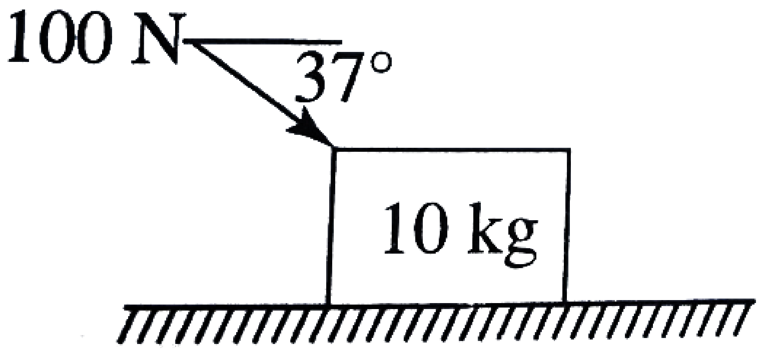
38. 

In the figure shoen calculate the angle of friction . The block dows not slide. Take $g = 10\frac{m}{s^2}$.

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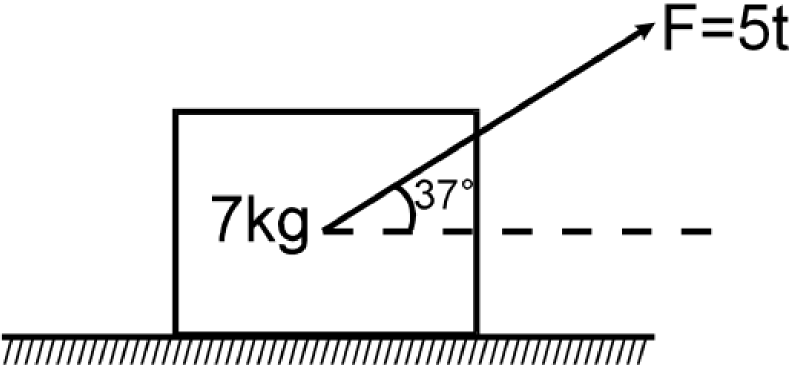
39. A block of 7 kg is placed on a rough horizontal surface and is pulled through a variable force F(in N) =5t, where 't' is time in second, at an angle of 37° with the horizontal as shown in figure. The coefficient of

static friction of the block with the surface is one. if the force starts acting at t=0 s, find the time at which the block starts to slide. (Take $g = 10m/s^2$)



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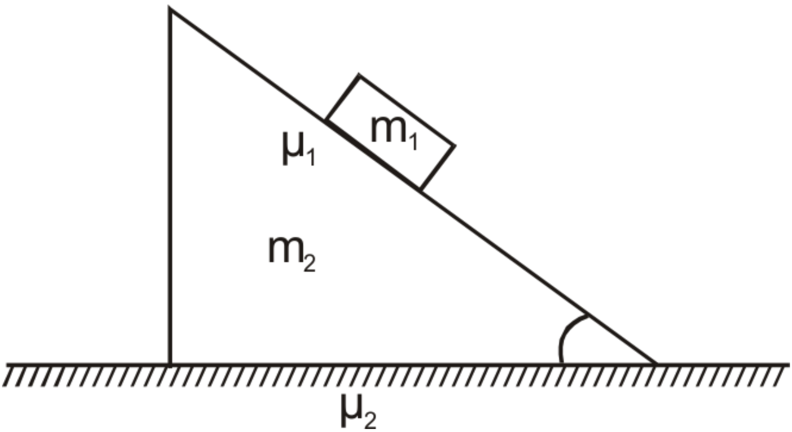
40. The block of mass m_1 is placed on a wedge of an angle θ, as shown. The block is moving over the inclined surface of the wedge. Friction coefficient between the block and the wedge is μ_1, whereas it is μ_2

between the wedge and the horizontal surface. if $\mu_1 = \frac{1}{2}, \theta = 45^\circ, m_1 = 4kg, m_2 = 5kg$ and $g = 10m/s^2$, find minimum value of μ_2 so that the wedge remains stationary on the surface. express your answer in multiple of 10^{-3}



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41.

In the figure shown , the coefficient of static friction between B and the wall is $\frac{2}{3}$ and the coefficient of kinetic friction between B and the wall is $\frac{1}{3}$. Other contacts are smooth. Find the minimum force F required to lift B, up. Now if the force applied on A is slightly increased than the calculated value of minimum force, then find the acceleration of B. mass of A is 2m and the mass of B is m. Take $\tan\theta = \frac{3}{4}$

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42.

Two blocks of mass M and 3M (in kg) are connected by an inextensible light thread which passes over a light frictionless pulley. The whole system is placed over a fixed horizontal table as shown.The coefficient of friction between the blocks and table surface is μ. The pulley is pulled by a string sttached to its centre and accelerated to left with acceleration $a\left(\frac{m}{s^2}\right)$. Assume that gravity acts with constant acceleration g$\left(\frac{m}{s^2}\right)$ downwards through the plane of table. Then:

(a) Find the forizontal accelration of both the blocks (Assume that both the blocks are moving.)

(b) What is the maximum acceleration a, for which the block of mass 3 M will remain stationary?

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43.

Three blocks are connected as shown in the figure. Valculate the minimum force required to move the body with constant velocity. The coefficient of friction at all surfaces is 0.25.

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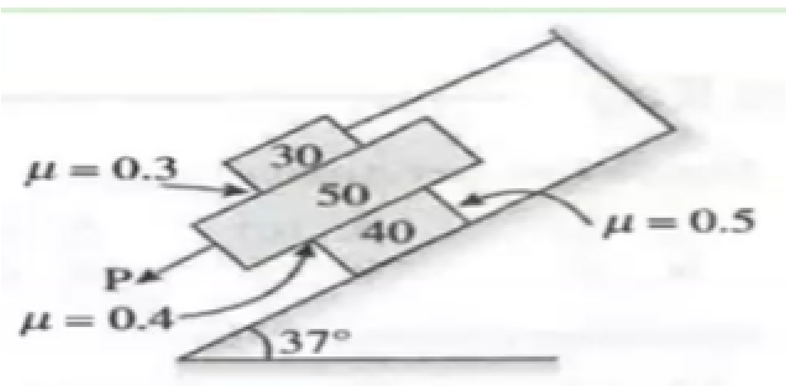
44.



The three flat blockss in the figure are positioned on the 37° incline and a force parallel to the inclined plane is applied to the middle blocks. The upper blocks is prevented from moving by a wire which attaches it to the fixed support. The masses of three blocks in kg and coefficient of static friction for each of the three pairs of contact surfaces is shoen in the figure. Determine the maximum value which force P may have before slipping take place anywhere.

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45. 1 kg particle at a height of 4 m has a speed of 2 m/s down a incline making an angle 53° with horizontal as shown in figure. It slides on a horizontal section of length 3 m at ground level and then up an incline making an angle 37° with horizontal. All surfaces have $\mu_k = 0.5$. How far from point O (bottom of right inclined plane), along the incline making and angle 37° with horizontal, does the particle first come to rest?

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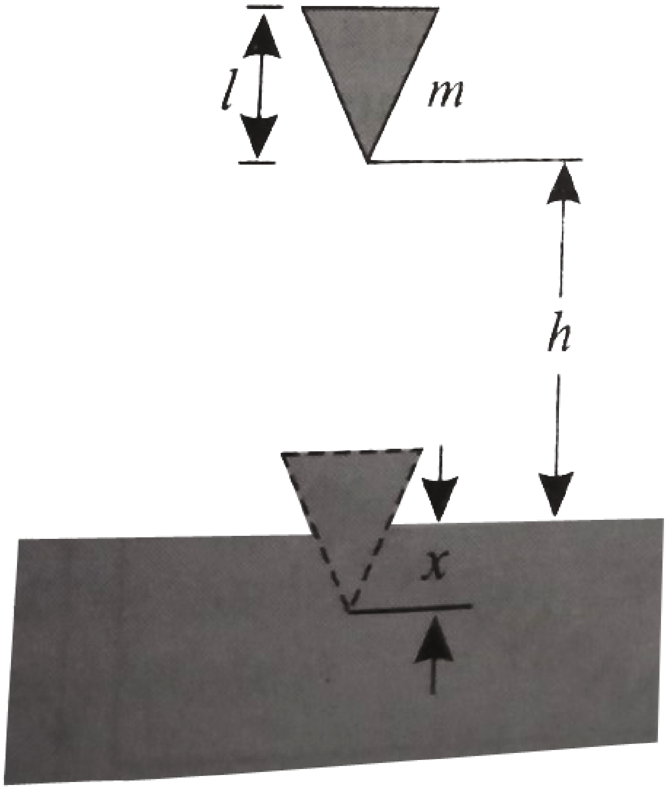

46.

A cone of mass m falls from a height h and penetrates into sand. The resistance force R of the sand is given by $R = kx^2$. If the cone penetrates up to a distance $x = d$ where $d < \lambda$, then find the value of k.

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47. A particle of mass $m = 1kg$ lying on x-axis experiences a force given by law

$F = x(3x - 2)$ Newton.

Where x is the x-coordinate of the particle in meters.

$$\overrightarrow{x = 0x = 4}$$

(a) Locate the point on x-axis where the particle is in equilibrium.

(b) Draw the graph of variation of force F (y-axis) with x-coordinate of the particle (x-axis). Hence or otherwise indicate at which positions the particle is in stable or unstable equilibrium.

(c) What is the minimum speed to be imparted to the particle placed at $x = 4$ meters such that it reaches tha origin.

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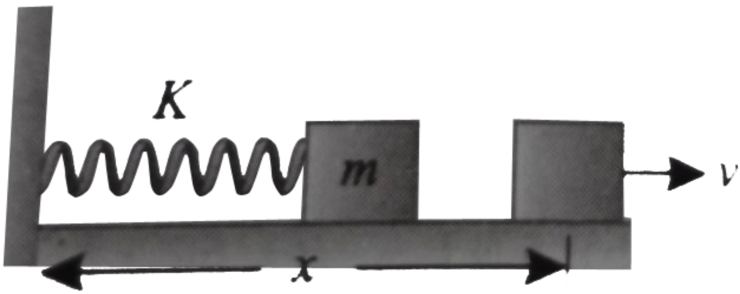

48.

A block of mass m is pushed against a spring of spring constant k fixed at one end to a wall.The block can slide on a frictionless table as shown in the figure. The natural length of the spring is L_0 and it is compressed to one fourth of natural length and the block is released.Find its velocity as a function of its distance (x) from the wall and maximum velocity of the block. The block is not attached to the spring.

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49. Consider a one-dimensional motion of a particle with total energy E. There are four regions A, B, C and D in which the relation between potential energy V, kinetic energy K and total energy E is as given below:

Region A:V gt E

Region B: V lt E

Region C:K gt E

Region D:V gt K

Which of the following regions the particle cannot be found?

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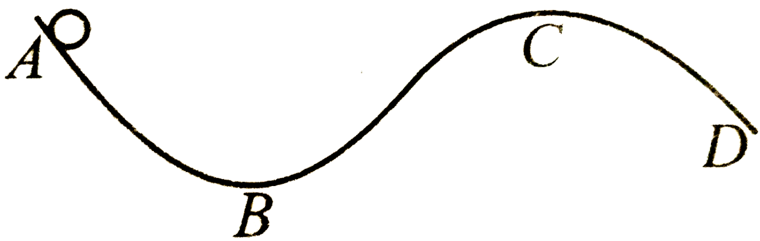
50. A curved surface is shown in figure. The portion BCD is frictionless. There are two spherical balls of identical radii and masses. Balls are released from rest one by one from A which is at a slightly greater height than C. With the surface AB ball 1 has a small friction and ball 2 has a negligible friction. For which balls is

total mechanical energy conserved?



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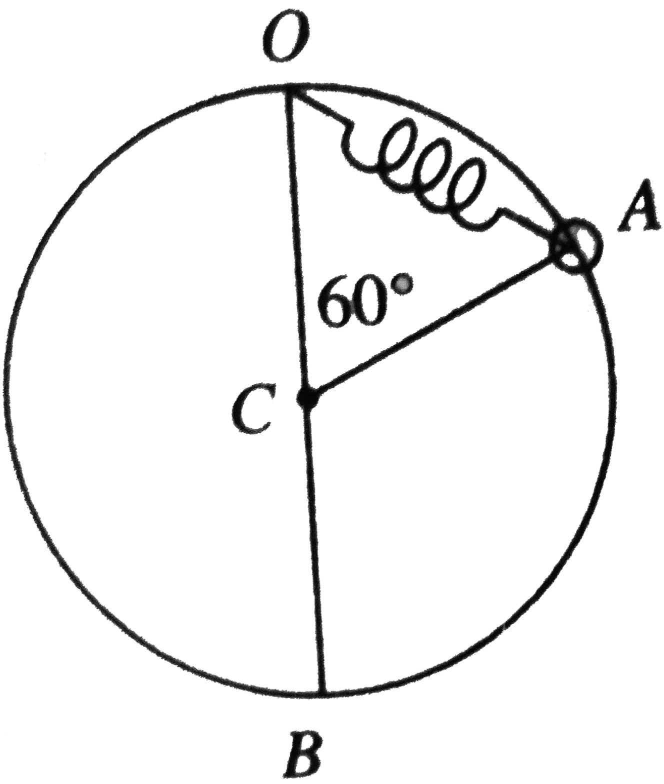
51. A particle of mass $5kg$ is free to slide on a smooth ring of radius $r = 20cm$ fixed in a vertical plane. The particle is attached to one end of a spring whose other end is fixed to the top point O of the ring. Initially, the particle is at rest at a point A of the ring such that $\angle OCA = 60^{\circ}$, C being the centre of the ring. The natural length of the spring is also equal to $r = 20cm$.

After the particle is released and slides down the ring, the contact force between the particle and the ring becomes zero when it reaches the lowest position B. Determine the force constant $\left(in \times 10^2 Nm^{-1}\right)$ of the spring.



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Single Correct

1. Which of the following is not equal to watt?

A. Joule/second

B. Ampere $\times$ volt

C. $(\text{Ampere})^2 \times$ ohm

D. Ampere/volt

Answer: D

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2. Which of the following quantities has its unit as newton - second?

A. Velocity

B. Angular momentum

C. Momentum

D. Energy

Answer: C

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3. A suitable unit for gravitational constant is

A. $kg - m\sec^{-1}$

B. $Nm^{-1}\sec$

C. Nm^2kg^{-2}

D. $kgm\sec^{-1}$

Answer: C

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4. The unit of angular acceleration in the SI system is

A. Nkg^{-1}

B. ms^{-2}

C. $rads^{-2}$

D. $mkg^{-1}K$

Answer: C

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5. Which of the following is not a unit of energy?

A. $W - s$

B. kg-m/sec

C. N-m

D. Joule

Answer: B

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6. Temperature can be expressed as a derived quantity in terms of any of the following

A. Length and mass

B. Mass and time

C. Length, mass and time

D. None of these

Answer: D

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7. $Erg - m^{-1}$ can be the unit of measure for

A. Force

B. Momentum

C. Power

D. Acceleration

Answer: A

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8. The unit of potential energy is

A. $g\left(\frac{cm}{\sec^2}\right)$

B. $g\left(\frac{cm}{\sec}\right)^2$

C. $g\left(\frac{cm^2}{\sec}\right)$

D. $g\left(\frac{cm}{\sec}\right)$

Answer: B

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9. Which of the following represents a volt?

A. Joule/second

B. Watt/Ampere

C. Watt/Coulomb

D. Coulomb/Joule

Answer: B

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10. If the unit of force and length be ecah increased by four times, then the unit of energy is increased by

A. Increased 4 times

B. Increased 8 times

C. increased 16 times

D. Decreased 16 times

Answer: C

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11. Ampere-hour is a unit of

A. Quantity of electricity

B. Strength of electric current

C. Power

D. Energy

Answer: A

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Multiple Correct Answer Type

1. Which of the following ratios express pressure?

A. Force/Area

B. Energy/Volume

C. Energy/Area

D. Force/Volume

Answer: A::B

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2. Porous rock through which groundwater can move is called an aquifer. The volume V of water that, in time T. moves through a cross section of area A of the aquifer is given by $\frac{V}{t} = \frac{KAH}{L}$, Where H is the vertical height of the aquifer over the horizontal distance L. This relation is called Darcy's law. The quantity K is the hydraulic conductivity of the aquifer. What are the SI units of K?

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3. Which of the following has value 1:

A. $\tan 45^{\circ}$

B. $\sin 90^{\circ}$

C. $\cos 90^{\circ}$

D. $\cos 0^{\circ}$

Answer: A::B::D

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4. Which of the following has value zero:

A. $\sin 0^{\circ}$

B. $\tan 0^{\circ}$

C. $\cos 0^{\circ}$

D. cot0 °

Answer: A::B

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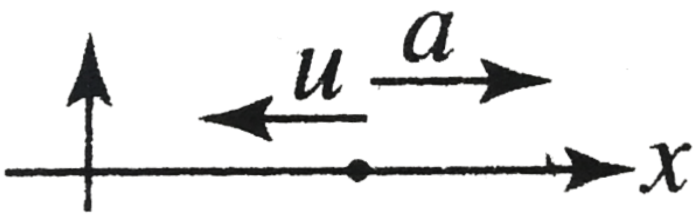
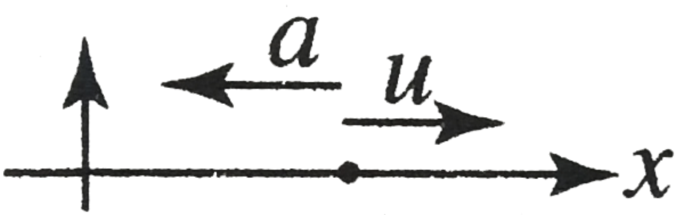
5. 



For a particle moving along straight line with constant acceleration (a), we define velocity of the particle with time as

$v = u + at$, (u = initial velocity)

Draw the velocity-time graph of the particle in following situations.

(i) Velocity is decresing with time (i.e., acceleration in negative)

(ii) Initial velocity is negative but acceleration is positive

Watch Video Solution

6. A particle is moving along x-direction with a constant acceleration a. The particle starts from $x = x_0$

position with initial velocity u. We can define the position of the particle with time by the relation

$$x = x_0 + ut + \frac{1}{2}at^2$$

plot the position of the particle in relation with time is following situations

(i) If initial position of the particle is on negativ x-axis, initial velocity is positive and acceleration is negative.

(ii) If initial position is positive, initial velocity is negative and acceleration is positive.

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7. which of the following four statements are correct?

A. A body can have zero velocity and still be accelerated

B. A body can have a constant velocity and still have a varying speed

C. A body can have a constant speed and still have a varying velocity

D. the direction of the velocity of a body can change when its acceleration is constant

Answer: A::C::D

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8. A particle is moving on the x-axis. If initial velocity $u > 0$, and acceleration $a < 0$ and a is constant then number of possible calues of the time for which the particle is at distance d from its starting point may be:

A. one

B. two

C. three

D. four

Answer: A::B::C

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9. For a particle moving in straight line with increasing speed the appropriate sign of acceleration a and velocity v can be:

A. $a > 0$ and $v > 0$

B. $a < 0$ and $v < 0$

C. $a > 0$ and $v < 0$

D. $a < 0$ and $v > 0$

Answer: A::B

Watch Video Solution

10. A particle of mass m moves along a curve $y = x^2$. When particle has x-coordinate as $\frac{1}{2}$ m and x-component of velocity as $4\frac{m}{s}$, then

A. the position coordinate of particle are $\left(\frac{1}{2}, \frac{1}{4}\right)$m

B. The velocity of particle will be along the line $4x - 4y - 1 = 0$.

C. the magnitude of velocity at that instant is $4\sqrt{2}\frac{m}{s}$

D. The magnitude of velocity at that instant is $2\sqrt{2}\frac{m}{s}$.

Answer: A::B::C

Watch Video Solution

11. The velocity of a particle moving in the positive direction of x-axis veries as $v = 10\sqrt{x}$. Assuming that at $t = 0$, particle was at $x = 0$

A. The initial velocity of the particle is zero

B. the initial velocity of the particle is $2.5\frac{m}{s}$.

C. The accelration of the particle is $2.5\frac{m}{s^2}$.

D. The acceleration of the particle is $50\frac{m}{s^2}$.

Answer: A::D

Watch Video Solution

12. A particle moves along x-axis such that its position veries with time as $x = 50t - 5t^2$. Select the correct alternative (s).

A. The particle has travelled 130m distance by $t = 6s$.

B. At $t = 4s$ and $t = 12s$, the particle is at 120 m distance from starting point.

C. the particle will never be at a distance of 130 m from starting point.

D. During the whole motion, the particle does not have same velocity at 2 different instants.

Answer: A::B::D

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13. A stone is projected vertically upwards $y = 0$ second. The net displacement of stone is zero in time interval between $t = 0$ second to $t = T$ seconds. Pick up the correct statement

A. From time $t = \frac{T}{4}$ seconds to $t = \frac{3T}{4}$ second, the average velocity is zero.

B. the change in velocity from time $t = 0$ to $t = \frac{T}{4}$ second is same as change in velocity from $t = \frac{T}{8}$

second to $t = \frac{3T}{8}$ second

C. The distance travelled from $t = 0$ to $t = \frac{T}{4}$ second is larger than distance travelled from $t = \frac{T}{4}$ second to $t = \frac{3T}{4}$ second

D. The distance travelled from $t = \frac{T}{2} second \rightarrow t = \frac{3T}{4} second$ is half the distance travelled from $t = \frac{T}{2}$ second to $t = T$ second.

Answer: A::B::C

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14. A person, standing on the roof of a 40 m high tower, throws a ball vertically upwards with speed 10 m/s. Two seconds later, he throws another ball again in vertical direction (use $g = 10\frac{m}{s^2}$). Both the balls hit the ground simultaneously.

A. The first ball hits the ground after 4 seconds.

B. The second ball was projected vertically downwards with speed 5 m/s

C. The second ball was projected vertically downwards with speed 5 m/s.

D. the distance travelled by the first ball is 10 m greater than the distance travelled by the second ball.

Answer: A::C::D

Watch Video Solution

15. A balloon starts rising from the ground with a constant acceleration of $1.25 m/s^2$. After 8 s, a stone is released from the balloon. Find the time taken by the stone to reach the ground. (Take $g = 10 m/s^2$)

A. cover a distance of 50 m till it strikes the ground.

B. have a displacement of 50 till it reaches the ground.

C. reach the ground in 4 seconds.

D. begin to move down instantaneously.

Answer: A::C::D

Watch Video Solution

16. A man in a lift ascending with an upward acceleration a throws a ball vertically upwards with a velocity v with respect to himself and catches it after t_1 seconds. After wards when the lift is descending with the same acceleration a acting downwards the man again throws the ball vertically upwards with the same velocity with respect to him and catches it after t_2 seconds?

A. The acceleration of the ball w.r.t. ground is g when it is in air

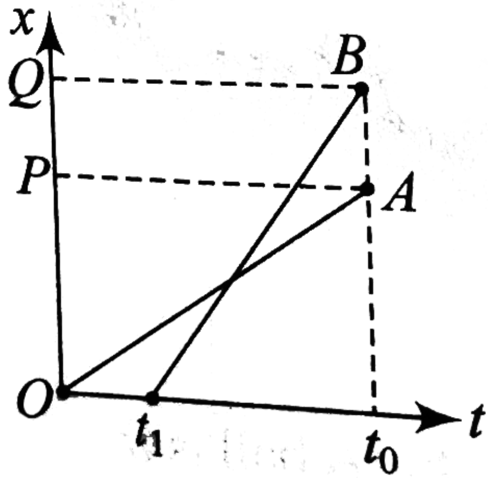
B. the velocity v of the ball relative to the ligt is $\frac{g(t_1 + t_2)}{t_1 + t_2}$

C. the acceleration a of the lift is $\frac{g(t_2 - t_1)}{t_1 + t_2}$

D. The velocity v of the ball relative to the man is $\frac{>_1 t_2}{(t_1 + t_2)}$

Answer: A::C::D

Watch Video Solution

17. 

The position-time (x-t) graphs for two children A and B returning from their school O to their homes P and Q respectively along straight line path (taken as x-axis) are shown in figure. Choose the correct statement (s):

A. A lives closer to the school B

B. A starts from the school earlier than B

C. A and B have equal average velocities from 0 to t_0.

D. B overtakes A on the way

Answer: A::B::D

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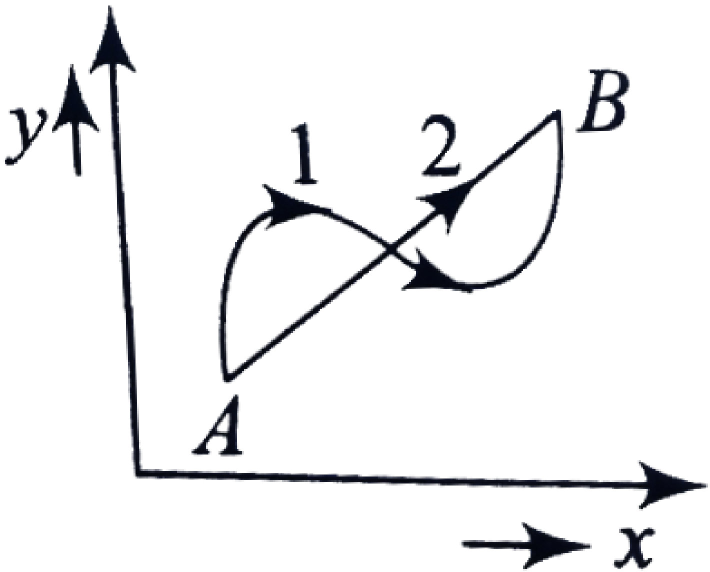

18.

A particle can travel point A to B from two different path 1 and 2, as shown, in same interval of time. Then which of the following is incorrect?

A. Average velocity along the two paths must be equal

B. the particle may travel along both the paths unaccelerated

C. the direction instantaneous velocity along the path 1 and 2 can be same for a maximum of two point on the parths.

D. The average and instantaneous velocity along path 1 can have direction.

Answer: A::C::D

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19. At the highest point of the path of a projectile, its

A. speed is zero

B. spoeed is minimum

C. kinetic energy is minimum

D. Potential energy is maximum

Answer: B::C::D

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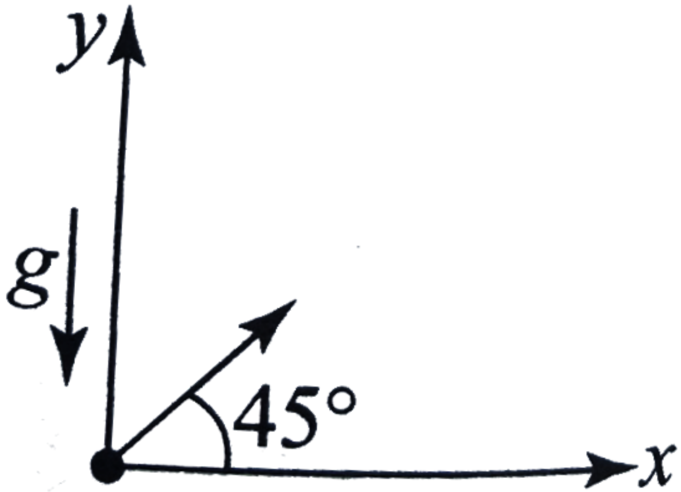
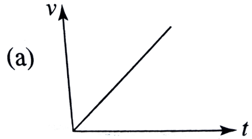
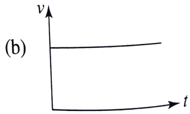
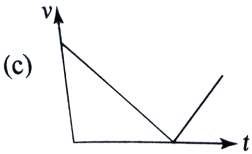
20.

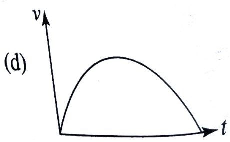


A stone is projected at an angle 45° with horizontal above horizontal x-axis as shown in figure (and y-axis is vertical). Four graphs representing the magnitude of horizontal (v_x) or magnitude of vertical (v_y) component of velocity of stone w.r.t. time t as shown. Then which of the following magnitude of velocity versus time graph best represents v_x versus t and v_y versus t respectively for the stone.

A. 

B. 

C. 

D. 

Answer: B::C

View Text Solution

21. A stone is projected from level ground with speed u and ann at angle θ with horizontal. Somehow the acceleration due to gravity (g) becomes double (that is 2g) immediately after the stone reaches the maximum height and remains same thereafter. Assume direction of acceleration due to gravity always vertically downwards.

Q. The total time of flight of particle is:

A. $\frac{3}{2}\frac{u\sin\theta}{g}$

B. $\frac{u\sin\theta}{g}\left(1+\frac{1}{\sqrt{2}}\right)$

C. $\frac{2u\sin\theta}{g}$

D. $\frac{u\sin\theta}{g}\left(2+\frac{1}{\sqrt{2}}\right)$

Answer: B

Watch Video Solution

22. A stone is projected from level ground with speed u and ann at angle θ with horizontal. Somehow the acceleration due to gravity (g) becomes double (that is 2g) immediately after the stone reaches the maximum height and remains same thereafter. Assume direction of acceleration due to gravity always vertically downwards.

Q. The horizontal range of particle is

A. $\frac{3}{4}\frac{u^2 \sin 2\theta}{g}$

B. $\frac{u^2 \sin 2\theta}{2g}\left(1+\frac{1}{\sqrt{2}}\right)$

C. $\frac{u^2}{g}\sin 2\theta$

D. $\frac{u^2 \sin 2\theta}{2g}\left(2+\frac{1}{\sqrt{2}}\right)$

Answer: B

Watch Video Solution

23. A stone is projected from level ground with speed u and ann at angle θ with horizontal. Somehow the acceleration due to gravity (g) becomes double (that is 2g) immediately after the stone reaches the maximum height and remains same thereafter. Assume direction of acceleration due to gravity always vertically downwards.

Q. The angle ϕ which the velocity vector of stone makes with horizontal just before hitting the ground is given by:

A. $\tan\phi = 2\tan\theta$

B. $\tan\phi = 2\cot\theta$

C. $\tan\phi = \sqrt{2}\tan\theta$

D. $\tan\phi = \sqrt{2}\cos\theta$

Answer: C

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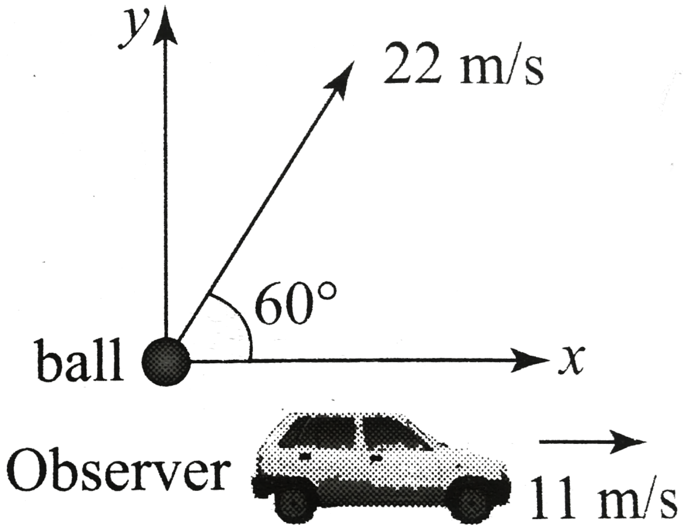

24.

A football is kicked with a speed of $22\frac{m}{s}$ at an angle of 60° to the positive x direction taken along horizontal. At that instant, an observer moves past the football in a car that moves with a constant speed of $11\frac{m}{s}$ is the positive x direction. Take $+ve$ y direction vertically upwards. $\left(g = 10\frac{m}{s^2}\right)$

A. The initial velocity of the ball relative to the observer in the car is $11\sqrt{3}\frac{m}{s}$ in the $+y$ direction

B. The initial velocity of the ball relative to the observer in the car is $17\frac{m}{s}$ at $60\,^{\circ}$ to the $+x$ direction

C. According to the observer in the car, the ball will follow a path that is straight up and down in the y direction.

D. According to the observer in the car, the ball will follow a straight line that is angled (less than $90\,^{\circ}$) with respect to the observer.

Answer: A::C

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25. A particle is projected from a horizontal floor with speed $10\frac{m}{s}$ at an angle 30° with the floor and striking the floor after sometime. State which is correct.

A. Velocity of particle will be perpendicular to initial direction two seconds after projection.

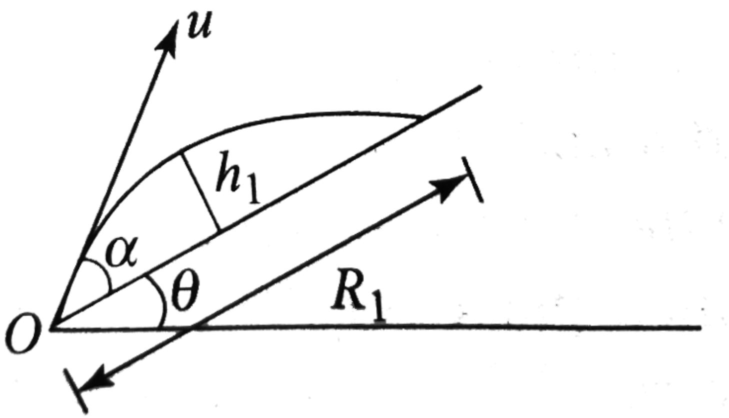
B. Minimum speed of particle will be $5\sqrt{3}\frac{m}{\text{sec}}$.

C. Displacement of particle after half second will be $\frac{1}{4}\sqrt{235}\text{m}$

D. The particle will strike the floor at 2 sec.

Answer: B::C

Watch Video Solution

26. 

Two balls are thrown from an inclined plane at angle of projection α with the plane one up the incline plane and other down the incline as shown in the figure. If R_1 & R_2 be their respective ranges, then:

A. $h_1 = h_2$

B. $R_2 - R_1 = T_1^2$

C. $R_2 - R_1 = g\sin\theta T_2^2$

D. $R_2 - R_1 = g\sin\theta T_1^2$

Answer: A::C::D

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27. Two boats A and B having same speed relative to river are moving in a river. Boat A moves normal to the river current as observed by an observer moving with velocity of river current. Boat B moves normal to the river as observed by the observer on the ground.

A. To a ground observer Boat B moves faster than A

B. To a ground observer boat A moves faster than B

C. to the given moving observer boat B moves faster than A

D. To the given moving observer the speeds of boat A and B are same

Answer: B::D

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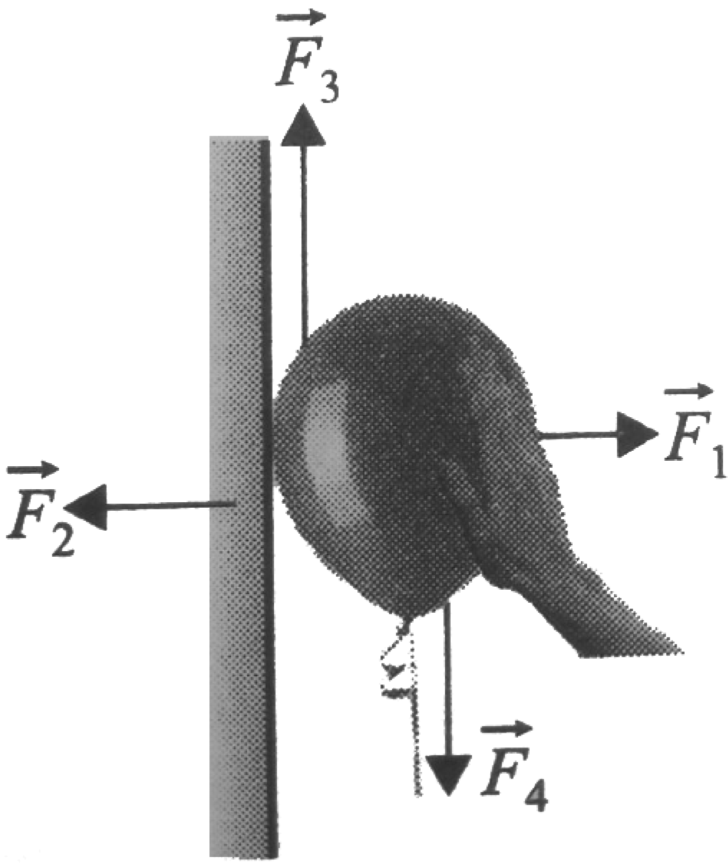

28.

In the figure shown, a balloon is pressed against a wall.

It is in equilibrium and maximum compressed state.

$\vec{F}$ = force of balloon on hand of man, $\vec{F}_2$ = force of balloon on wall, $\vec{F}_3$ = friction, $\vec{F}_4$ = weight of balloon.

Which of the following statements are correct:

A. $\vec{F}_1$ and $\vec{F}_2$ are action reaction pairs

B. $\vec{F}_3$ and $\vec{F}_4$ are action reaction pairs

C. $\vec{F}_1 + \vec{F}_2 = 0$

D. $\vec{F}_3 + \vec{F}_4 = 0$

Answer: C::D

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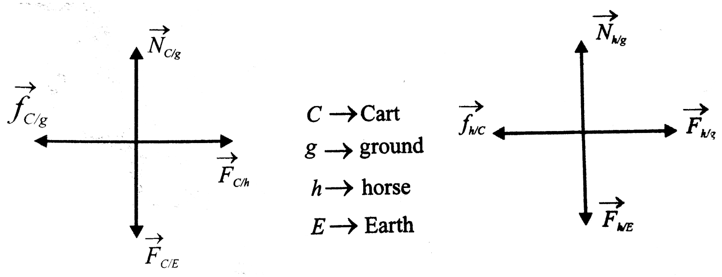
29. Consider a cart being pulled by a horse with a constant velocity. The horse exerts force $\vec{F}_{C/h}$ on the cart. (The subsript indicates the force on the cart due to the horse). The first subscript denotes the body on which the force acts and the second due to which it acts.



Choose the correct statement (s):

A. $\vec{f}\left(\frac{C}{g}\right), \vec{N}\frac{C}{g}, \vec{N}\frac{h}{g}$ are externel forces on a system consisting of horse and cart.

B. $\vec{F}\frac{h}{g} + \vec{f}\frac{C}{g} = 0$

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

D. $\vec{F}\frac{C}{h}$ and $\vec{f}\frac{h}{C}$ are action reaction pairs

Answer: A::B::D

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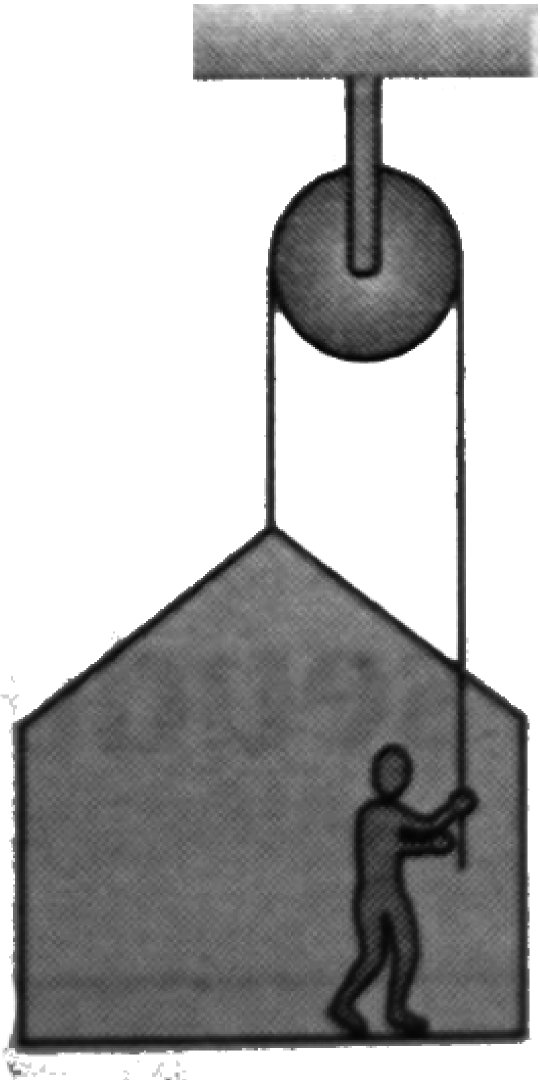
30.



A painter is applying force himself to raise him and the box with an acceleration of $5\frac{m}{s^2}$ by a massless rope and pulley arrangement as shown in figure. Mass of painter is 100 kg and that of box is 50 kg. If $g = 10\frac{m}{s^2}$, then:

A. Tension in the rope is 1125 N

B. tension in the rope is 2250 N

C. force of contact between the painter and the floor is 375 N

D. none of these

Answer: A::C

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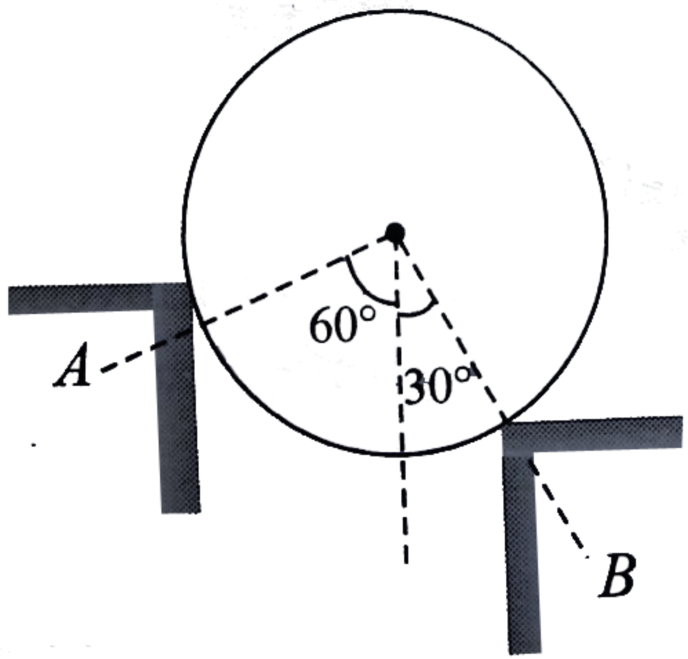

31.

A cylinder of mass M and radius R is resting on two corner edges A and B as shown in figure. The normal reaction at the edges A and B are: (Neglect friction)

A. $N_A = \sqrt{2}N_B$

B. $N_B = \sqrt{3}N_A$

C. $N_A = \dfrac{Mg}{2}$

D. $N_B = \frac{2\sqrt{3}Mg}{5}$

Answer: B::C

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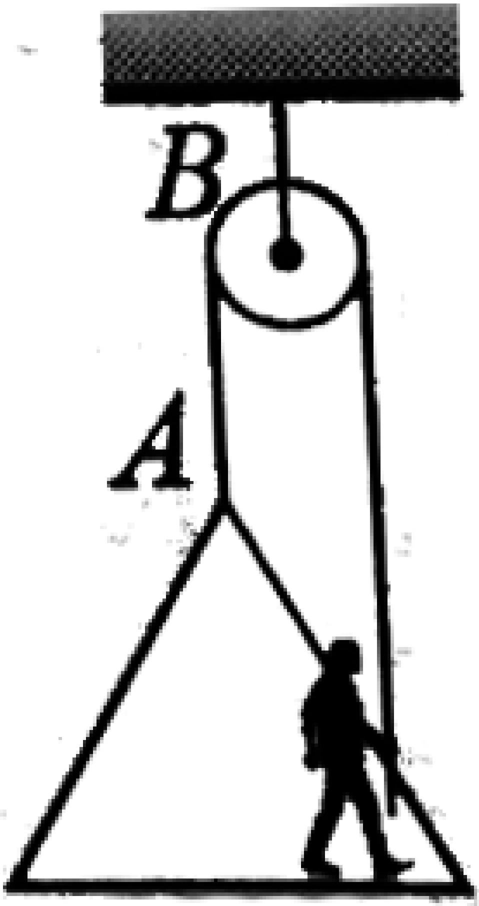
32.



To paint the side of a building, painter normally hoists himself up by pulling on the rope A as in figure. The painter and plateform together weigh 200 N. The rope B can withstand 300 N. Then

A. The maximum acceleration that painter can have upwards is $5\frac{m}{s^2}$.

B. To hoist himself up, rope B must withstand minimum 400 N force.

C. Rope A will have a tension of 100 N when the painter is at rest.

D. The painter must exert a force of 200 N on the rope A to go downwards slowly.

Answer: A::C

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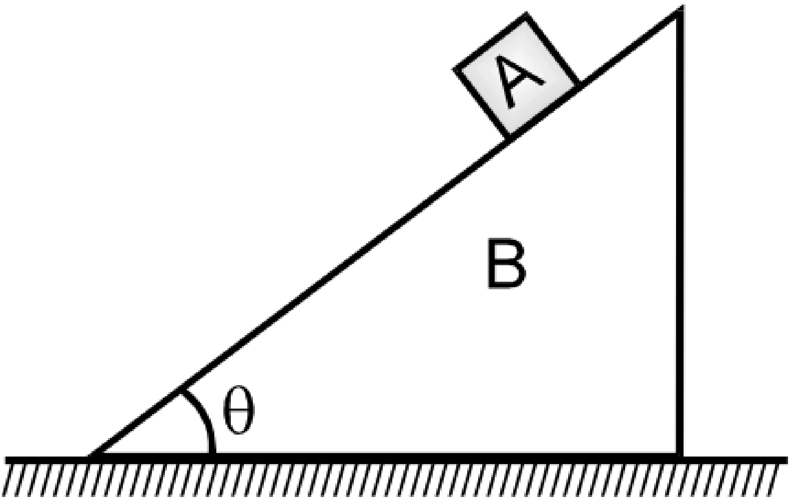
33. In the figure shown , A and B are free of to move. All the surfaces are smooth. $\left(0 < \theta < 90\,^{\circ}\right)$



A. the accelration of A will be more than $g\sin\theta$

B. the acceleration of A will beless than $g\sin\theta$

C. normal force on A due to B will be more than $mg\cos\theta$

D. normal force on A due to B will be less than $mg\cos\theta$

Answer: A::D

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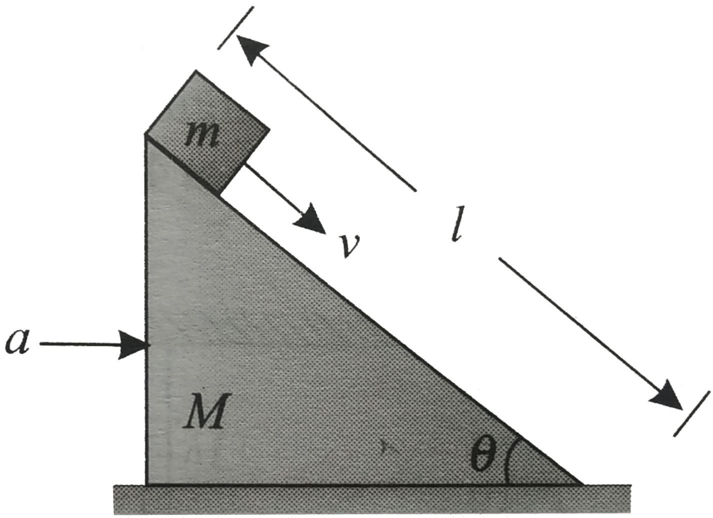
34.



A smooth wedge of mass M is pushed with an acceleration $a = > an\theta$ and a block of mass m is projected down the slant with a velocity v relative to the wedge.

Q. The time taken by the block to reach the ground is:

A. $\frac{l}{v}$

B. $\sqrt{\frac{2l}{g\sin\theta}}$

C. $\sqrt{\frac{2l}{g\cos\theta}}$

D. $\frac{v}{g\sin\theta}$

Answer: A

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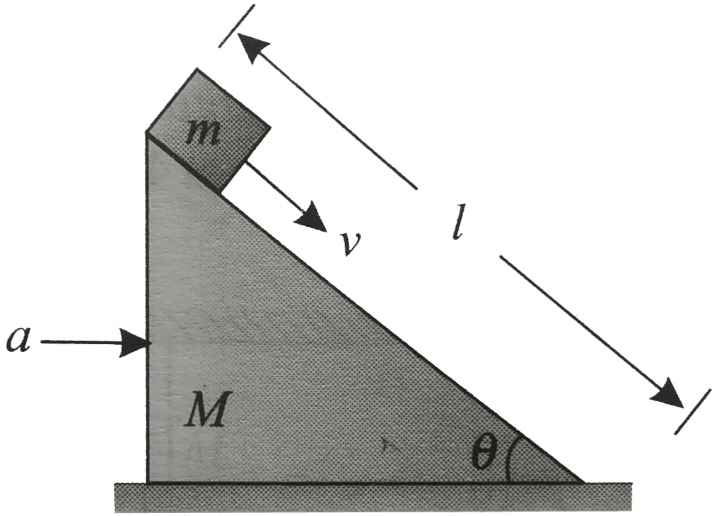

35.

A smooth wedge of mass M is pushed with an acceleration $a = g\tan\theta$ and a block of mass m is projected down the slant with a velocity v relative to the wedge.

Q. The normal reaction between wedge and block is:

A. $mg\cos\theta$

B. $mg\sec\theta$

C. $mg\cot\theta$

D. $m > an\theta$

Answer: B

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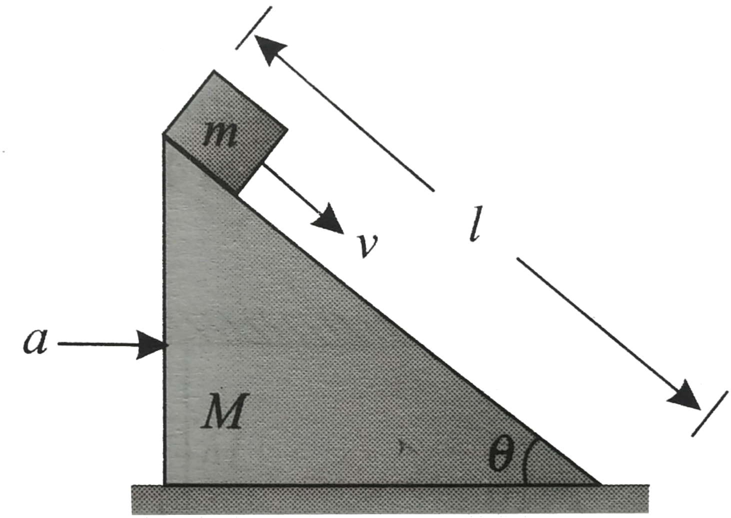

36.

A smooth wedge of mass M is pushed with an acceleration $a = \ > an\theta$ and a block of mass m is projected down the slant with a velocity v relative to the wedge.

`The horizontal force applied on the wedge is:

A. $(M + m)g\sin\theta$

B. $(M + m)g\cos\theta$

C. $Mg\tan\theta$

D. $(M + m)g\tan\theta$

Answer: D

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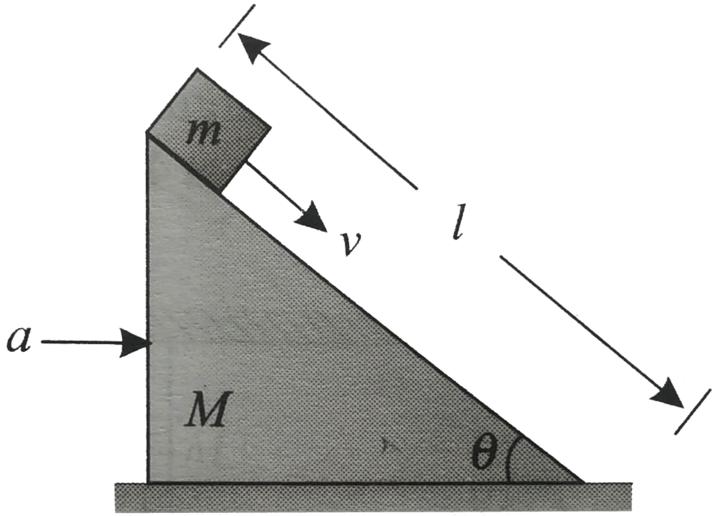
37.



A smooth wedge of mass M is pushed with an acceleration $a = > an\theta$ and a block of mass m is projected down the slant with a velocity v relative to the wedge.

Q. The normal reaction offered by ground to the wedge is:

A. $(M + m)g$

B. $(M + m)g\cos\theta$

C. $Mg\sin^2\theta + Mg$

D. $(M + m)g + mg\cos^2\theta$

Answer: A

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38.

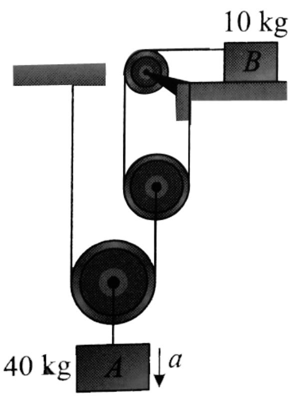

Figure shown two blocks A and B connected to an ideal pulley string system. In this system when bodies are released then:(neglect friction and take$g = 10\frac{m}{s^2}$)

A. Acceleration of block A is $1\frac{m}{s^2}$

B. Acceleration of block A is $2\frac{m}{s^2}$.

C. Tension in string connected to block B is 40 N

D. tension in string connected to block B is 80 N

Answer: B::D

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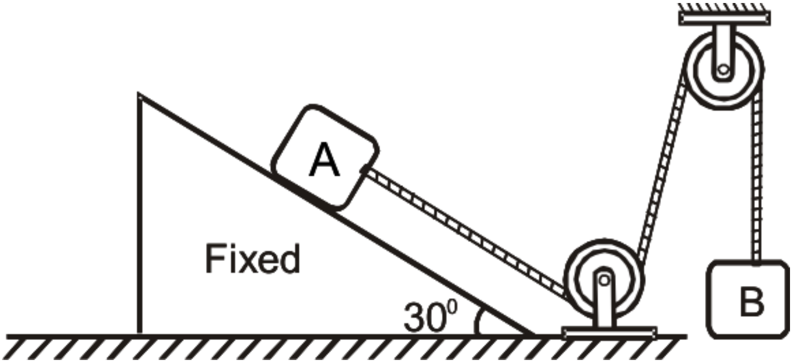
39. Two blocks A and B of equal mass m are connected through a massless string and arranged as shown in figure. The wedge is fixed on horizontal surface. Friction is absent everwhere. When the system is released from rest.



A. tension in string is $\frac{mg}{2}$

B. tension is stringig is $\frac{mg}{4}$

C. acceleration of A is $\frac{g}{2}$

D. acceleration of A is $\frac{3}{4}g$

Answer: B::D

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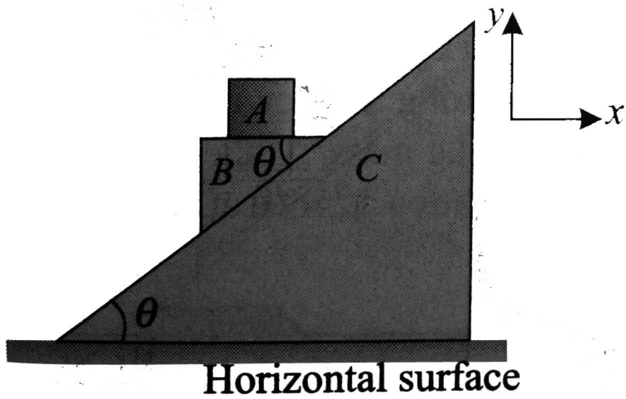
40. 

In the figure shown all the surface are smooth. All the blocks A,B and C are movable x-axis is horizontal and y-axis vertical as shown. Just after the system is relased from the position as shown.

A. Acceleration of A relative to ground is in negative y-direction

B. Acceleration of A relative to B is in positive x-direction

C. The horizontal acceleration of B relative to ground is in negative x-direction.

D. The acceleration of B relative to ground directed along the inclined surface of C is greater than $g \sin \theta$.

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

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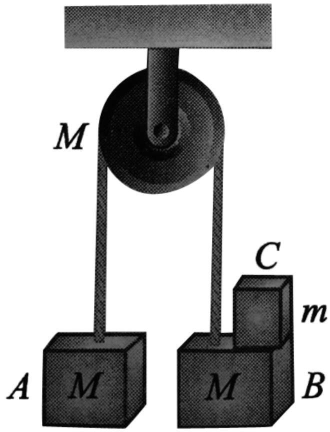
41.



For the following system shown assume that pulley is frictionless, string is massless (m remains on M),

Q. The acceleration of the block A is

A. $\frac{mg}{2M+m}$

B. $\frac{2mg}{2M+m}$

C. $\frac{mg}{M+2m}$

D. $\frac{Mg}{M+2m}$

Answer: A

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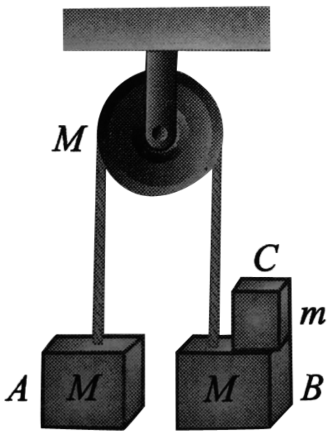
42.



For the following system shown assume that pulley is frictionless, string is massless (m remains on M),

Q. Normal reaction on m is (force on C due to B)

A. $\frac{Mmg}{2M+m}$

B. $2Mmg\frac{)}{2M+m}$

C. $\frac{Mmg}{M+2m}$

D. $\frac{2Mmg}{M+m}$

Answer: B

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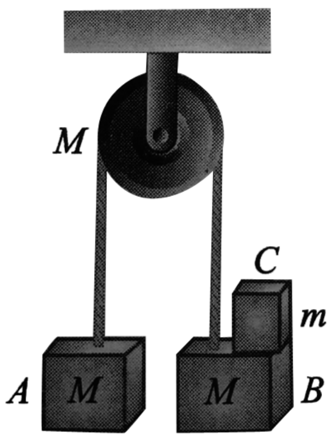

43.

For the following system shown assume that pulley is frictionless, string is massless (m remains on M),

Q. The force on the ceiling is

A. $\dfrac{(M+m)mg}{2M+m}$

B. $\dfrac{(6M+5m)mg}{M+m}$

C. $\dfrac{(M+m)mg}{M+m}$

D. $\dfrac{(6M+5m)Mg}{2M+m}$

Answer: D

Watch Video Solution

44.

Two blocks of mass M and m, are used to compress two different massless spring as shown. The left spring is compressed by 3 cm, while the right spring is compressed by an unknown amount.. The system is at rest, and all surfaces fixed and smooth. Which of the following statements are true?

A. The force exerted on block of mass m by the right spring is 6 N to the left.

B. The force exerted on block of mass m by the right spring is impossible to determine.

C. The net force on block of mass m is zero

D. The normal force exerted by block of mass m on block of mass M is 6N.

Answer: A::C::D

Watch Video Solution

45. When a bicycle is in motion, the force of friction exerted by the ground on the two wheels is such that it acts

A. in the backward direction on the from wheel and in the forward direction on the rear wheel

B. In the forward direction on the front wheel and in the backward direction on the rear wheel

C. in the backward direction on both front and the rear wheels

D. in the forward direction on both front and the rear wheels

Answer: A::C

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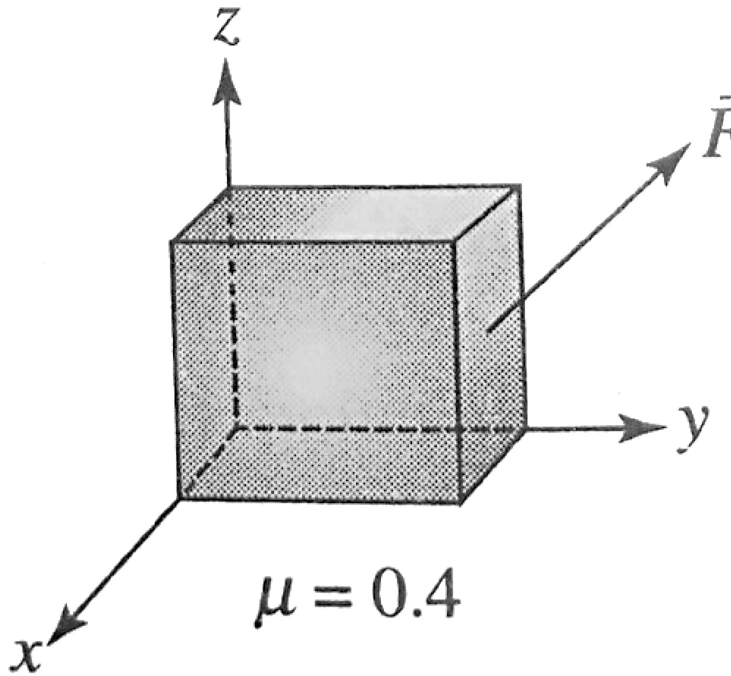

46.

A solid cube of mass 5 kg is placed on a rough horizontal surface, in xy-plane as shown. The friction coefficient between the surface and the cube is 0.4. An external force $\vec{F} = 6\hat{i} + 8\hat{j} + 20\hat{k}N$ is applied on the cube. (use $g = 10\frac{m}{s^2}$)

A. The block start silpping over the surface

B. the friction force on the cube by the surface is 10 N.

C. The friction force acts in xy-plane at angle 127° with the positive x-axis in clockwise direction.

D. The contact force exerted by the surface on the cube is $10\sqrt{10}N$.

Answer: B::C::D

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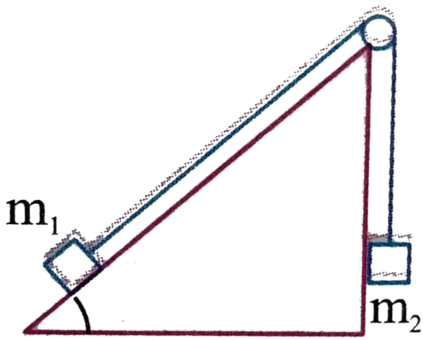
47. Two blocks of masses m_1 and m_2 are connected by a string of negligible mass which pass over a frictionless pulley fixed on the top of an inclined plane as shown in figure. The coefficient of friction between m_1 and plane is μ.



A. If $m_1 = m_2$ the mass m_1 first begin to move up inclined plane when the agle of inclination is θ ,then $\mu = \tan\theta$.

B. If $m_1 = m_2$ the mass m_1 first begin to move up the inclined plane when the angle of inclination is θ, then `mu=sectheta-tantheta.

C. If $m_1 = 2m_2$ the mass m_1 first begin to slide down the plane if $\mu = 2\tan\theta$.

D. If $m_1 = 2m_2$ the mass m_1 first begin to slide down the plane if $\mu = \tan\theta - \frac{1}{2}\sec\theta$.

Answer: B::D

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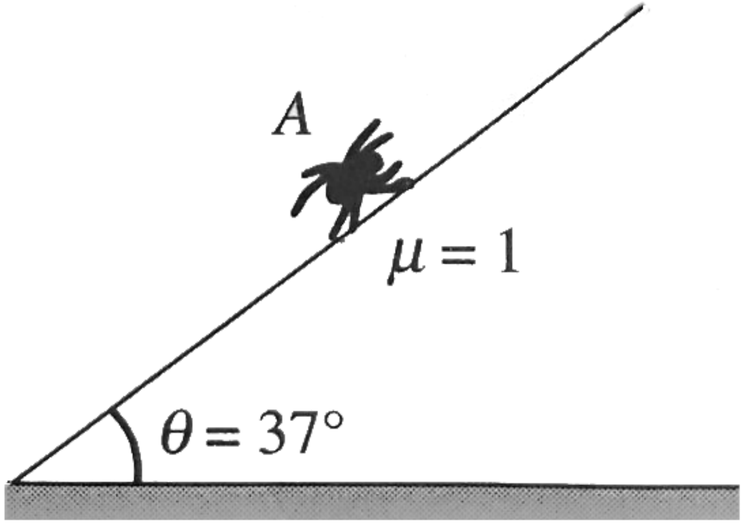
48.



An insect of mass m, starts moving on a rough inclined surface from point A. As the surface is vert sticky, the corfficient of fricion between the insect and the incline is $\mu = 1$. Assume that it can move in any direction, up the incline or down the incline then

A. the maximum possible acceleration of the insect can be $14 \frac{m}{\sec^2}$

B. the maximum possible acceleration of the insect can be $1 \dfrac{m}{\sec^2}$

C. the insect can move with a constant velocity

D. the insect cannot move with a constant velocity

Answer: A::C

Watch Video Solution

49. The given plot shows the variation of U, the potential energy of interation between two particles, with the distance separating them, r.

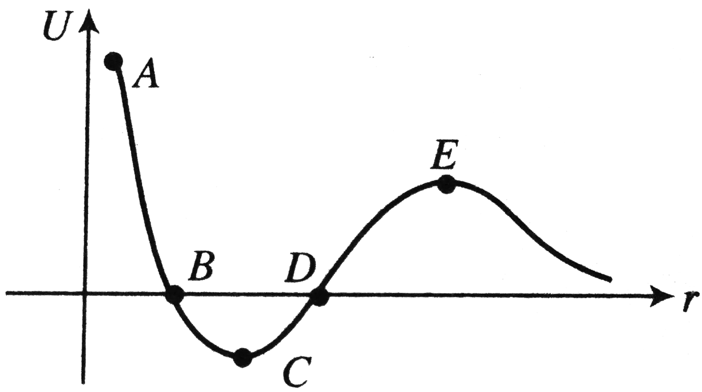
1. B and D are equilibrium points.

2. C is point of stable equilibrium.

3. The force of interaction between the two particles is attractive between points C and B, and repulsive between pionts D and E on the curve.

4. The force of interaction between the particle is repulsive between points C and A.

Which of the above statements are correct?



A. B and D are equilibrium points

B. C is a point of stable equilibrium

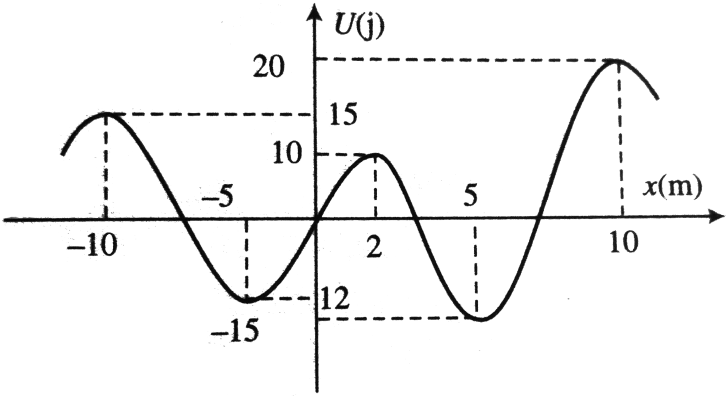
C. The force of interation between the two particles is attractive between points C and D and repulsive between points D and E on the curve.

D. The force of interation between the particles is repulsive between points E and F on the curve.

Answer: B::D

Watch Video Solution

50. In figure, the variation of potential energy of a particle of mass $m = 2kg$ is represented w.r.t its x-coordinate. The particle moves under the effect of the conservative force along the x-axis. Which of the following statements is incorrect about the particle?



A. If it is released at the origin it will move in negative x-axis

B. If it is released at $x = 2 + \triangle$ where $\triangle \to 0$ then its maximum speed will be $5\frac{m}{s}$ and it will perform oscillatory motion

C. If initially $x = -10m$ and $\vec{u} = \sqrt{6}\hat{i}\frac{m}{s}$ then it will cross $x = 10m$

D. $x = -5m$ and $x = +5$ m are unstable equilibrium positions of the particle.

Answer: A::B::C

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51. One of the forces acting on the particle is conservative, then

A. Its work is zero when the particle moves exactly once around any closed path.

B. its work equals the change in the kinetic energy of the particle

C. Then that particular force must be constant.

D. Its work depends on the end points of the motion, not on the path between.

Answer: A::D

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52. 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. The string becomes slack when the particle reaches its highest point.

B. The velocity of the particle becomes zero at the highest point.

C. The kinetic energy of the ball in initial position was $\frac{3}{2}mgl$

D. The velocity of the particle at the highest point is $\sqrt{gl}$

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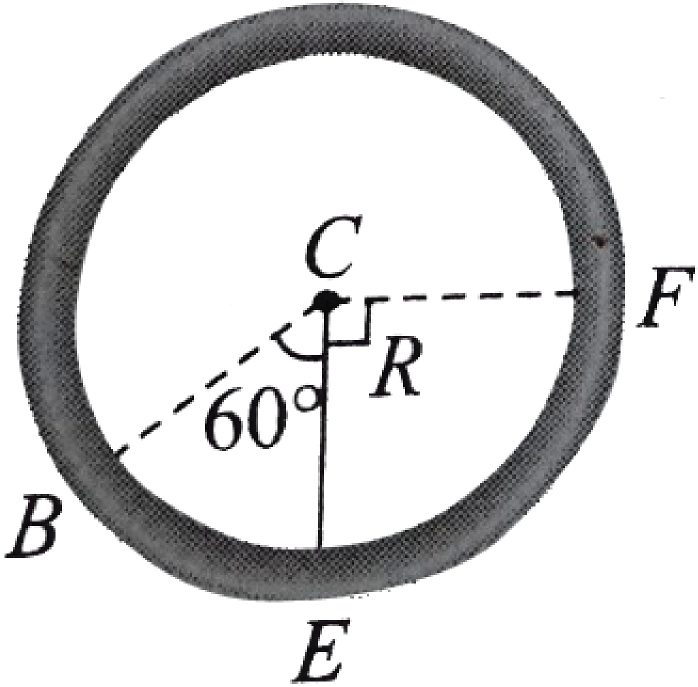
53.



As shown in figure BEF is a fixed vertical circular tube. A block of mass m starts moving in the tube at point B with velocity V towards E. It is just able to complete the vertical circle. Then.

A. Velocity at B must be $\sqrt{3Rg}$

B. velocity at F must be $\sqrt{2Rg}$

C. Normal reaction at point F is 2 mg.

D. The normal reaction at point E is 6 mg.

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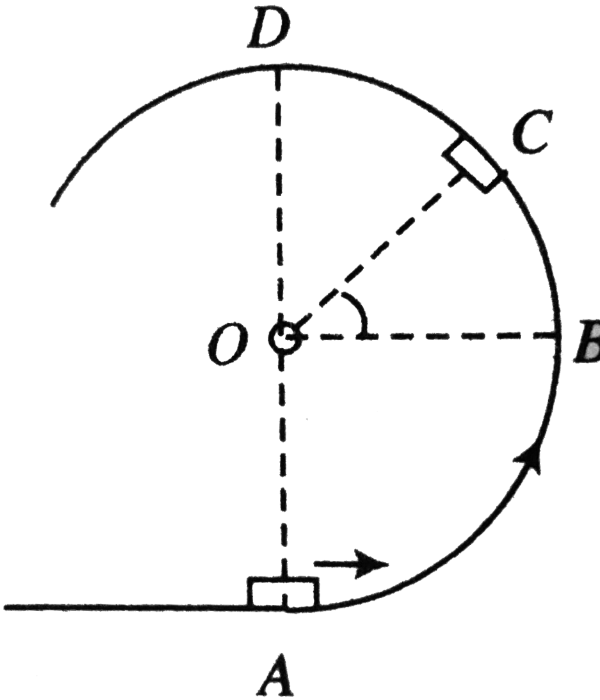
54. A small block of mass m is pushed on a smooth track from position A with a velocity $2\sqrt{5}$ times the minimum velocity required to reach point D. The block will leave the contact with track at the point where normal force between them becomes zero.



At what angle θ with horizontal does the block gets separated from the track?

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

B. $\sin^{-1}\left(\frac{3}{4}\right)$

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

D. never leaves contact with the track

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Single Correct Answer type

1. If u_1 and u_2 are the units selected in two systems of measurement and n_1 and n_2 their numerical values, then

A. $n_1 u_1 = n_2 u_2$

B. $n_1 u_1 + n_2 u_2 = 0$

C. $n_1 n_2 = u_1 u_2$

D. $\left(n_1 + u_1\right)l = \left(n_2 + u_2\right)$

Answer: A

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2. To determine the young's modulus of a wire , the formula is $Y = \frac{F}{A}.\frac{L}{\Delta l}$, where L = l ength ,A = area of cross - section of the wire , ΔL = change in the length of the wire when streched with a force F. Find the conversion factor to change it from CGS t o MKS system.

A. 1

B. 10

C. 0.1

D. 0.01

Answer: C

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3. Young's modulus of a material has the same units as

(A) pressure (B) strain (C) compressibility (D) Force

A. pressure

B. strain

C. compressibility

D. force

Answer: A

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4. Which of the following is the smallest unit?

A. millimetre

B. angstrom

C. fermi

D. metre

Answer: C

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5. Which of the following is not the unit of energy ?

A. calorie

B. joule

C. electron volt

D. watt

Answer: D

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6. In CGS system the magnitude of the force is 100 dynes. In another system where the fundamental phyical quamtities are kilogram , meter , and minute, find the magnitude of the force.

A. 0.036

B. 0.36

C. 3.6

D. 36

Answer: C

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7. A physical quantity is measured and the result is expressed as nu where u is the unit used and n is the numberical value. If the result is expressed in various units then

A. $n \propto u^2$

B. $n \propto u$

C. $n \propto \sqrt{u}$

D. $n \propto \frac{1}{u}$

Answer: D

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8. If $x = at + bt^2$, where x is the distance rtravelled by the body in kilometer while t is the time in seconds , then find the units of b.

A. $\frac{km}{s}$

B. km - s

C. $\frac{km}{s^2}$

D. km - s^2

Answer: C

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9. In $S = a + bt + ct^2$. S is measured in metres and t in seconds. The unit of c is

A. None

B. m

C. ms^{-1}

D. ms^{-2}

Answer: D

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10. Find out the units and dimensions of the constants a and b in the vander waal.s equation $\left(P + \frac{a}{V^2}\right)(V - b) = RT.$

A. Dyne $\times cm^5$

B. Dyne $\times cm^4$

C. Dyne/ $\left(cm^3\right)$

D. Dyne/ $\left(cm^2\right)$

Answer: B

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11. A watt is

A. $\frac{kgm}{s^2}$

B. $kgm^2\frac{)}{s^3}$

C. $k\frac{g(m)}{s}$

D. $k\frac{g\left(m^2\right)}{s^2}$

Answer: B

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12. Experiment shows that two perfectly neutral parallel metal plates separated by a small distance d sttract eachother via a very weak force, known as the Casimir force. The force per unit area of the plates, F, depends only on the Planck constant h, on the speed of light c, and on d. Which of the following has the best chance of being correct for F?

A. $F = \frac{hc}{d^2}$

B. $F = \frac{hc}{d^4}$

C. $F = \frac{hd^2}{c}$

D. $F = \frac{d^4}{hc}$

Answer: B

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13. Select the pair whose dimensions are same

A. pressure and stress

B. stress and strain

C. pressure and force

D. power and force

Answer: A

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14. Dimensional formula $ML^{-1}T^{2}$ does not represent the physical quantity

A. young's modulus of elasticity

B. stress

C. strain

D. pressure

Answer: C

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15. Which pair has the same dimensions?

A. work and power

B. density and relative density

C. momentum and impulse

D. stress and strain

Answer: C

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16. The dimensional formul for impulse is same as the dimensional formula for

A. momentum

B. force

C. rate of change of momentum

D. torque

Answer: A

Watch Video Solution

17. Which of the following is dimensionally correct?

A. pressure = energy per unit area

B. *pressure*=`energy per unit volume

C. pressure = force per unit volume

D. pressure = momentum per unit volume per unit time

Answer: B

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18. The equation of state for real gas is given by $\left(\left(p + \frac{a}{V^2}(V - b) = RT\right.\right.$. The dimension of the constant a is ....

A. ML^5T^{-2}

B. $ML^{-1}T^{-2}$

C. $M^0L^3T^0$

D. $M^0L^6T^0$

Answer: A

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19. The frequency of vibration f of a mass m suspended from a spring of spring constant k is given by a relation of the type $f = Cm^x k^y$, where C is a dimensionless constant. The values of x and y are

A. $x = \frac{1}{2}, y = \frac{1}{2}$

B. $x = -\frac{1}{2}, y = -\frac{1}{2}$

C. $x = \frac{1}{2}, y = -\frac{1}{2}$

D. $x = -\frac{1}{2}, y = \frac{1}{2}$

Answer: D

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20. The quantities A and B are related by the relation, $m = A/B$, where m is the linear density and A is the force. The dimensions of B are of

A. pressure

B. work

C. latent heat

D. None of these

Answer: C

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21. The velocity of a freely falling body changes as $g^p h^q$ where g is acceleration due to gravity and h is the height. The values of p and q are

A. $1, \frac{1}{2}$

B. $\frac{1}{2}, \frac{1}{2}$

C. $\frac{1}{2}, 1$

D. 1,1

Answer: B

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22. Which of the following do not have same dimensions ?

A. work and enegy

B. angle and strain

C. relative density and refractive index

D. planck constant and energy

Answer: D

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23. A small steel ball of radius r is allowed to fall under gravity through a column of a viscous liquid of coefficient of viscosity η. After some time the velocity of the ball attains a constant value known as terminal velocity υ_T. The terminal velocity depends on (i) the mass of the ball m (ii) η, (iii) r and (iv) acceleration due to gravity g . Which of the following relations is dimensionally correct?

A. $v_T \propto \frac{mg}{\eta r}$

B. $v_T \propto \frac{\eta r}{mg}$

C. $v_T \propto \eta rmg$

D. $v_T \propto \frac{mgr}{\eta}$

Answer: A

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24. An athlletic coach told his team that muscle times speed equals power. What dimesions does he view for muscle?

A. MLT^{-2}

B. $ML^{2}T^{-2}$

C. MLT^{-2}

D. L

Answer: A

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25. If p represents radiation pressure, c represents speed of light and S represents radiation energy striking unit area per sec. The non-zero integers x,y,z such that $p^y S^y c^z$ is dimensionless are

A. $x = 1, y = 1, z = -1$

B. $x = 1, y = 1, z = 1$

C. $x = -1, y = 1, z = 1$

D. $x = 1, y = 1, z = 1$

Answer: B

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26. If velocity v acceleration A and force F are chosen as fundamental quantities, then the dimensional formula of angular momentum is terms of v,A and F would be

A. $FA^{1}v$

B. $Fv^{3}A^{-2}$

C. $Fv^{2}A^{-1}$

D. $F^{2}v^{2}A^{-1}$

Answer: B

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27. If dimensions of A and B are different, then which of the following operation is valid?

A. $\frac{A}{B}$

B. $A + B$

C. $A - B$

D. None

Answer: A

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28. A force F is given by $F = at + bt^2$, where t is time .

What are the dimensions of a and b?

A. MLT^{-3} and ML^2T^{-4}

B. MLT^{-3} and MLT^{-4}

C. MLT^{-1} and MLT^0

D. MLT^{-4} and MLT^1

Answer: B

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29. If speed of light c, accleratio due to gravity g and pressure p are taken as fundamental units, the dimension of gravitational constant (G) are

A. $c^2 g^0 p^{-2}$

B. $c^0 g^2 p^{-1}$

C. $c g^3 p^{-2}$

D. $c^{-1} g^0 p^{-1}$

Answer: B

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30. If the time period $(T)$of vibration of a liquid drop depends on surface tension (S) , radius(r) of the drop , and density (ρ) of the liquid , then find the expression of T.

A. $T = k\sqrt{\frac{\rho r^3}{S}}$

B. $T = k\sqrt{\frac{\rho^{\frac{1}{2}} r^3}{S}}$

C. $T = k\sqrt{\frac{\rho r^3}{S^{\frac{1}{2}}}}$

D. None of these

Answer: A

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31. If pressure P, velocity V and time T are taken as fundamental physical quantities, the dimensional formula of force if

A. $PV^{-2}T^{2}$

B. $P^{-1}V^{2}T^{-2}$

C. PVT^{2}

D. $P^{-1}VT^{2}$

Answer: A

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32. If the energy (E) ,velocity (v) and force (F) be taken as fundamental quantities,then the dimension of mass will be

A. Ev^2

B. Ev^{-2}

C. Fv^{-1}

D. Fv^{-2}

Answer: B

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33. A physical quantity x depends on quantities y and z as follows : $x = Ay + B\tan(Cz)$, where A, B and C are constants. Which of the followings do not have the same dimensions?

A. x and B

B. C and z^{-1}

C. y and $\frac{B}{A}$

D. x and A

Answer: D

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34. If the velocity of light (c) , gravitational constant (G) , and Planck's constant (h) are chosen as fundamental units , then find the dimensions of mass in new system.

A. $c^{\frac{1}{2}}G^{\frac{1}{2}}h^{\frac{1}{2}}$

B. $c^{\frac{1}{2}}G^{\frac{1}{2}}h^{\frac{-1}{2}}$

C. $c^{\frac{1}{2}}G^{\frac{-1}{2}}h^{\frac{1}{2}}$

D. $c^{\frac{-1}{2}}G^{\frac{1}{2}}h^{\frac{1}{2}}$

Answer: C

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35. If force (F), length L and time T are taken as fundamental units, the dimensional formula for mass will be

A. $FL^{-1}T^{2}$

B. $FL^{-1}T^{-2}$

C. $FL^{-1}T^{-1}$

D. $FL^{2}T^{2}$

Answer: A

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36. Position of a body with acceleration a is given by $x = Ka^m t^n$, here t is time Find demension of m and n.

A. $m = 1, n = 1$

B. $m = 1, n = 2$

C. $m = 2, n = 1$

D. $m = 2, n = 2$

Answer: B

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37. In a system of units, if force (F), acceleration (A) and time (T) are taken as fundamental units, then the dimensional formula of energyy is

A. FA^2T

B. FAT^2

C. F^2AT

D. FAT

Answer: B

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38. Density of a liquid in CGS system is $0.625 \frac{g}{cm^3}$. What is its magnitude is SI system?

A. 0.625

B. 0.0625

C. 0.00625

D. 625

Answer: D

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39. If the speed v of a particle of mass m as function of time t is given by $v = \omega A \sin\left[\left(\frac{\sqrt{k}}{m}\right)t\right]$, where A has dimension of length.

A. the argument of trigonometric function must be a dimensionless quntity

B. Dimensional formula of ω is LT^{-1}

C. Dimensional formula of k is MLT^{-2}

D. Dimensional formula of $\sqrt{\frac{k}{m}}$ is T

Answer: A

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40. What is the number of significant figures in 0.0310×10^3?

A. 2

B. 3

C. 4

D. 6

Answer: B

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41. The number of significant figures in 0.06900 is

A. 5

B. 4

C. 3

D. 2

Answer: B

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42. The sum of the numbers 436.32, 227.2 and 0.301 in appropriate significant figures is

A. 663.821

B. 664

C. 663.8

D. 663.82

Answer: B

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43. The mass and volume of a body are 4.237 g and 2.5 cm^3, respectively. The density of the material of the body in correct significant figures is

A. 1.6048 g cm^{-3}

B. 1.69 g cm^{-3}

C. 1.7 g cm^{-3}

D. 1.695 g cm^{-3}

Answer: C

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44. The numbers 2.745 and 2.735 on rounding off to 3 significant figures will give

A. 2.75 and 2.74

B. 2.74 and 2.73

C. 2.75 and 2.73

D. 2.74 and 2.74

Answer: D

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45. The length and breadth of a rectangular sheet are 16.2 cm and 10.1 cm, respectively. The area of the sheet in appropriate significant figures and error is

A. $164 \pm 3 cm^2$

B. $163.62 \pm 2.6 cm^2$

C. $163.6 \pm 2.6 cm^2$

D. $163.62 \pm 3 cm^2$

Answer: A

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46. The dicimal equivalent of $\frac{1}{20}$ up to three significant figures is

A. 0.0500

B. 0.05000

C. 0.0050

D. 5.0×10^{-2}

Answer: A

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47. In the context of accuracy of measurement and significant figures in expressing result of experiment, which of the following is /are correct

(1) Out of the two measurements 50.14 cm and 0.00025 ampere, the first one has greater accuracy

(2) If one travels 478 km by rail and 397 m by road,, the total distance travelled is 478 km

A. Only (1) is correct

B. Only (2) is correct

C. both are correct

D. none of them is correct

Answer: C

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48. If $L = 2.331 cm, B = 2.1 cm$, then `L+B=

A. 4.431cm

B. 4.43 cm

C. 4.4 cm

D. 4 cm

Answer: C

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49. Measure of two quantities along with the precision of respective measuring intrument is $A = 2.5ms^{-1} \pm 0.5ms^{-1}$, $B = 0.10s \pm 0.01s$ The value of AB will be

A. $(0.25 \pm 0.08)m$

B. (0.25 ± 0.5)m

C. (0.25 ± 0.05)m

D. (0.25 ± 0.135)m

Answer: A

Watch Video Solution

50. You measure two quantities as A=1.0m $\pm 0.2m$, $B = 2.0m \pm 0.2m$. We should report correct value for $\sqrt{AB}$ as

A. 1.4m ± 0.4m

B. 1.41 ± 0.15m

C. 1.4m + 0.3m

D. 1.4m ± 0.2m

Answer: D

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51. Which of the following measurement is most precise ?

A. 5.00mm

B. 5.00cm

C. 5.00m

D. 5.00km

Answer: A

Watch Video Solution

52. The mean length of an object is 5 cm. which of the following measurements is most accurate?

A. 4.9cm

B. 4.805cm

C. 5.25cm

D. 5.4cm

Answer: A

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53. The period of oscillation of a simple pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$ where l is about 100 cm and is known to have 1 mm accuracy. The period is about 2 s. The time of 100 oscillation is measrued by a stop watch of least count 0.1 s. The percentage error is g is

A. 0.1 %

B. 1 %

C. 0.2 %

D. 0.8 %

Answer: C

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54. Percentage erros in the measurement of mass and speed are 2% and 3% respectively. The error in the estimation of kinetic energy obtained by measuring mass and speed will be:

A. 11 %

B. 8 %

C. 5 %

D. 1 %

Answer: B

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55. The error in the measurement of the radius of a sphere is 1%. Find the error in the measurement of volume.

A. 1%

B. 3%

C. 5%

D. 7%

Answer: B

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56. The mean time period of second's pendulum is 2.00 s and mean absolute error in the time period is 0.05s. To express maximum estimate of error, the time period should be written as

A. $(2.00 \pm 0.01)s$

B. $(2.00 \pm 0.025)s$

C. $(2.00 \pm 0.05)s$

D. $(2.00 \pm 0.10)s$

Answer: C

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57. A body travels uniformly a distance of $(13.8 \pm 0.2)m$ in a time $(4.0 \pm 0.3)s$. Find the velocity of the body within error limits and the percentage error.

A. $(3.45 \pm 0.2)ms^{-1}$

B. $(3.45 \pm 0.3)ms^{-1}$

C. $(3.45 \pm 0.4)ms^{-1}$

D. $(3.45 \pm 0.5)ms^{-1}$

Answer: B

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58. A body travels uniformly a distance of $13.8 \pm 0.2m$ in time $4.0 \pm 0.3s$. The velocity of the body within error limits is?

The percentage errors in the above problem is?

A. $7\ \%$

B. $5.95\ \%$

C. $8.95\ \%$

D. $9.85\ \%$

Answer: C

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59. A physical parameter a can be determined by measuring the parameters $b, c, d,$ and e using the relation $a = b^{\alpha}c^{\beta}/d^{\gamma}e^{\delta}$. If the maximum errors in the measurement of $b, c, d,$ and $eareb_1\,\%, c_1\,\%, d_1\,\%,$ and $e_1\,\%$, then the maximum error in the value of a determined by the experminent.

A. $\left(b_1 + c_1 + d_1e_1\right)\%$

B. $\left(b_1 + c_1 - d_1 - e_1\right)\%$

C. $\left(\alpha b_1 + \beta c_1 - \gamma d_1 - \delta e_1\right)\%$

D. $\left(\alpha b_1 + \beta c_1 + \gamma d_1 + \delta e_1\right)\%$

Answer: D

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60. The relative density of material of a body is found by weighting it first in air and then in water . If the weight in air is $(5.00 \pm 0.05)N$ and the weight in water is $(4.00 \pm 0.05)N$. Find the relative density along with the maximum permissible percentage error.

A. $5.0 \pm 11\%$

B. $50 \pm 1\%$

C. $5.0 \pm 6\%$

D. $1.25 \pm 5\%$

Answer: A

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61. In an experiment, the period of oscillation of a simple pendulum was observed to e 2.63 s, 2.56 s, 2.42 s, 2.71 s and 2.80 s. the mean absolute error is

A. 0.1s

B. 0.11s

C. 0.01s

D. 1.0s

Answer: B

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62. The length of a cylinder is measured with a meter rod having least count $0.1 cm$. Its diameter is measured with Vernier calipers having least count $0.01 cm$. Given that length is $5.0 cm$ and radius is $2 cm$. Find the percentage error in the calculated value of the volume.

A. 1%

B. 2%

C. 3%

D. 4%

Answer: C

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63. In an experiment , the following observations were recorded:

$L = 2.820m, M = 3.00kg, l = 0.087cm, diameter, D = 0.041cm$. Taking $g = 9.81ms^{-2}$ and using the formula , $Y = \frac{4MgL}{\pi D^2 l}$, find the maximum permissible error in Y.

A. 7.96 %

B. 4.56 %

C. 6.50 %

D. 8.42 %

Answer: C

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64. If there is a positive error of 50% in the measurement of velocity of a body , find the error in the measurement of kinetic energy.

A. 25%

B. 50%

C. 100%

D. 125%

Answer: D

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65. A physical quantity A is related to four observable a,b,c and d as follows, $A = \frac{a^2 b^3}{c\sqrt{d}}$, the percentage errors of measurement is a,b,c and d,are 1% ,3% ,2% and 2% respectively. What is the percentage error in the quantity A?

A. 12%

B. 7%

C. 5%

D. 14%

Answer: D

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66. A wire has a mass (0.3 ± 0.003)g, radius (0.5 ± 0.005) mm and length (0.6 ± 0.006) cm. The maximum percentage error in the measurement of its density

A. 1

B. 2

C. 3

D. 4

Answer: D

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67. Convert 18 degree into radians

A. $\frac{\pi}{10} rad$

B. $\frac{\pi}{180} rad$

C. $\frac{\pi}{18} rad$

D. $\frac{18}{\pi}$

Answer: A

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68. Value of $\sin\left(37^{\circ}\right)\cos\left(53^{\circ}\right)$ is

A. $\frac{9}{25}$

B. $\frac{12}{25}$

C. $\frac{16}{25}$

D. $\frac{3}{5}$

Answer: A

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69. If $\sin\theta = \frac{1}{3}$, then $\cos\theta$ will be

A. $\frac{8}{9}$

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

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

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

Answer: C

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70. $\sin\left(90^\circ + \theta\right)$ is

A. $\sin\theta$

B. $\cos\theta$

C. $-\cos\theta$

D. $-\sin\theta$

Answer: B

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71. $\cos\left(30^{\circ}\right)$ is equal to

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

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

C. $\frac{1}{\sqrt{2}}$

D. none

Answer: A

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72. If $\sin\theta = \frac{1}{3}$, then $\cos\theta$ will be

A. $\frac{8}{9}$

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

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

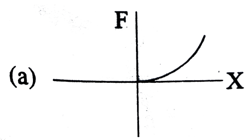
D. $\frac{3}{4}$

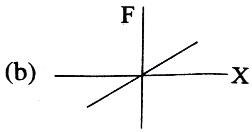
Answer: C

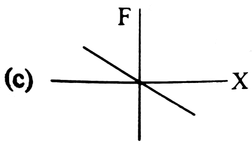
Watch Video Solution

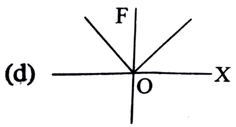
73. The spring force is given by $F = -kx$, here k is a constant and x is the deformation of spring. The $F - x$

graph is

A. 

B. 

C. 

D. 

Answer: C

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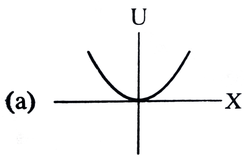
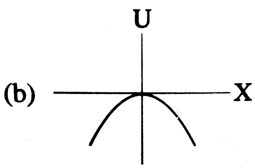
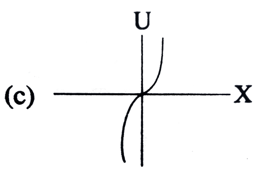
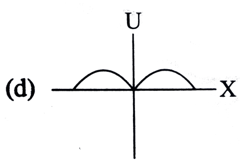
74. A body is attached to a spring whose other end is fixed. If the spring is elongated by x, its potential energy is $U = 5x^2$, where x is in metre and U is in joule. U-x graph is

A. 

B. 

C. 

D. 

Answer: A

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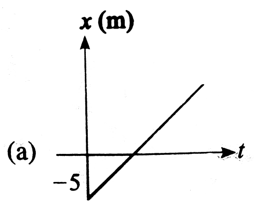
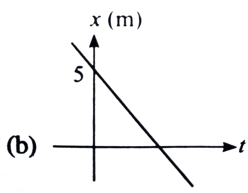
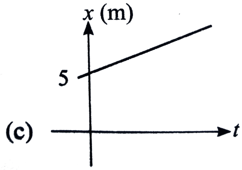
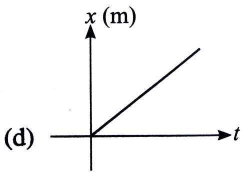
75. A particle starts moving with constant, velocity $v = 2\frac{m}{s}$, from position $x = 5m$ The position time graph will be

A. 

B. 

C. 

D. 

Answer: C

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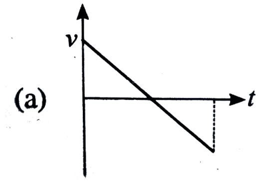
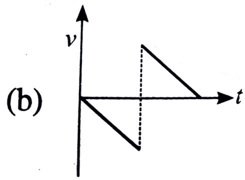
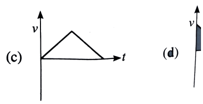
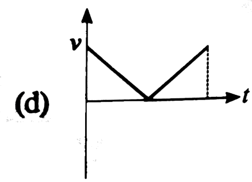
76. A stone is allowed to fall freely from a certain Height. Neglecting air resistance, which graph represents the variation of velocity v with time t ?

A. 

B. 

C. 

D. 

Answer: C

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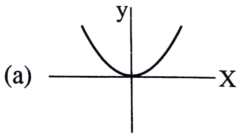
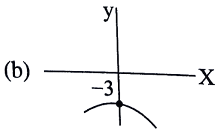
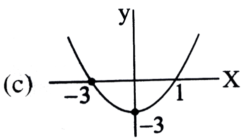
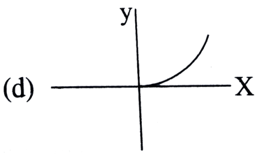
77. If $y = x^2 + 2x - 3, y - x$ graph is

A. 

B. 

C. 

D. 

Answer: C

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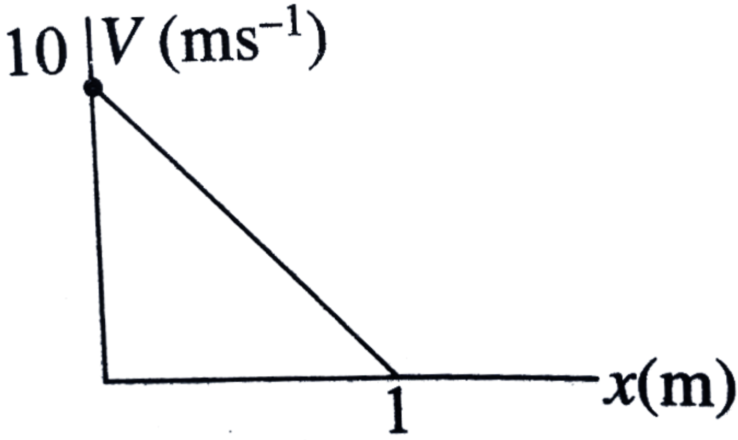
78.



The velcocity displacement graph of a particle moving along a straight line is shown in figure. The velocity as function of $x(0 \leq x \leq 1)$ is

A. - $10x$

B. - $10x + 10$

C. $10x$ - 10

D. - $10x^2 + 10x + 10$

Answer: B

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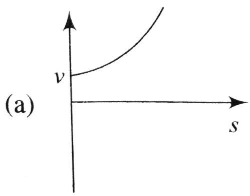
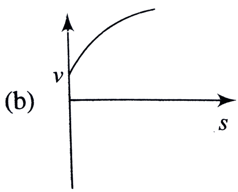
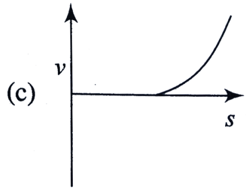
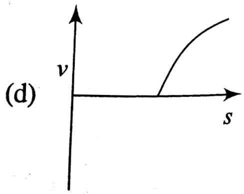
79. Which of the following best represents the graph of velocity (v) versus displacement (s) for a particle travelling with an acceleration (uniform) and some non zero initial velocity?

A. 

B. 

C. 

D. 

Answer: D

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80. Differentiation of $\sin(x^2)$ w.r.t. x is

A. $\cos(x^2)$

B. $2x\cos(x^2)$

C. $x^2\cos\left(x^2\right)$

D. $-\cos(2x)$

Answer: B

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81. If $y = 2\sin^2\theta + \tan\theta$ then $\frac{dy}{dth\eta}$ will be

A. $4\sin\theta\cos\theta + \sec\theta\tan\theta$

B. $2\sin2\theta + \sec^2\theta$

C. $4\sin\theta + \sec^2\theta$

D. $2\cos^2\theta + \sec^2\theta$

Answer: B

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82. If $y = \sin x$ and $x = 3t$ then $\frac{dy}{dt}$ will be

A. $3\cos(x)$

B. $\cos x$

C. $-3\cos(x)$

D. $-\cos x$

Answer: A

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83. If $y = \sin\left(t^2\right)$, then $\frac{d^2y}{dt^2}$ will be

A. $2t\cos\left(t^2\right)$

B. $2\cos\left(t^2\right) - 4t^2\sin\left(t^2\right)$

C. $4t^2\sin\left(t^2\right)$

D. $2\cos\left(t^2\right)$

Answer: B

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84. The displace ment of a body at any time t after starting is given by $s = 10t - \frac{1}{2}(0.2)t^2$. The velocity of the body is zero after:

A. 50 s

B. 100 s

C. 80 s

D. 40 s

Answer: A

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85. if $y = x^2 \sin x + \frac{3x}{\tan x}$, then $\frac{dy}{dx}$ will be

A. $2x\sin x + x^2\cos x + \frac{3\tan x - 3x\sec^2 x}{\tan^2 x}$

B. $2x\sin x + \dfrac{3x\sec^2 x - 3\tan x}{\tan^2 x}$

C. $\dfrac{x^2\cos x + 2x\sin x - \left(3\tan x - 3x\sec^2 x\right)}{\tan^2 x}$

D. $\dfrac{x^2\cos x - 2x\sin x - \left(3\tan x - 3x\sec^2 x\right)}{\tan^2}$

Answer: A

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86. The value of the function $(x - 1)(x - 2)^2$ at its maxima is

A. 1

B. 2

C. 0

D. $\frac{4}{27}$

Answer: D

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87. The adjacent sides of a rectangle with given perimeter as 100 cm and enclosing maximum area are

A. 10 cm and 40 cm

B. 20 cm and 30 cm

C. 25 cm and 25 cm

D. 15 cm and 35 cm

Answer: C

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88. The area of a rectangle will be maximum for the given perimeter, when rectangle is a

A. parallelogram

B. trapezium

C. square

D. none of these

Answer: C

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89. if $x + y = 10$, thent he maximum value of xy is

A. 5

B. 20

C. 25

D. none of these

Answer: C

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90. the sum of two numbers is fixed. Then its multiplication is maximum, when

A. each number is half of the sum

B. each number is $\frac{1}{3}$ and $\frac{2}{3}$ respectively of the sum

C. each number is $\frac{1}{4}$ and $\frac{3}{4}$ respectively of the sum

D. none of these

Answer: A

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91. If sum of two numbers is 3, then maximum value of the product of first and the square of second is

A. 4

B. 3

C. 2

D. 1

Answer: A

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92. If from a wire of length 36 metre a rectangle of greatest area is made, than its two adjacent sides in metre are

A. 6,12

B. 9,9

C. 10,8

D. 13,5

Answer: B

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93. 20 is divided into two parts so that product of cube of one quantity and square of the other quantity is maximum. The parts are

A. 10, 10

B. 16, 4

C. 8, 12

D. 12, 8

Answer: D

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94. Let x and y be two real variable such that $x > 0$ and $xy = 1$. Find the minimum value of $x + y$.

A. 2

B. 3

C. 4

D. 0

Answer: A

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95. Divide 20 into two parts such that the product of one part and the cube of the other is maximum. The two parts are

A. $(10, 10)$

B. $(5, 15)$

C. $(13, 7)$

D. none of these

Answer: B

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96. The maximum and minimum values of $x^3 - 18x^2 + 96x$ in interval $(0, 9)$ are

A. 160,0

B. 128,160

C. 160,128

D. 0,160

Answer: C

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97. The maximum values of $\sin x(1 + \cos x)$ will be at the

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

B. $x = \frac{\pi}{6}$

C. $x = \frac{\pi}{3}$

D. $x = \pi$

Answer: C

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98. The function $f(x) = 2x^3 - 3x^2 - 12x + 4$ has

A. no maxima and minima

B. one maximum and one minimum

C. two maximum

D. two minima

Answer: B

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99. The perimeter of a sector is p. The area of the sector is maximum when its radius is

A. $\sqrt{p}$

B. $\frac{1}{\sqrt{p}}$

C. $\frac{p}{2}$

D. $\frac{p}{4}$

Answer: D

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100. The minimum value of $x^2 + \frac{250}{x}$ is

A. 75

B. 50

C. 25

D. 55

Answer: A

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101. A man 2 metres high walks at a uniform speed of 5 km/hr away from a lamp-post 6 metres high. Find the rate at which the length of his shadow increases.

A. 5m/h

B. $\frac{5}{2}\frac{m}{h}$

C. $\frac{5}{3}\frac{m}{h}$

D. $\frac{5}{4}\frac{m}{s}$

Answer: B

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102. A ladder 5 m in length is resting against vertical wall. The bottom of the ladder is pulled along the ground away from the wall at the rate of 1.5m/sec. Then the highest point of the ladder when the foot of the ladder is 4.0 m away from the wall , decreases at the rate of

A. 2m/sec

B. 3m/sec

C. 2.5m/sec

D. 1.5m/sec

Answer: A

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103. If by dropping a stone in a quiet lake a wave moves in circle at a speed of 3.5cm/sec, then the rate of increase of the enclosed circular region when the radius of the circular wave is 10 cm, is $\left(\pi = \frac{22}{7}\right)$

A. 220sq.cm/sec

B. 110sq.cm/sec

C. 35sq.cm/sec

D. 350sq.cm/sec

Answer: A

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104. A ladder is resting with the wall at an angle of 30°. A man is ascending the ladder at the rate of 3 ft/sec. His rate of approaching the wall is

A. 3ft/sec

B. $\frac{3}{2}f\frac{t}{\sec}$

C. $\frac{3}{4}f\frac{t}{\sec}$

D. $\frac{3}{\sqrt{2}}f\frac{t}{\sec}$

Answer: B

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105. If the edge of a cube increases at the rate of 60 cm per second, at what rate the volume is increasing when the edge is 90 cm

A. 486000 cu cm per sec

B. 1458000cu cm per sec

C. 43740000cu cm per sec

D. none of these

Answer: B

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106. If the rate of increase of area of a circle is not constant but the rate of increase of perimeter is constant, then the rate of increase of area varies

A. As the square of the perimeter

B. inversely as the perimeter

C. as the radius

D. inversely as the radius

Answer: C

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107. The sides of an equilateral triangle are increasing at the rate of 2 cm/sec . The rate of which its area increases, when side is 10 cm, is

A. $\sqrt{3}$ sq. unit/sec

B. 10 sq. unit/sec

C. $10\sqrt{3}$ sq. unit/sec

D. $\frac{10}{\sqrt{3}}$ sq. unit/sec

Answer: C

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108. A spherical iron ball 10cm in radius is coated with a layer of ice of uniform thickness that melts at a rate of $50cm^3/m \in$. When the thickness of ice is 5cm, then find the rate at which the thickness of ice decreases.

A. $\frac{1}{54\pi}$ cm/min

B. $\frac{5}{6\pi}$ cm/min

C. $\frac{1}{36\pi}$ cm/min

D. $\frac{1}{18\pi}$ cm/min

Answer: D

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109. A spherical balloon is being inflated at the rate of 35 cc/min. The rate of increase of the surface area of the bolloon when its diameter is 14 cm is

A. 7 sq. cm/min

B. 10 sq.cm/min

C. 17.5 sq. cm/min

D. 28 sq. cm/min

Answer: B

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110. A population $p(t)$ of 1000 bacteria inroduced into nutrient medium grows according to the relation $p(t) = 1000 + \frac{1000t}{100 + t^2}$. The maximum size of this bacterial population is

A. 1100

B. 1250

C. 1050

D. 5250

Answer: C

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111. A ladder 10m long rest against a vertical wall with the lower end on the horizontal ground. The lower end of the ladder is pulled along the ground away from the wall at the rate of 3 cm/sec. The height of the upper end while it is descending at the rate of 4 cm/sec is

A. $4\sqrt{3}$m

B. 6 m

C. $5\sqrt{2}$ m

D. 8 m

Answer: B

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112. Evaluate: `intsqrt(1+sinx)dx ,0

A. $\frac{1}{2}\left(\frac{\sin(x)}{2} - \frac{\cos(x)}{2}\right) + c$

B. $\frac{1}{2}\left(\frac{\sin(x)}{2} + \frac{\cos(x)}{2}\right) + c$

C. $2\sqrt{1 + \sin x} + c$

D. $-2\sqrt{1 - \sin x} + c$

Answer: D

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113. $\int\left(2\sin x + \frac{1}{x}\right)dx$ is equal to

A. $-2\cos x + \log x + c$

B. $2\cos x + \log x + c$

C. $-2\sin x - \dfrac{1}{x^2} + c$

D. $-2\cos x + \dfrac{1}{x^2} + c$

Answer: A

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114. $\int \left(\sqrt{1 + \cos x}\right) dx$ equals

A. $2\sqrt{2}\dfrac{\sin(x)}{2} + c$

B. $-2\sqrt{2}\dfrac{\sin(x)}{2} + c$

C. $-2\sqrt{2}\frac{\cos(x)}{2}+c$

D. $2\frac{\sqrt{\cos(x)}}{2}+c$

Answer: A

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115. $\int 2\sin x\cos x dx$ is equal to

A. $\cos 2x+c$

B. $\sin 2x+c$

C. $\cos^2 x+c$

D. $\sin^2 x+c$

Answer: D

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116. If $y = \sin(2x+3)$ then $\int y dx$ will be:

A. $\frac{\cos(2x+3)}{2}$

B. $-\frac{\cos(2x+3)}{2} + C$

C. $-\cos(2x+3)$

D. $-2\cos(2x+3)$

Answer: B

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117. $\int 2\sin(x)dx$ is equal to:

A. $-2\cos x + C$

B. $2\cos x + C$

C. $-2\cos x$

D. $2\cos x$

Answer: A

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118. If $y = x^2$, then $\int_0^2 y dx$ will be :

A. $\frac{x^3}{3} + C$

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

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

D. 0

Answer: B

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119. If $y = x^2$, then area of curve y v/s x from $x = 0$ to 2 will be:

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

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

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

D. $\frac{2}{3}$

Answer: B

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120. value of $\int_0^{\frac{\pi}{2}} \cos 3t dt$ is

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

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

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

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

Answer: B

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121. $\int\left(\cos.\frac{x}{2}-\sin.\frac{x}{2}\right)^{2}dx$ equals

A. $x+\cos x+c$

B. $2\cos^{2}\left(\frac{x}{2}\right)+c$

C. $\frac{1}{3}\left(\cos\left(\frac{x}{2}\right)-\frac{x}{2}\right)^{3}+c$

D. $x-\cos x+c$

Answer: A

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122. Given that $\vec{A} + \vec{B} + \vec{C} = 0$, out of three vectors two are equal in magnitude and the magnitude of third vector is $\sqrt{2}$ times that of either of two having equal magnitude. Then angle between vectors are given by

A. $30^{\circ}, 60^{\circ}, 90^{\circ}$

B. $40^{\circ}, 45^{\circ}$, 90^@`

C. $45^{\circ}, 60^{\circ}, 90^{\circ}$

D. $90^{\circ}, 135^{\circ}, 135^{\circ}$

Answer: D

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123. A boy walks uniformly along the sides of a rectangular park of size $400m \times 300m$, starting from one corner to the other corner diagonally opposite. Which of the following statements is incorrect?

A. he has travelled a distance is 700m

B. his displacement is 700m

C. his displacement is 500m

D. his velocity is not uniform throughout the walk

Answer: B

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124. When three forces of $50N, 30N$ and $15N$ act on body, then the boy is

A. at rest

B. moving with uniform velocity

C. in equilibrium

D. moving with an acceleration

Answer: D

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125. The magnitudes of vectors $\vec{A}, \vec{B}$ and $\vec{C}$ are 3,4 and 5 units respectively. If $\vec{A} + \vec{B} = \vec{C}$, the angle between $\vec{A}$

and vecB` is

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

B. $\cos^{-1}(0.6)$

C. $\tan^{-1}\left(\frac{7}{5}\right)$

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

Answer: A

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126. 100 coplanar forces each equal to 10 N act on a body. Each force makes angle $\frac{\pi}{50}$ with the preceding force. What is the resultant of the forces

A. 1000N

B. 500N

C. 250N

D. zero

Answer: D

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127. Five equal forces of 10 N r=each are applied at one point and all are lying in one plane .If the angles between them are equal , the resultant force will be

A. zero

B. 10N

C. 20N

D. $10\sqrt{2}N$

Answer: A

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128. A scooter going due east at $10ms^{-1}$ turns right through an angle of 90°. If the speed of the scooter remain unchanged in taking turn, the change is the velocity the scooter is

A. $20.0ms^{-1}$ south eastern direction

B. zero

C. $10.0ms^{-1}$ in southern direction

D. $14.14ms^{-1}$ in south-west direction

Answer: D

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129. If a man goes 10 m toward north and 20 m toward east, then his displacement is

A. 22.36 km

B. 2 km

C. 5 km

D. 20 km

Answer: A

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130. If the resultant of n forces of different magnitudes acting at a point is zero, then the minimum value of n is

A. 1

B. 2

C. 3

D. 4

Answer: C

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131. A force of 5 N acts on a particle along a direction making an angle of 60° with vertical .Its vertical componment be

A. 10 N

B. 3 N

C. 4 N

D. 2.5 N

Answer: D

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132. y component of velocity is 20 and x component of velocity is 10. The direction of motion of the body with the horizonatal at this instant is

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

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

C. 45°

D. 0°

Answer: A

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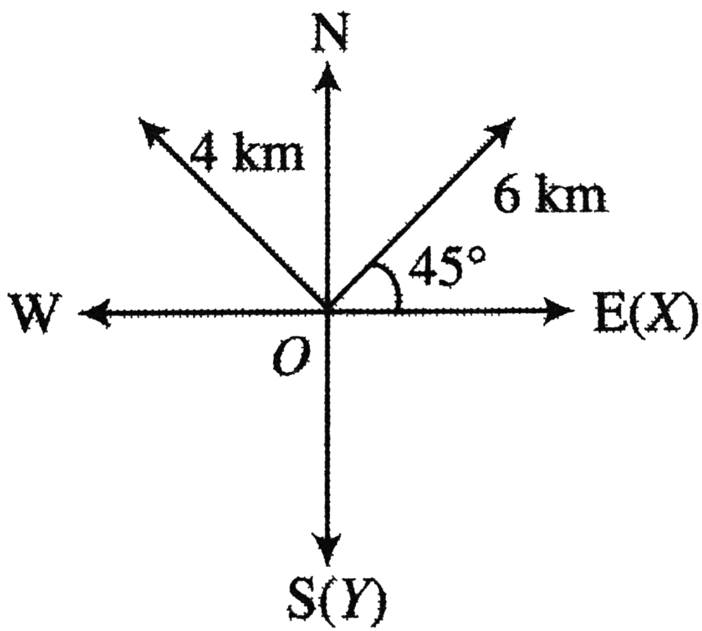
133. A car travles 6km towards north at an angle of 45° to the east and then travles distance of 4km towards north at an angle of 135° to east (figure). How far is the point from the starting point? What angle does the straight line joining its initial and final position makes with the east?



A. $\sqrt{50}km$ and $\tan^{-1}(5)$

B. $10km$ and $\tan^{-1}(\sqrt{5})$

C. $\sqrt{52}km$ and $\tan^{-1}(5)$

D. $\sqrt{52}km$ and $\tan^{-1}(\sqrt{5})$

Answer: C

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134. A vector $\vec{a}$ is turned without a change in its length through a small angle $d\theta$. Find the value of $|\Delta\vec{a}|$ and Δa.

A. 0,$adth\eta$

B. $adth\eta$,0

C. 0,0

D. none of these

Answer: B

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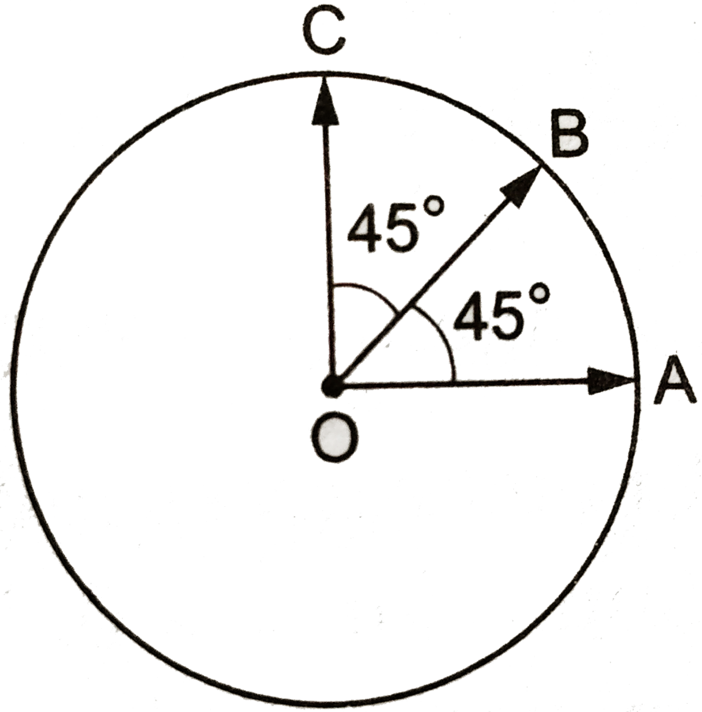
135. Find the resultant of the three vectors $\overrightarrow{OA}$, $\overrightarrow{OB}$ and $\overrightarrow{OC}$ shown in figure. Radius of the circle is R.



A. 2R

B. $R\left(1+\sqrt{2}\right)$

C. $R\sqrt{2}$

D. $R\left(\sqrt{2}-1\right)$

Answer: B

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136. Two forces, each of magnitude F have a resultant of the same magnitude F. The angle between the two forces is

A. 45°

B. 120°

C. 150°

D. 60°

Answer: B

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137. The resultant of A and B is R_1 On reversing the vector B , the resultant R_2 what is the value of $R_1^2 + R_2^2$?

A. $A^2 + B^2$

B. $A^2 - B^2$

C. $2\left(A^2 + B^2\right)$

D. $2\left(A^2 - B^2\right)$

Answer: C

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138. Forces F_1 and F_2 act on a point mass in two mutually perpendicular directions. The resultant force on the point mass will be

A. $F_1 + F_2$

B. $F_1 - F_2$

C. $\sqrt{F_1^2 + F_2^2}$

D. $F_1^2 + F_2^2$

Answer: C

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139. The sum of two forces at a point is 16N. if their resultant is normal to the smaller force and has a magnitude of 8N, then two forces are

A. 6 N and 10N

B. 8 N and 8 N

C. 4 N and 12 N

D. 2 N and 14 N

Answer: A

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140. If vector P, Q and R have magnitude 5,12,and 13 units and $\vec{P} + \vec{Q} = \vec{R}$, the angle between Q and R is

A. $\dfrac{\cos^{-1}(5)}{12}$

B. $\dfrac{\cos^{-1}(5)}{13}$

C. $\dfrac{\cos^{-1}(12)}{13}$

D. $\dfrac{\cos^{-1}(7)}{13}$

Answer: C

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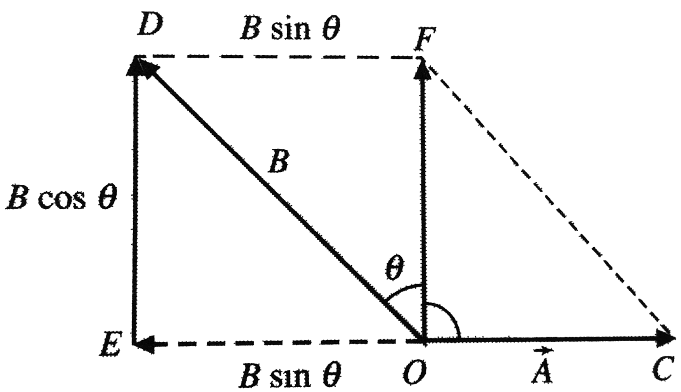
141. The resultant of two vectors $\vec{A}$ and $\vec{B}$ is perpendicular to the vector $\vec{A}$ and its magnitude is equal to half of the magnitude of the vector $\vec{B}$. Find out the angles between $\vec{A}$ and $\vec{B}$.



A. $120\ °$

B. $150\ °$

C. $135\ °$

D. none of these

Answer: B

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142. The resultant $\vec{P}$ and $\vec{Q}$ is perpendicular to $\vec{P}$. What is the angle between $\vec{P}$ and $\vec{Q}$?

A. $\cos^{-1}\left(\frac{P}{Q}\right)$

B. $\cos^{-1}\left(\frac{-P}{Q}\right)$

C. $\sin^{-1}\left(\frac{P}{Q}\right)$

D. $\sin^{-1}\left(\frac{-P}{Q}\right)$

Answer: B

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143. If the sum of two unit vectors is a unit vector, then the magnitude of their difference is :

A. $\sqrt{2}$

B. $\sqrt{3}$

C. $\frac{1}{\sqrt{2}}$

D. $\sqrt{5}$

Answer: B

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144. Maximum and minimum magnitudes of the resultant of two vectors of magnitudes P and Q are in the ratio 3:1. Which of the following relation is true?

A. $P = 2Q$

B. $P = Q$

C. $PQ = 1$

D. none of these

Answer: A

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145. Two forces $3N$ and $2N$ are at an angle θ such that the resultant is R. The first force is now increased of $6N$ and the resultant become $2R$. The value of θ is

A. 30°

B. 60°

C. 90°

D. 120°

Answer: D

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146. If $\left|\vec{A}+\vec{B}\right| = \left|\vec{A}\right| = \left|\vec{B}\right|$ then angle between A and B will be :-

A. 90°

B. 120°

C. 0°

D. 60°

Answer: C

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147. The maximum and minimum magnitude of the resultant of two given vectors are 17 units and 7 unit respectively. If these two vectors are at right angles to each other, the magnitude of their resultant is

A. 14

B. 16

C. 18

D. 13

Answer: D

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148. Two equal forces (P each) act at a point inclined to each other at an angle of 120°. The magnitude of their resultant is

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

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

C. P

D. 2P

Answer: C

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149. The sum of the magnitudes of wto forces acting at a point is 18 and the magnitude of their resultant is 12 If the resultant is at 90° with the force of smaller magnitude , what aarae the magnitude of fores ?

A. 12, 5

B. 14, 4

C. 5, 13

D. 10, 8

Answer: C

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150. Three forces P, Q and R are acting on a particel in the plane, the angle between P and Q and that between Q and R are 150° and 120° respectively. Then for equilibrium, forces P, Q and R are in the ratio

A. $1:2:3$

B. $1:2:\sqrt{3}$

C. $3:2:1$

D. $\sqrt{3}:2:1$

Answer: D

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151. If a particle moves from point P(3,4,5) its displacement vector is given by

A. $\hat{i} + \hat{j} + 10\hat{k}$

B. $\hat{i} + \hat{j} + 5\hat{k}$

C. $\hat{i} + \hat{j}$

D. $2\hat{i} + 4\hat{j} + 6\hat{k}$

Answer: C

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152. $A = 2\hat{i} + \hat{j} - \hat{k}$ and $C = 6\hat{i} - 2\hat{k}$

vale os A-2B+3C would be

A. 20hati+5hatj+4hatk`

B. $20\hat{i} - 5\hat{j} - 4\hat{k}$

C. $4\hat{i} + 5\hat{j} + 20\hat{k}$

D. $5\hat{i} + 4\hat{j} + 10\hat{k}$

Answer: B

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153. Two forces $F_1 = 1N$ and $F_2 = 2N$ act along the lines x=0 and y=0, respectively. Then find the resultant of forces.

A. $\hat{i} + 2\hat{j}$

B. $\hat{i} + \hat{j}$

C. $3\hat{i} + 2\hat{j}$

D. $2\hat{i} + \hat{j}$

Answer: D

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154. Following forces start acting on a particle at rest at the origin of the co-ordiante system simultaneously

$\vec{F}_1 = -4\hat{i} - 4\hat{j} + 5\hat{k}, vacF_2 = 5\hat{i} + 8\hat{j} + 6\hat{k},$

$\vec{F}_3 = -3\hat{i} + 4\hat{j} - 7\hat{k}$ and $\vec{F}_4 = 2\hat{i} - 3\hat{j} - 2\hat{k}$ then the particle will move

A. in x-y plane

B. in y-z plane

C. in x-z plane

D. along x-axis

Answer: B

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155. A body is at rest under the action of three forces, two of which are $\vec{F}_1 = 4\hat{i}, \vec{F}_2 = 6\hat{j}$, the third force is

A. $4\hat{i} + 6\hat{j}$

B. $4\hat{i}$ - $6\hat{j}$

C. -$4\hat{i} + 6\hat{j}$

D. -$4\hat{i}$ - $6\hat{j}$

Answer: D

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156. The vector that must be added to the vector $\hat{i} - 4\hat{j} + 2\hat{k}$ and $3\hat{i} + 3\hat{j} - 7\hat{k}$ so that the resultant vector is a unit vector along the y-axis is

A. $4\hat{i} + 2\hat{j} + 5\hat{k}$

B. $-4\hat{i} - 2\hat{j} + 5\hat{k}$

C. $3\hat{i} + 4\hat{j} + 5\hat{k}$

D. null vector

Answer: B

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157. If $A = 3\hat{i} + 4\hat{j}$ and $B = 7\hat{i} + 24\hat{j}$,find the vector having the same magnitude as B and parallel to A.

A. $5\hat{i} + 20\hat{j}$

B. $15\hat{i} + 10\hat{j}$

C. $20\hat{i} + 15\hat{j}$

D. $15\hat{i} + 20\hat{j}$

Answer: D

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158. The unit vector parallel to the resultant of the vectors $\vec{A} = 4\hat{i} + 3\hat{j} + 6\hat{k}$ and $\vec{B} = -\hat{i} + 3\hat{j} - 8\hat{k}$ is

A. $\frac{1}{7}\left(3\hat{i} + 6\hat{j} - 2\hat{k}\right)$

B. $\frac{1}{7}\left(3\hat{i} + 6\hat{j} + 2\hat{k}\right)$

C. $\frac{1}{49}\left(3\hat{i} + 6\hat{j} - 2\hat{k}\right)$

D. $\frac{1}{49}\left(3\hat{i} - 6\hat{j} + 2\hat{k}\right)$

Answer: A

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159. The position vector of a particle is determined by the expression $\vec{r} = 3t^2\hat{i} + 4t^2\hat{j} + 7\hat{k}$. The displacement traversed in first 10 seconds is :

A. 500m

B. 300m

C. 150m

D. 100m

Answer: A

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160. Unit vector parallel to the resultant of vectors $\vec{A} = 4\hat{i} - 3\hat{j}$ and $\vec{B} = 8\hat{i} + 8\hat{j}$ will be

A. $\dfrac{24\hat{i} + 5\hat{j}}{13}$

B. $\dfrac{12\hat{i} + 5\hat{j}}{13}$

C. $\dfrac{6\hat{i} + 5\hat{j}}{13}$

D. none of these

Answer: B

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161. Show that the vectors $a = 3\hat{i} - 2\hat{j} + \hat{k}$, $b = \hat{i} - 3\hat{j} + 5\hat{k}$ and $c = 2\hat{j} + \hat{j} - 4\hat{k}$ form a right angled triangle.

A. an equilateral triangle

B. isosceles triangle

C. a right angled triangle

D. no triangle

Answer: C

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162. A person moves 30 m North and then 20 m towards East and finally $30\sqrt{2}m$ in South = West direction. The displacement of the person from the origin will be

A. 10m along north

B. 10m long south

C. 10 m along west

D. Zero

Answer: C

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163. The angles with a vector $\hat{i}+\hat{j}+\sqrt{2\hat{k}}$ makes with X,Y and Z axes respectively are

A. $60^\circ, 60^\circ, 60^\circ$

B. $45^\circ, 45^\circ, 45^\circ$

C. $60^\circ, 60^\circ, 45^\circ$

D. $45^\circ, 45^\circ, 60^\circ$

Answer: C

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164. If a vector $\vec{A}$ make angles α, β and γ, respectively, with the X, Y and Z axes , then $\sin^2\alpha+\sin^2\beta+\sin^2\gamma=$

A. 0

B. 1

C. 2

D. 3

Answer: C

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165. If two vectors $2\hat{i} + 3\hat{j} - \hat{k}$ and $-4\hat{i} - 6\hat{j} - \lambda\hat{k}$ are parallel to each other,then find the value of λ

A. 0

B. 2

C. 3

D. 4

Answer: B

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166. The angle between the two vectors $A = 3\hat{i} + 4\hat{j} + 5\hat{k}$ and $B = 3\hat{i} + 4\hat{j} - 5\hat{k}$ is

A. 90°

B. 0°

C. 60°

D. 45°

Answer: A

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167. If a vector $2\hat{i}+3\hat{j}+8\hat{k}$ is perpendicular to the vector $4\hat{i}$ - $4\hat{j}+\alpha\hat{k}$, then the value of α is

A. - 1

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

C. - $\frac{1}{2}$

D. 1

Answer: C

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168. If for two vector $\vec{A}$ and $\vec{B}$, sum $\left(\vec{A}+\vec{B}\right)$ is perpendicular to the difference $\left(\vec{A}-\vec{B}\right)$. The ratio of their magnitude is

A. 1

B. 2

C. 3

D. none of these

Answer: A

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169. Consider a `F = 4hati -3hatj . Another vector perpendicular to F is

A. $4\hat{i} + 3\hat{j}$

B. $6\hat{i}$

C. $7\hat{k}$

D. $3\hat{i} - 4\hat{j}$

Answer: C

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170. If $\left|\vec{V}_1 + \vec{V}_2\right| = \left|\vec{V}_1 - \vec{V}_2\right|$ and V_2 is finite, then

A. V_1 is parallel to V_2

B. $\vec{V}_1 = \vec{V}_2$

C. V_1 and V_2 are mutually perpendicular

D. $\left|\vec{V}_1\right| = \left|\vec{V}_2\right|$

Answer: C

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171. the angle between the vectors $\left(\hat{i} + \hat{j}\right)$ and $\left(\hat{j} + \hat{k}\right)$ is

A. 30°

B. 45°

C. 60°

D. 90°

Answer: C

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172. If $\vec{P}.\vec{Q} = PQ$, then angle between $\vec{P}$ and $\vec{Q}$ is

A. 0°

B. 30°

C. 45°

D. 60°

Answer: A

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173. A particle moves in the xy-plane under the action of a force F such that the components of its linear momentum p at any time t and $p_x = 2\cos$ t, $p_y = 2\sin$ t. the angle between F and p at time t is

A. $\theta = 0^\circ$

B. $\theta = 30^\circ$

C. $\theta = 90^\circ$

D. $\theta = 180^\circ$

Answer: C

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174. The position vectors of points A,B,C and D are $A = 3\hat{i} + 4\hat{j} + 5\hat{k}, B = 4\hat{i} + 5\hat{j} + 6\hat{k}, C = 7\hat{i} + 9\hat{j} + 3\hat{k},$ and $D = 4\hat{i} + 6\hat{j}$, then the displacement vectors AB and CD are

A. perpendicular

B. parallel

C. antiparallel

D. inclined at an angle of 60°

Answer: D

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175. When $\vec{A}.\vec{B} = -|A||B|$, then

A. $\vec{A}$ and $\vec{B}$ are perpendicular to each other

B. $\vec{A}$ and $\vec{B}$ act in the same direction

C. $\vec{A}$ and $\vec{B}$ act in the opposite direction

D. $\vec{A}$ and $\vec{B}$ can act in any direction

Answer: C

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176. The component of vector $A = 2\hat{i} + 3\hat{j}$ along the vector $\hat{i} + \hat{j}$ is

A. $\frac{5}{\sqrt{2}}$

B. $10\sqrt{2}$

C. $5\sqrt{}$

D. 5

Answer: A

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177. If a vector $\vec{A}$ is parallel to another vector $\vec{B}$ then the resultant of the vector $\vec{A} \times \vec{B}$ will be equal to

A. A

B. $\vec{A}$

C. zero vector

D. zero

Answer: C

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178. If $\vec{A} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{B} = 2\hat{i} - 2\hat{j} + 4\hat{k}$, then value of $\left|\vec{A}X\vec{B}\right|$ will be

A. $8\sqrt{2}$

B. $8\sqrt{3}$

C. $8\sqrt{5}$

D. $5\sqrt{8}$

Answer: B

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179. Which of the following is the unit vector perrpendicular to A and B?

A. $\left(\hat{A} \times \hat{B}\right)/(\text{ABsintheta})\grave{}$

B. $\dfrac{\hat{A} \times \hat{B}}{AB\cos\theta}$

C. $\dfrac{\vec{A} \times \vec{B}}{AB\sin\theta}$

D. $\dfrac{\vec{A} \times \vec{B}}{AB\cos\theta}$

Answer: C

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180. If $\vec{A} \times \vec{B} = \vec{C}$, then which of the following statements is wrong?

A. $\vec{C} \perp \vec{A}$

B. $\vec{C} \perp \vec{B}$

C. $\vec{C} \perp \left(\vec{A} + \vec{B}\right)$

D. $\vec{C} \perp \left(\vec{A} \times \vec{B}\right)$

Answer: D

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181. The angle between A and B is θ.The value of the triple product A .(B x A) is

A. A^2B

B. zero

C. $A^2B\sin\theta$

D. $A^2B\cos\theta$

Answer: B

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182. If $\vec{A} \times \vec{B} = \vec{B} \times \vec{A}$, then the angle between A and B is

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

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

C. π

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

Answer: C

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183. The angle between Vectors $\left(\vec{A} \times \vec{B}\right)$ and $\left(\vec{B} \times \vec{A}\right)$ is

A. zero

B. π

C. $(\pi)/(4)$

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

Answer: B

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184. A vector A points vertically upward and B points towards north.The vector product $A \times B$ is

A. zero

B. along west

C. along east

D. vectically downward

Answer: B

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185. Two vector A and B have equal magnitudes. Then the vector $A + B$ is perpendicular to

A. $A \times B$

B. $A - B$

C. $3A - 3B$

D. all of these

Answer: A

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186. Given that $\vec{a}$ and $\vec{b}$ are two non zero vectors, then the value of $\left(\vec{a}+\vec{b}\right)\times\left(\vec{a}-\vec{b}\right)$ is,

A. 0

B. $A^2 - B^2$

C. $\vec{B}\times\vec{A}$

D. $2\left(\vec{B}\times\vec{A}\right)$

Answer: D

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187. The linear velocity of a rotating body is given by $\vec{v} = \vec{\omega} \times \vec{r}$, where $\vec{\omega}$ is the angular velocity and $\vec{r}$ is the radius vector. The angular velocity of a body is $\vec{\omega} = \hat{i} - 2\hat{j} + 2\hat{k}$ and the radius vector $\vec{r} = 4\hat{j} - 3\hat{k}$, then $|\vec{v}|$ is

A. $\sqrt{29}$ units

B. $\sqrt{31}$ units

C. $\sqrt{37}$ units

D. $\sqrt{41}$ units

Answer: A

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188. Two adjacent sides of a parallelogram are respectively by the two vectors $\hat{i} + 2\hat{j} + 3\hat{k}$ and $3\hat{i} - 2\hat{j} + \hat{k}$. What is the area of parallelogram?

A. 8

B. $8\sqrt{3}$

C. $3\sqrt{8}$

D. 192

Answer: B

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189. The vectors from origin to the points A and B are $\vec{A} = 3\hat{i} - 6\hat{j} + 2\hat{k}$ and $\vec{B} = 2\hat{i} + \hat{j} + 2\hat{k}$ respectively. The area of triangle OAB be

A. $\frac{5}{2}\sqrt{17}$ sq. units

B. $\frac{2}{5}\sqrt{17}$ sq. units

C. $\frac{3}{5}\sqrt{17}$ sq. units

D. $\frac{5}{3}\sqrt{17}$ sq. units

Answer: A

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190. If $\left|\vec{A}\times\vec{B}\right| = \sqrt{3}\vec{A}.\,\vec{B}$ then the value of $\left|\vec{A}+\vec{B}\right|$ is :-

A. (A^2+B^2+(AB)/(sqrt3))^((1)/(2))`

B. $A+B$

C. $\left(A^2B^2+\sqrt{3}AB\right)^{\frac{1}{2}}$

D. $\left(A^2+B^2+AB\right)^{\frac{1}{2}}$

Answer: D

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191. The muerical value of the ratio of average velocity to average speed is.

A. unity

B. unity or less

C. unity or more

D. less than unity

Answer: B

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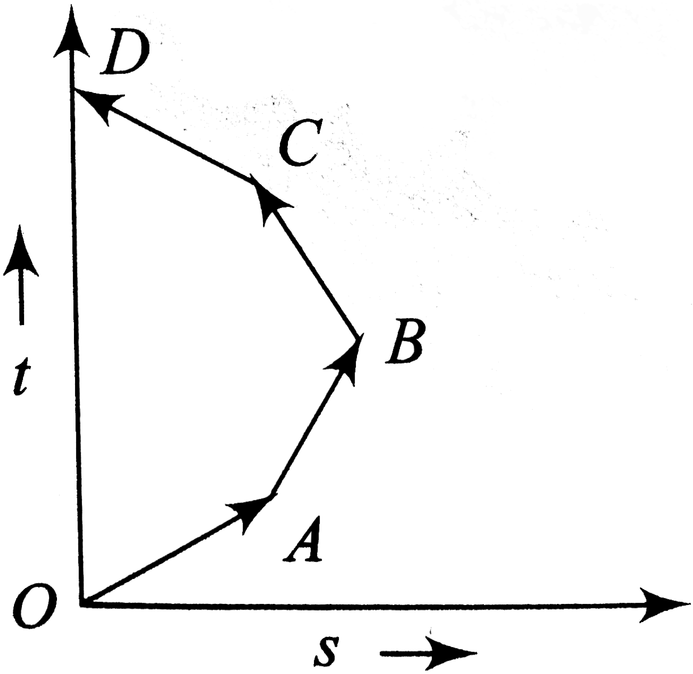
192.



Which of the following option is correct for the object having a staright line motion represented by the following graph?

A. The object moves with constantly increasing velocity from O to A and then it moves with constant velocity.

B. velocity of the object increases uniformly

C. average velocity is zero

D. the graph shoen is impossible

Answer: C

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193. The numerical ratio of displacement to the distance covered is always a) always equal to one b) always less than one c) always greater than one d) equal to or more than one

A. less than one

B. equal to one

C. equal to or less than one

D. equal to or greater than one

Answer: C

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194. A particle moves along a straight line path. After some time it comes to rest. The motion is with constant acceleration whose direction with respect to the direction of velocity is :

A. positive throughout motion

B. negative throughout motion

C. first positive then negative

D. first negative then positive

Answer: B

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195. If a car covers $\frac{2}{(5)^{th}}$ of the total distance with v_1 speed and $\frac{3}{(5)^{th}}$ distance with v_2. Then average speed is

A. $\frac{1}{2}\sqrt{v_1 v_2}$

B. $\dfrac{v_1 + v_2}{2}$

C. (2v_1v_2)/(v_1+v_2)`

D. $\dfrac{5v_1v_2}{3v_1 + 2v_2}$

Answer: D

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196. A car is moving on a straight road covers one third of the distance with a speed of 20 km/h and the rest with a speed of 60 km/h. The average speed of the car is

A. 40 $\dfrac{km}{hr}$

B. $80\frac{km}{hr}$

C. $46\frac{1}{2}\frac{km}{hr}$

D. $36\frac{km}{hr}$

Answer: D

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197. A man walks on a straight road from his home to a market $2.5km$ away a speed of $5kmh^{-1}$. Finnding the market closed , he instantly turns and walks back home with a speed of $7.5kmh^{-1}$. The average speed of the man over the interval of time 0 to 50 min is equal to

A. $5\frac{km}{hr}$

B. $\frac{25}{4}\frac{km}{hr}$

C. $\frac{30}{4}\frac{km}{hr}$

D. $\frac{45}{8}\frac{km}{hr}$

Answer: D

Watch Video Solution

198. consider the acceleration velocity and displacement of a tennis ball as it falls to the ground and bouces back. Derections of which of these changes in the process

A. velocity only

B. displacement and velocity

C. acceleration, velocity and displacement

D. displacement and acceleration

Answer: B

Watch Video Solution

199. The position of a particle moving in the xy plane at any time t is given by $x = \left(3t^2 - 6t\right)$ metres, $y = \left(t^2 - 2t\right)$ metres. Select the correct statement about the moving particle from the following

A. The acceleration of particle is zero at $t = 0$ second

B. the velocity of the particle is zero $t = 0$ second

C. the velocity of the particle is zero at $t = 1$ second

D. the velocity and acceleration of the particle are never zero

Answer: C

Watch Video Solution

200. The acceleration a in ms^{-2} of a particle is given by $a = 3t^2 + 2t + 2$, where t is the time. If the particle starts out with a velocity $v = 2ms^{-1}$ at $t = 0$, then find the velocity at the end of $2s$.

A. 12 $\frac{m}{s}$

B. 18 $\frac{m}{s}$

C. 27 $\frac{m}{s}$

D. 36 $\frac{m}{s}$

Answer: B

Watch Video Solution

201. The x and y-coordinates of a particle at any time t are given by $x = 7t + 4t^2$ and y = 5t, where x and y are in metre and t seconds. The acceleration of particle at t = 5 is

A. zero

B. 8 $\frac{m}{s^2}$

C. 20 $\frac{m}{s^2}$

D. 40 $\frac{m}{s^2}$

Answer: B

Watch Video Solution

202. The acceleration of a particle is increasing linerly with time t as bt. The particle starts from the origin with an initial velocity v_0. The distance travelled by the particle in time t will be

A. $v_0 t + \frac{1}{3} b t^2$

B. $v_0 t + \frac{1}{3} b t^3$

C. $v_0 t + \frac{1}{6} b t^3$

D. $v_0 t + \frac{1}{2} b t^2$

Answer: C

Watch Video Solution

203. A body starts from the origin and moves along the X-axis such that the velocity at any instant is given by $\left(4t^3 - 2t\right)$, where t is in sec and velocity in m/s. what is the acceleration of the particle when it is 2 m from the origin?

A. $28\frac{m}{s^2}$

B. $22\frac{m}{s^2}$

C. $12\frac{m}{s^2}$

D. $10\frac{m}{s^2}$

Answer: B

Watch Video Solution

204. The relation between time t and displacement x is $t = \alpha x^2 + \beta x$, where α and β are constants. The retardation is

A. $2\alpha v^3$

B. $2\beta v^3$

C. $2\alpha\beta v^3$

D. $2\beta^2 v^3$

Answer: A

Watch Video Solution

205. The relation $3t = \sqrt{3x} + 6$ describe the displacement of a particle in one direction where x is in metres and t in sec.

The displacement, when velocity is zero is

A. 24 metres

B. 12 metres

C. 5 metres

D. zero

Answer: D

Watch Video Solution

206. If the velocity of a particle is given by $v = (180 - 16x)^{\frac{1}{2}} \frac{m}{s}$, then its acceleration will be

A. zero

B. $8\frac{m}{s^2}$

C. $-8\frac{m}{s^2}$

D. $4\frac{m}{s^2}$

Answer: C

Watch Video Solution

207. A particle moves along X-axis as

$x = 4(t - 2) + at(t - 2)^2$

Which of the following is true ?

A. The initial velocity of particle is 4

B. the acceleration of particle is 2a

C. The particle is at origin at $t = 0$

D. none of these

Answer: B

Watch Video Solution

208. The position vector of a aprticle is given as $\vec{r} = \left(t^2 - 4t + 6\right)\hat{i} + \left(t^2\right)\hat{j}$. The time after which the velocity vector and acceleration vector becomes perpendicular to each other is equal to

A. 1 sec

B. 2 sec

C. 1.5 sec

D. not possible

Answer: A

Watch Video Solution

209. A particle experiences a constant acceleration for 20 sec after starting from rest. If it travels distance S_1

in the first 10 sec and a distance S_2 in the next 10 sec, Then

A. $S_1 = S_2$

B. $S_1 = \frac{S_2}{3}$

C. $S_1 = \frac{S^2}{2}$

D. $S_1 = \frac{S_2}{4}$

Answer: B

Watch Video Solution

210. A body is moving from rest under constance accelration and let S_1 be the displacement in the first

$(p - 1)$ sec and S_2 be the displacement in the first p sec.

The displacement in $\left(p^2 - p + 1\right)^{th}$ sec will be

A. $S_1 + S_2$

B. $S_1 S_2$

C. $S_1 - S_2$

D. $\frac{S_1}{S_2}$

Answer: A

Watch Video Solution

211. A particle travels 10m in first 5 sec and 10 m in next 3 sec. Assuming constant acceleration what is the distance travelled in next 2 sec.

A. 8.3 m

B. 9.3 m

C. 10.3 m

D. none of above

Answer: A

Watch Video Solution

212. A particle starts from rest, accelerates at $2\frac{m}{s^2}$ for 10 s and then goes for constant speed for 30 s and then decelerates at $4\frac{m}{s^2}$. Till it stops. What is the distance travelled by it?

A. 750 m

B. 800 m

C. 700 m

D. 850 m

Answer: A

Watch Video Solution

213. A car starts from rest and moves with uniform acceleration a on a straight road from time $t = 0$ to

$t = T$. After that, a constant deceleration brings it to rest. In this process the average speed of the car is

A. $\frac{aT}{4}$

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

C. $\frac{aT}{2}$

D. aT

Answer: C

Watch Video Solution

214. A body is moving with uniform acceleration describes 40 m in the first 5 sec and 65 m in next 5 sec.

Its initial velocity will be

A. 4 m/s

B. 2.5 m/s

C. 5.5 m/s

D. 11 m/s

Answer: C

Watch Video Solution

215. A car , starting from rest, accelerates at the rate f through a distance S then continues at constant speed for time t and then decelerates at the rate $\frac{f}{2}$ to come to rest . If the total distance traversed is $15S$, then

A. $S = \frac{1}{2}ft^2$

B. $S = \frac{1}{4}ft^2$

C. $S = \frac{1}{72}ft^2$

D. $S = \frac{1}{6}ft^2$

Answer: C

Watch Video Solution

216. A man is 45m behind the bus when the bus start accelerating from rest with acceleration $2.5ms^{-2}$. With what minimum velocity should the man start running to catch the bus

A. 12 m/s

B. 14 m/s

C. 15 m/s

D. 16 m/s

Answer: C

Watch Video Solution

217. A car A is travelling on a straight level road with a uniform speed of 60 km/h. It is followed by another car

B which in moving with a speed of 70 km/h. When the distance between then is 2.5km, the car B is given a deceleration of $20\frac{km}{h^2}$. After how much time will B catch up with A

A. 1 hr

B. $\frac{1}{2}$hr

C. $\frac{1}{4}$ hr

D. $\frac{1}{8}$ hr

Answer: B

Watch Video Solution

218. The speed of a body moving with uniform acceleration is u. This speed is doubled while covering a distance S. When it covers an additional distance S, its speed would become

A. $\sqrt{3}u$

B. $\sqrt{5}u$

C. $\sqrt{11}u$

D. $\sqrt{7}u$

Answer: D

Watch Video Solution

219. A body is released form the top of a tower of height h meters. It takes t seconds to reach the ground. Where is the ball at the time t/2 sec ?

A. At $\frac{h}{2}$ from the ground

B. At $\frac{h}{4}$ from the ground

C. depends upon mass and volume of the body

D. at $\frac{3h}{4}$ from the ground

Answer: D

Watch Video Solution

220. A ball is projected upwards from a height h above the surface of the earth with velocity v. The time at which the ball strikes the ground is

A. $\frac{v}{g} + \frac{2hg}{\sqrt{2}}$

B. $\frac{v}{g}\left[1 - \sqrt{1 + \frac{2h}{g}}\right]$

C. $\frac{v}{g}\left[1 + \sqrt{1 + \frac{2gh}{v^2}}\right]$

D. $\frac{v}{g}\left[1 + \sqrt{v^2 + \frac{2h}{h}}\right]$

Answer: C

Watch Video Solution

221. A body is projected vertically up with a velocity v and after some time it returns to the point from which it was projected. The average velocity and average speed of the body for the total time of flight are

A. $\frac{\vec{v}}{2}$ and $\frac{v}{2}$

B. 0 and $\frac{v}{2}$

C. 0 and 0

D. $\frac{\vec{v}}{2}$ and 0

Answer: B

Watch Video Solution

222. Two bodies are thrown simultaneously from a tower with same initial velocity v_0: one vertically upwards, the other vertically downwards. The distance between the two bodies after time t is

A. $2v_0t + \frac{1}{2} >^2$

B. $2v_0t$

C. $v_0t + \frac{1}{2}g\,t^2$

D. v_0t

Answer: B

Watch Video Solution

223. A body falling from a high Minarret travels 40 m in the last 2 seconds of its fall to ground. Height of Minaret in meter is (take, $g = 10ms^{-2}$)

A. 60

B. 45

C. 80

D. 50

Answer: B

Watch Video Solution

224. A man drops a ball downside from the roof of a tower of height 400 metres. At the same time another ball is thrown upside with a velocity $50\text{meter}/\text{sec}$ from the surface of the tower, then they will meet at which height from the surface of the tower.

A. 100 meters

B. 320 meters

C. 80 meters

D. 240 meters

Answer: C

Watch Video Solution

225. A body falls freely form rest. It covers as much distance in the last second of its motion as covered in the first three seconds. The body has fallen for a time of

A. 6 sec

B. 5 sec

C. 4 sec

D. 3 sec

Answer: B

Watch Video Solution

226. A body is projected up with a speed u and the time taken by it is T to reach the maximum height H. Pich out the correct statement

A. it reaches $\frac{H}{2}$ in $\frac{T}{2}$ sec

B. It acquires velocity $\frac{u}{2}$ in (T)/(2)` sec

C. Its velocity is $\frac{u}{2}$ at $\frac{H}{2}$

D. same velocity at 2T

Answer: B

Watch Video Solution

227. A body falling from the rest has a velocity v after it falls through a heigh h. The distance it has to fall down further for its velocity to become double, will be

A. 2h

B. 4h

C. 6h

D. 8h

Answer: B

Watch Video Solution

228. A man throws balls with the same speed vertically upwards one after the other at an interval of 2s. What should be the speed of the throw so than two balls are in the sky at any time ? (Take $g = 9.8 m/s^2$)

A. at least 0.8 m/s

B. any speed less than 20 m/s

C. only with speed 20 m/s

D. more than 20 m/s

Answer: D

Watch Video Solution

229. A train A which is 120 m long is running with velocity 20 m/s while train B which is 130 m long is running in opposite direction with velocity 30 m/s. What is the time taken by train B to cross the train A?

A. 6s

B. 36 s

C. 38 s

D. none of these

Answer: D

Watch Video Solution

230. A 210 meter long train is moving due north at a of 25 m/s. a small bird is flying due south a little above the train with speed 5 m/s. The time taken by the bird to cross the train is

A. 6s

B. 7s

C. 9s

D. 10s

Answer: B

Watch Video Solution

231. A police jeep is chasing with, velocity of $45km/h$ a thief in another jeep moving with velocity $153km/h$. Police fires a bullet with muzzle velocity of $180m/s$. The velocity it will strike the car of the thief is.

A. 150 m/s

B. 27 m/s

C. 450 m/s

D. 250 m/s

Answer: A

Watch Video Solution

232. The distance between two particles is decreasing at the rate of 6 m/sec,when they travel in opposite direction to each other. If these particles travel with same speeds and in the same direction, then the separation increase at the rate of 4 m/sec. The particles have speed as

A. 5 m/sec, 1 m/sec

B. 4 m/sec, 1 m/sec

C. 4 m/sec, 2 m/sec

D. 5 m/sec, 2 m/sec

Answer: A

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Watch Video Solution

233. A boat moves with speed of 5 km/h relative to water in a river flowing with a speed of 3 km/h and having a width of 1 km. The minimum time taken around a round trip is

A. 5 min

B. 60 min

C. 20 min

D. 30 min

Answer: D

Watch Video Solution

234. An express train is moving with a velocity v_1. Its driver finds another train is movig on the same track in the same direction with velocity v_2. To escape collision, driver applies a retardation a on the train. The minimum time of escaping collision be

A. $t = \dfrac{v_1 - v_2}{a}$

B. $t_1 = \dfrac{v_1^2 - v_2^2}{2}$

C. none

D. both

Answer: A

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Watch Video Solution

235. A thief is running away on a straight road in a moving with a speed of $9ms^{-1}$. A policeman chases him on a motor cycle moving at a speed of $10ms^{-1}$. If the instantaneous separation of the jeep from the motor cycle is $100m$, how long will it take for the policeman to catch the thief ?.

A. 1s

B. 19s

C. 90s

D. 100s

Answer: D

Watch Video Solution

236. Two trains one of length 100m and another of length 125 m, are moving in mutually opposite directions along parallel lines, meet each other. Each with speed 10 m/s. If their acceleration are $0.3\frac{m}{s^2}$ and $0.2\frac{m}{s^2}$ respectively, then the time they take to pass each other will be

A. 5s

B. 10s

C. 15s

D. 20s

Answer: B

Watch Video Solution

237. Two cars are moving in the same direction with the same speed $30km/hr$. They are separated by a distance of $5km$, the speed of a car moving in the opposite direction of it meets these two cars at an interval of 4 minutes, will be.

A. 40 km/hr

B. 45 km/hr

C. 30 km/hr

D. 15 km/hr

Answer: B

Watch Video Solution

238. A boat takes two hours to travel 8 km and back in still water. If the velocity of water is 4 km/h, the time taken for going upstream 8 km and coming back is

A. 2h

B. 2h 40min

C. 1h 20min

D. cannot be estimated with the information given

Answer: B

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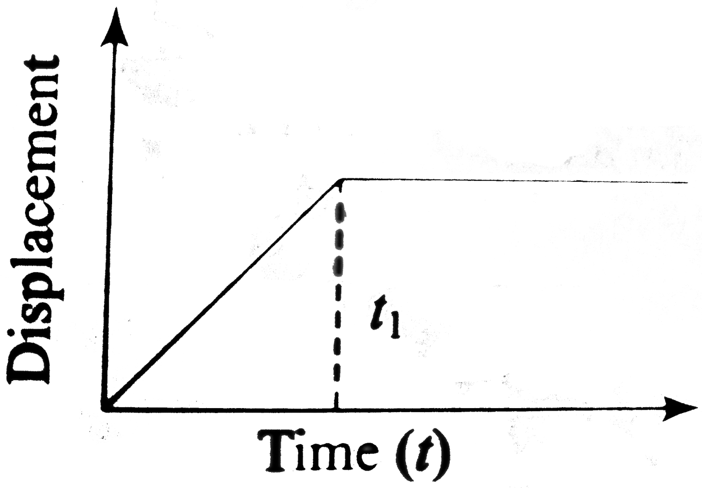
239. 

The x-t graph shoen in figure reprents

A. Constant velocity

B. velocity of the body is continuously changing

C. instantaneous velocity

D. the body travels with constant speed upto time t_1 and then stops

Answer: D

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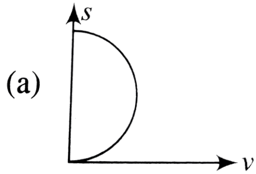
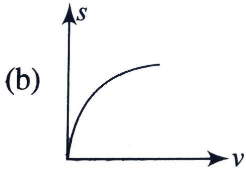
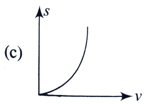
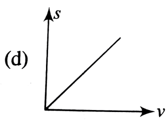
240. An object is moving with a uniform acceleration which is parallel to its instantaneous direction of motion. The dispalcement (s)-velocity (v) graph of this object is.

A. 

B. 

C. 

D. 

Answer: C

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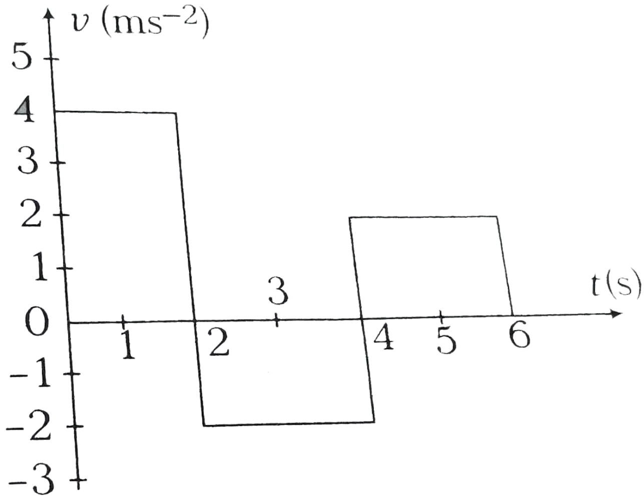
241. The velocity the graph of a moving in a straight line is shown in the figure. The displacement and distance travelled by the body in 6 are respectively



A. 8m,16m

B. 16m,8m

C. 16m,16m

D. 8m,8m

Answer: A

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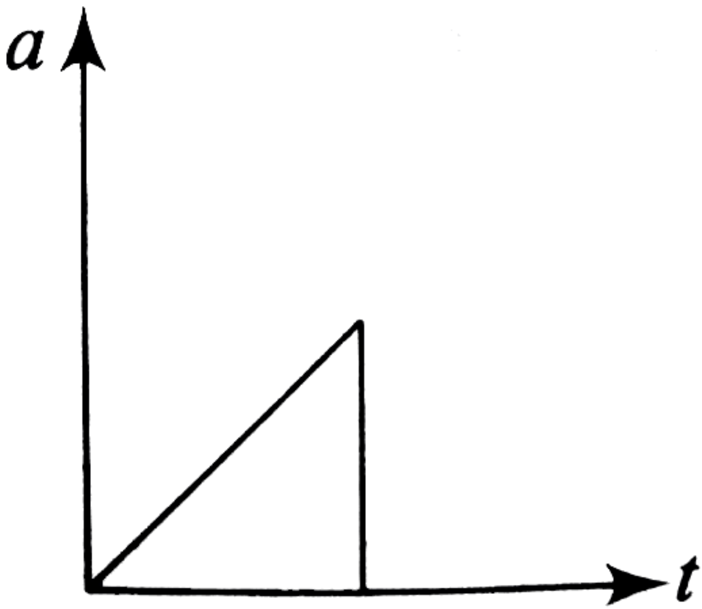
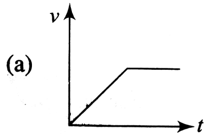
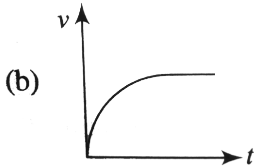
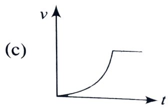


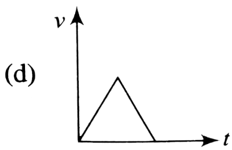
242.

The acceleration time graph of a body is shown below the most probable velocity time graph of the body is

A. 

B. 

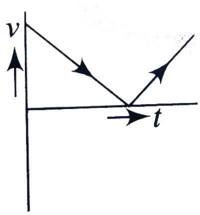
C. 

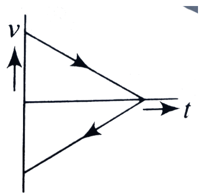
D. 

Answer: C

Watch Video Solution

243. A ball is thrown vertically upwards. Which of the following plots represents the speed time graph of the ball during its height if the air resistance is not ignored?

A. (a)


B. (b)


C.

D.

Answer: D

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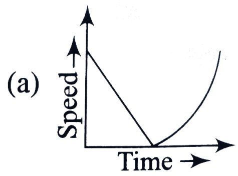
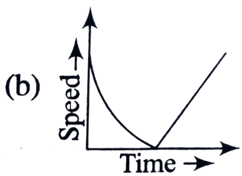
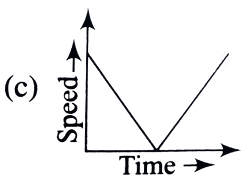
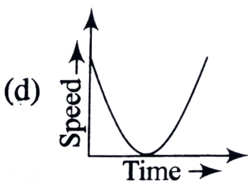
244. A ball is thrown vertically upwards. Which of the following plots represent the speed graph of the ball during its flight if the air resistence is not ignored?

A. 

B. 

C. 

D. 

Answer: C

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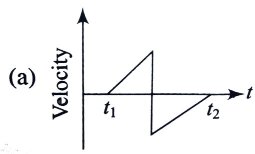
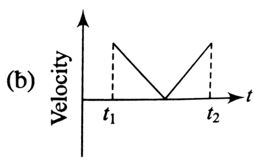
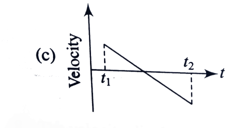
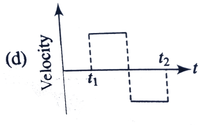
245. A batsman hits a sixes and the ball touches the ground outside the cricket ground. Which of the following graph describes the variation of the cricket ball's vertical velocity v with time between the time t_1 as it hits the bat and time t_2 when it touches the ground?

A. 

B. 

C. 

D. 

Answer: C

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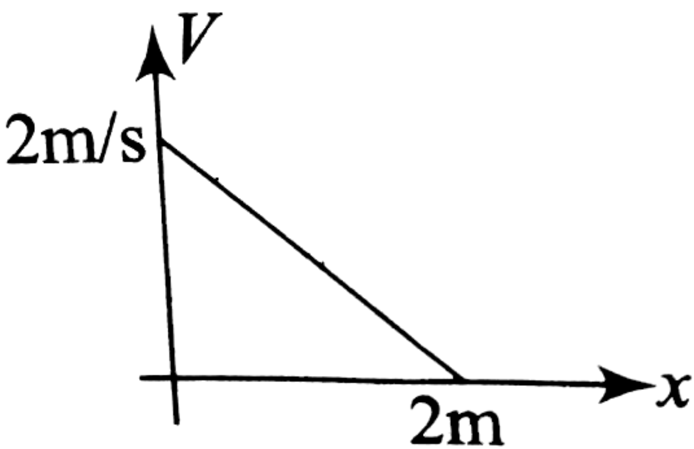
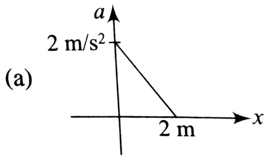
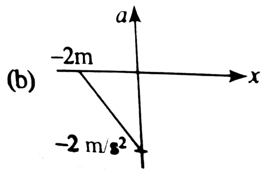
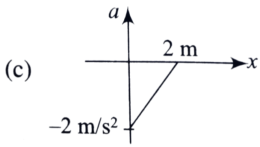
246. 

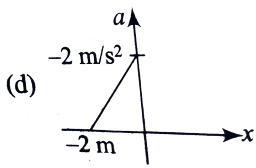
The velocity displacement graph of a particle moving along a straight line is shown in figure.

Then the acceleration displacement graph is.

A. 

B. 

C. 

D. 

Answer: C

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247. A body of mass m is thrown upwards at an angle θ with the horizontal with velocity v. while rising up the velocity of the mass after t seconds will be

A. $\sqrt{(v\cos\theta)^2 + (v\sin\theta)^2}$

B. $\sqrt{\left(v\cos\theta - vson\theta^2\right) - gt}$

C. $\sqrt{v^2 + g^2t^2 - (2v\sin\theta)gt}$

D. $\sqrt{v^2 + g^2t^2 - (2v\cos\theta)gt}$

Answer: C

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248. Velocity of a stone projected, 2 second bofore it reaches the maximum height makes angle 53° with the horizontal then the velocity at highest point will be

A. $20\frac{m}{s}$

B. $15\frac{m}{s}$

C. $25\frac{m}{s}$

D. $\frac{80}{2}\frac{m}{s}$

Answer: B

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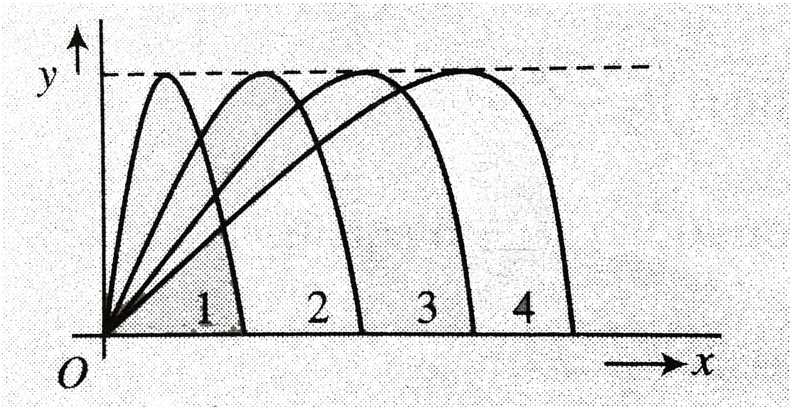
249. Figure shows four paths for a kicked football. Ignoring the effects of air on the flight, rank the paths according to the initial horizontal velocity component, highest first.



.

A. 1,2,3,4

B. 2,3,4,1

C. 3,4,1,2

D. 4,3,2,1

Answer: D

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250. Four bodies A,B, C and D are projected with equal speeds having angles of projection $15^\circ, 30^\circ, 45^\circ$ and 60° with the horizontal respectively. The body having the shortest range is

A. P

B. Q

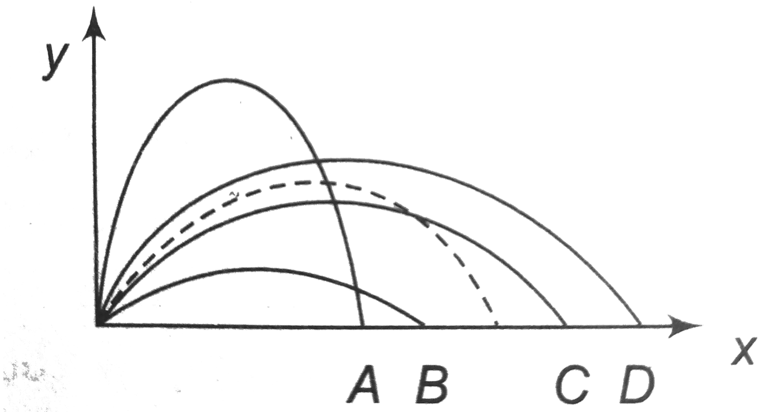
C. R

D. S

Answer: A

Watch Video Solution

251. The path of a projectile in the absence of air drag is shown in the figure by dotted line. If the air resistance is not ignored then which one of the paths shown in the figure is appropriate for the projectile?



A. B

B. A

C. D

D. C

Answer: A

Watch Video Solution

252. A stone projected with a velocity u at an angle (theta)with the horizontal reaches maximum heights H_1. When it is projected with velocity u at an angle $\left(\frac{\pi}{2} - \theta\right)$ with the horizontal, it reaches maximum height H_2. The relations between the horizontal range R of the projectile, H_1 and H_2, is

A. $R = 4\sqrt{H_1 H_2}$

B. $R = 4(H_1 - H_2)$

C. $R = 4(H_1 + H_2)$

D. $R = \frac{H_1^2}{H_2^2}$

Answer: A

Watch Video Solution

253. An object is projected with a velocity of $20\frac{m}{s}$ making an angle of 45° with horizontal. The equation for the trajectory is $h = Ax - Bx^2$ where h is height, x is horizontal distance, A and B are constants. The ratio A:B is $(g = ms^{-2})$

A. $1:5$

B. $5:1$

C. $1:40$

D. $40:1$

Answer: D

Watch Video Solution

254. A projectile can have same range R for two angles of projection. It t_1 and t_2 are the times of flight in the two cases, then what is the product of two times of flight ?

A. $t_1 t_2 \propto R^2$

B. $t_1 t_2 \propto R$

C. $t_1 t_2 \propto \frac{1}{R}$

D. $t_1 t_2 \propto \frac{1}{R^2}$

Answer: B

Watch Video Solution

255. A stone is projected from the ground with velocity $50\frac{m}{s}$ at an angle of 30°. It crosses a wall after 3 sec. How far beyond the wall the stone will strike the ground $\left(g = 10\frac{m}{\sec^2}\right.$?

A. 90.2 m

B. 89.6 m

C. 86.6 m

D. 70.2 m

Answer: C

Watch Video Solution

256. A particle is projected with a velocity v so that its range on a horizontal plane is twice the greatest height attained. If g is acceleration due to gravity, then its range is

A. $\frac{4v^2}{5g}$

B. $\frac{4g}{5v^2}$

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

D. $\frac{4v^2}{\sqrt{5}g}$

Answer: A

Watch Video Solution

257. A man standing on the roof a house of height h throws one particle vertically downwards and another particle horizontally with same velocity u. Find the ratio of their velocities when they reach the earth's surface.

A. $\sqrt{2gh + u^2} : u$

B. $1 : 2$

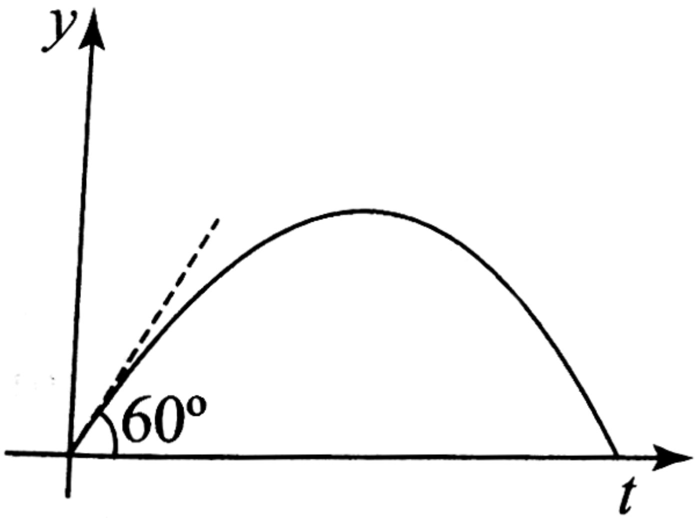
C. $1 : 1$

D. $\sqrt{2gh + u^2} : \sqrt{2gh}$

Answer: C

Watch Video Solution

258.



A particle is projected from the horizontal x-z plane, in vertical x-y plane where x-axis is horizontal and positive y-axis vertically upwards. The graph of y coordinate of the particle v/s time is as shown . The range of the particle is $\sqrt{3}$. Then the speed of the projected particle is:

A. $\sqrt{3}\frac{m}{s}$

B. $\sqrt{\frac{403}{4}}\frac{m}{s}$

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

D. $\sqrt{28}\frac{m}{s}$

Answer: D

Watch Video Solution

259. A particle is projected from a point (0,1) of Y-axis (assume + Y direction vertically upwards) aiming towards a point (4,9). It fell on ground along x axis in 1 sec. Taking $g = 10\frac{m}{s^2}$ and all coordinate in metres. Find the X-coordinate where it fell.

A. (3,0)

B. (4,0)

C. (2,0)

D. $(2\sqrt{5},0)$

Answer: C

Watch Video Solution

260. A particle at a height h from the ground is projected with an angle 30° from the horizontal, it strikes the ground making angle 45° with horizontal. It is again projected from the same point with the same speed but with an angle of 60° with horizontal.

Find the angle it makes with the horizontal when it strikes the ground

A. $\tan^{-1}(4)$

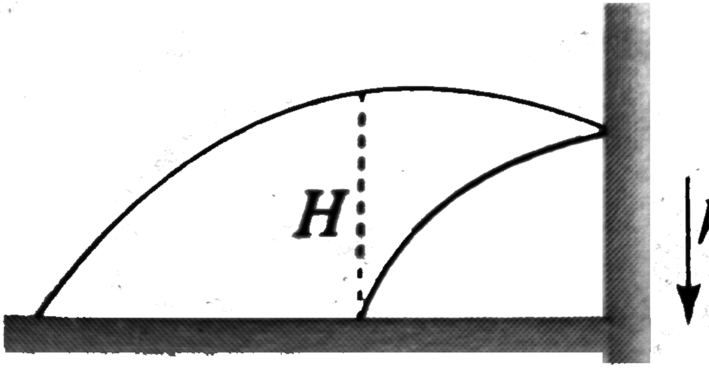
B. $\tan^{-1}(5)$

C. $\tan^{-1}\left(\sqrt{5}\right)$

D. $\tan^{-1}\left(\sqrt{3}\right)$

Answer: C

View Text Solution



261.

A stone is projected from a horizontal plane. It attains maximum height H & strikes a stationary smooth wall & falls on the ground vertically below the maximum height. Assuming the collision to be elastic the height of the point on the wall where ball will strike is

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

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

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

D. none of these

Answer: C

Watch Video Solution

262. A projectile A is projected from ground. An observer B running on ground with uniform velocity of magnitude 'v' observes A to move along a straight line. The time of flight of A as measured by B is T. Then the the range R of projectile on ground is

A. $R = vT$

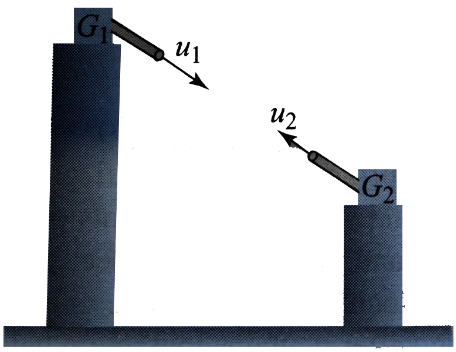
B. $R < vT$

C. $R > vT$

D. information insufficient to draw inference

Answer: A

Watch Video Solution



263.

Two guns are mounted (fixed) on two vertical cliffs that are very high from the ground as shown in figure. The muzzle velocity of the shell from G_1 is u_1 and that from

G_2 is u_2. Such that the shells collide with each other in air is (Assume that there is no resistance of air)

A. $1:2$

B. $1:4$

C. will not collide for any ratio

D. will collide for any ratio

Answer: D

Watch Video Solution

264. Two particles are projected from the same point with the same speed at different angles θ_1 & θ_2 to the horizontal. They have the same range. Their times of flight are t_1 & t_2 respectily

A. $\frac{t_1}{t_2} = \tan^2\theta_1$

B. $\frac{t_1}{\sin\theta_1} = \frac{t_2}{\cos\theta_2}$

C. $\frac{t_1}{t_2} = \tan\theta_1$

D. $\frac{t_1}{t_2} = \tan^2\theta_2$

Answer: C

Watch Video Solution

265. Thre stones A, B and C are simultaneously projected from same point with same speed. A is thrown upwards, B is thrown horizontally and C is thrown downwards from a boulding. When the distance between stone A and C becomes 10 m, then distance between A and B will be-

A. 10 m

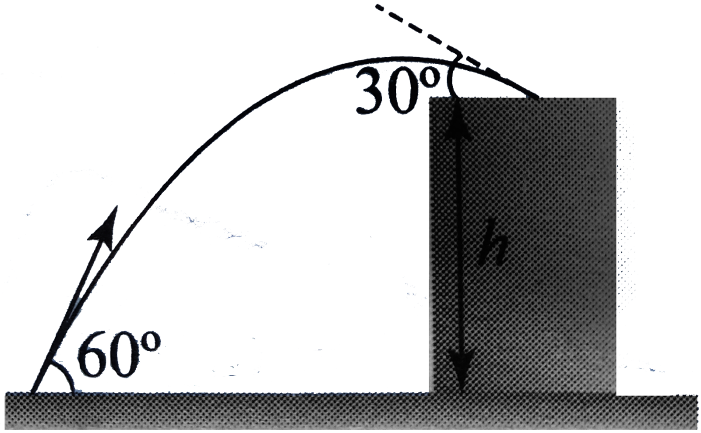
B. 5 m

C. $5\sqrt{2}m$

D. $10\sqrt{2}m$

Answer: C

Watch Video Solution

266. 

A stone projected at an angle of $60°$ from the ground level strikes at an angle of $30°$ on the roof of a building of height h. Then the speed of projection of the stone is:

A. $\sqrt{2gh}$

B. $\sqrt{6gh}$

C. $\sqrt{3gh}$

D. $\sqrt{gh}$

Answer: C

Watch Video Solution

267. A bullet is fired from horizontal ground at some angle passes through the point (3R/4 ,R/4), where R is the range of the bullet. Assume point of the fire to be origin and the bullet moves in x-y plane with x-axis horizontal and y-axis vertically upwards. Then angle of projection is

A. 30°

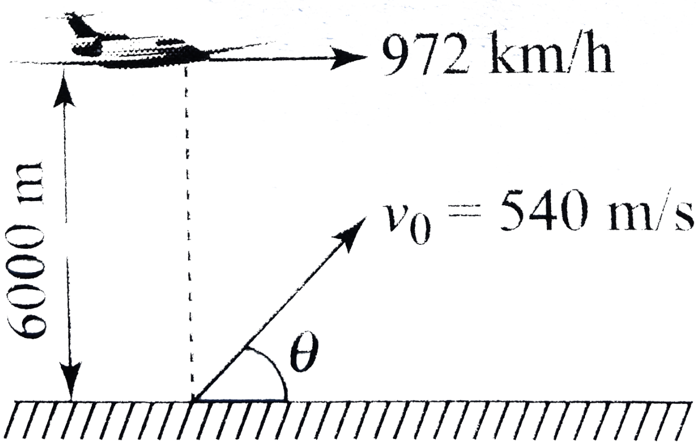
B. 37°

C. 53°

D. none

Answer: C

Watch Video Solution

268. 

An aircraft moving with a speed of 1000 km/h is at a heirgh of 6000 m, just overhead of an anti-aircraft gun.

If the muzzle velocity of the gun is 540 m/s, the firing angle θ for the bullet to hit the aircraft should be

A. 73°

B. 30°

C. 60°

D. 45°

Answer: C

Watch Video Solution

269. A stone is projectef from level ground such that its horizontal and vertical components of initial velocity are $u_x = 10\frac{m}{s}$ and $u_y = 20\frac{m}{s}$ respectively. Then the angle between velocity vector of stone one second before and one second after it attains maximum height is:

A. 30°

B. 45°

C. 60°

D. 90°

Answer: D

Watch Video Solution

270. In the climax of a movie, the hero jumps from a helicopter and the villain chasing the hero also jumps from the same level . After sometime when they come at same horizontal level, the villain fires bullet horizontally towards the hero, Both were falling with constant acceleration `2(m)/(s^2), because of parachute, Assuming the hero to be within the range of bullet, which of the following is correct.

A. bullet will hit the hero

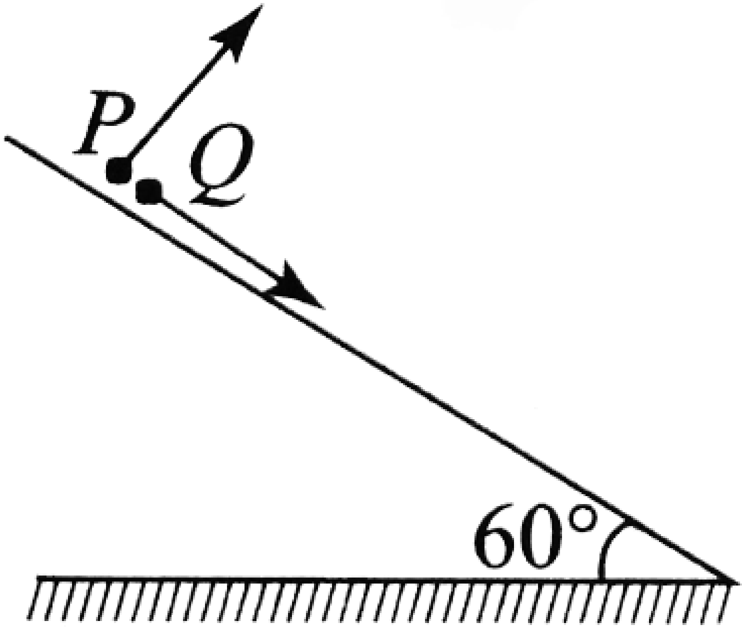
B. bullet will pass above the hero

C. bullet will pass below the hero

D. bullet will definitely hit the hero, if both were falling with constant acceleration g instead of $2\frac{m}{s^2}$

Answer: C

Watch Video Solution

271. 

A particle P is projected from a point on the surface of smooth inclined plane (see figure). Simultaneously another particle Q is released on the smooth inclined plane from the same position. P and Q collide after $t = 4$. The speed of projection of P is

A. $5 \frac{m}{s}$

B. $10\frac{m}{s}$

C. $15\frac{m}{s}$

D. $20\frac{m}{s}$

Answer: B

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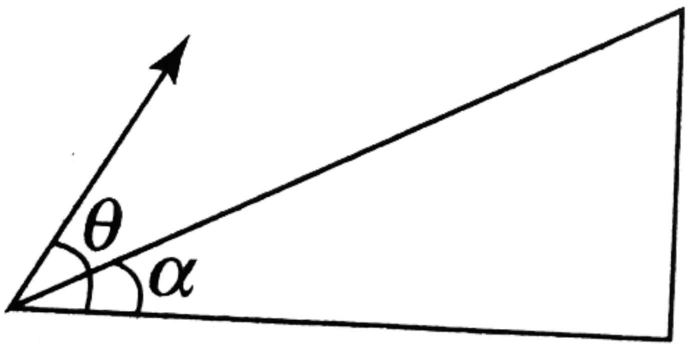


272.

A projectile is fired at an angle θ with the horizontal.

Find the condition under which it lands perpendicular on an inclined plane inclination α as shown figure.

A. $\sin\alpha = \cos(\theta - \alpha)$

B. $\cos\alpha = \sin(\theta - \alpha)$

C. $\tan\theta = \cot(\theta - \alpha)$

D. $\cot(\theta - \alpha) = 2\tan\alpha$

Answer: D

Watch Video Solution

273. A ball is projected with velocity u at right angle to the slope which inclined at an angle α with the horizontal. The distance x along the inclined plane that it will travell before again striking the slope is-

A. $\frac{2u^2}{g}\cos\alpha$

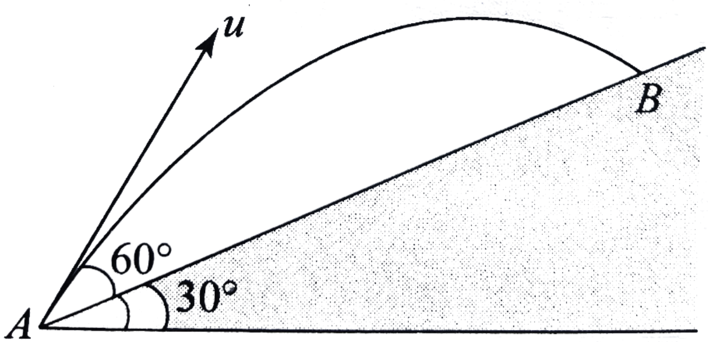
B. $\frac{2u^2}{g}\tan\alpha$

C. $\frac{2u^2}{g}\frac{\tan\alpha}{\cos\alpha}$

D. $\frac{2u^2}{g}\frac{\tan\alpha}{\sin\alpha}$

Answer: A

Watch Video Solution

274. 

A stone is projected from point A with speed u making an angle 60° with horizontal as shown. The fixed inclined suface makes an angle 30° with horizontal. The stone lands at B after time t. Then the distance AB is equal to

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

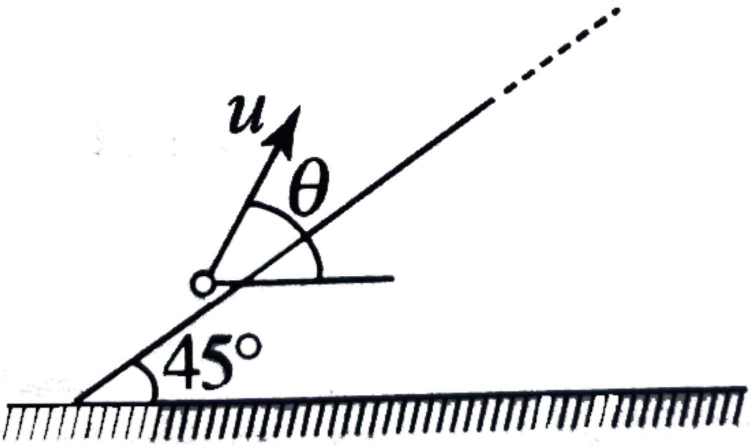
B. $\frac{\sqrt{3}}{2}$

C. $\sqrt{3}ut$

D. $2ut$

Answer: A

Watch Video Solution

275. 

A particle is projected from surface of the inclined plane with speed u and at an angle θ with the horizontal. After some time the particle collides elastically with the smooth fixed inclined plane for the first time and subsequently moves in vertical direction. Starting from projection, find the time taken by the particle to reach maximum height. (Neglect time of collision).

A. $\frac{2u\cos\theta}{g}$

B. $\frac{2u\sin\theta}{g}$

C. $\frac{u(\sin\theta + \cos\theta)}{g}$

D. $\frac{2u}{g}$

Answer: C

Watch Video Solution

276. A particle is projected from a point P (2,0,0)m with a velocity $10\frac{m}{s}$ making an angle 45° with the horizontal. The plane of projectile motion passes through a horizontal line PQ which makes an angle of 37° with positive x-axis, xy plane is horizontal. The coordinates of the point where the particle will strike the line PQ is

A. (10,6,0)m

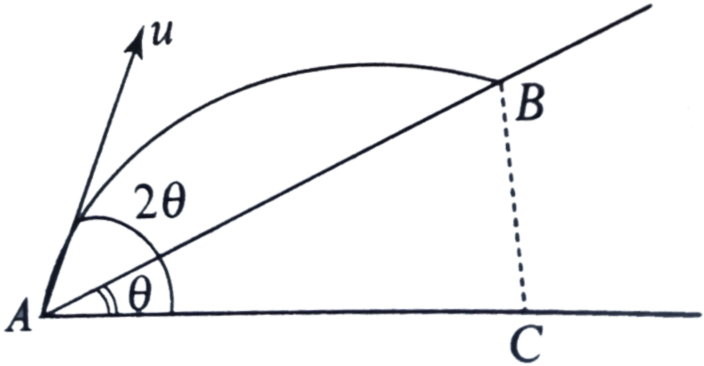
B. (8,6,0)m

C. (10,8,0)m

D. (6,10,0)m

Answer: A

Watch Video Solution

277. 

A particle is projected from point A on plane AB, so that $AB = \frac{2u^2 \tan\theta}{g\sqrt{3}}$ in the figure as shown. If u is the velocity of projection, find angle θ.

A. 30°

B. 60°

C. 90°

D. 45°

Answer: A

Watch Video Solution

278. On an inclined plane two particles A and B are projected with same speed at the same angle with the horizontal, particle A down and particle B up the plane. If the ratio of time of flight of A and B is $\cot\theta$, where θ is the angle at which B is projected measured from inclined plane, find the angle at which particles are projected.

A. 90°

B. 60°

C. 30°

D. 45°

Answer: D

Watch Video Solution

279. A river is flowing from West to East at a speed of 8 m per min A. man on the South bank of the river, capable of swimming at 20 m/min in still water, wants to swim across the river in the shortest time. He should swim in a direction.

A. Due north

B. due north-east

C. due north-east with double the speed of river

D. none of these

Answer: A

Watch Video Solution

280. A person swims in a river aiming to reach exactiy opposite pouint on the bank of a an angle 120° with the direction of flow of water.The speed of water in stream is

A. $1\frac{m}{s}$

B. $0.5\frac{m}{s}$

C. 0.25(m)/(s)`

D. $0.433\frac{m}{s}$

Answer: C

Watch Video Solution

281. A boat is sent across a river with a velocity 8 kmh^{-1} If the resultant velocity of boat is $10h^{-1}$,then velocity of the river is

A. $4\frac{km}{h}$

B. $6\frac{km}{h}$

C. $8\frac{km}{h}$

D. $10\frac{km}{h}$

Answer: B

Watch Video Solution

282. A man sitting in a bus travelling in a direction from west to east with a speed of $40km/h$ observes that the rain-drops are falling vertically down. To the another man standing on ground the rain will appear

A. to fall vertically down

B. to fall at an angle going from west to east

C. To fall at an angle going from east to west

D. The information given is insufficient to dicide the direction of rain.

Answer: B

Watch Video Solution

283. A boat is rowed across a river at the rate of $4.5\frac{km}{hr}$. The river flows at the rate of $6\frac{km}{hr}$. The velocity of boat in $\frac{m}{s}$ is:

A. 3.1

B. 2.1

C. 2.9

D. 5

Answer: B

Watch Video Solution

284. A swimmer crosses the river along the line making an angle of 45° with the direction of flow. Velocity of the river water is $5\frac{m}{s}$. Swimmer takes 12 seconds to cross the river of width 60 m. The velocity of the swimmer with respect to water will be:

A. $10\frac{m}{s}$

B. $5\frac{m}{s}$

C. $5\sqrt{5}\frac{m}{s}$

D. $5\sqrt{2}\frac{m}{s}$

Answer: B

Watch Video Solution

285. A jet airplane travelling at the speed of $500kmh^{-1}$ ejects its products of combustion at the speed of $1500kmh^{-1}$ relative to the jet plane. The speed of the products of combustion with respect to an observer on the ground is

A. $1000 kmh^{-1}$ in the direction west to east

B. $1000\ kmh^{-1}$ in the direction east to west

C. $2000\ kmh^{-1}$ in the direction west to east

D. $2000 kmh^{-1}$ in the direction east to west

Answer: B

Watch Video Solution

286. Rain is falling vertically with a velocity of $3 kmh^{-1}$. A man walks in the rain with a velocity of $4 kmh^{-1}$. The rain drops will fall on the man with a velocity of

A. $5 kmh^{-1}$

B. $4kmh^{-1}$

C. $3kmh^{-1}$

D. $1kmh^{-1}$

Answer: A

Watch Video Solution

287. A man who can swin at the rate of 2 $\left.\frac{km}{h}r\right)$(in still river) crosses a river to a point exactly opposite on the other bank by swimming in a direction of 120° to the flow of the water in the river. The velocity of the water current in $\frac{km}{hr}$ is

A. 1

B. 3

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

D. $\frac{3}{2}$

Answer: A

Watch Video Solution

288. An aeroplane is to go along straight line from A to B, and back again. The relative speed with respect to wind is V. The wind blows perpendicular to line AB with speed v. The distance between A and B is l. The total time for the round trip is:

A. $\frac{2l}{\sqrt{V^2 - v^2}}$

B. $\frac{2vl}{V^2 - v^2}$

C. $\frac{2Vl}{V^2 - v^2}$

D. $\frac{2l}{\sqrt{V^2 + v^2}}$

Answer: A

Watch Video Solution

289. Man A is sitting in a car moving with a speed of 54 $\frac{km}{hr}$ observes a man B in front of the car crossing perpendicularly a road of width 15 m in three seconds. Then the velocity of man B (in $\frac{m}{s}$) will be:

A. $5\sqrt{10}$ towards the car at some angle

B. $5\sqrt{10}$ away from from the car at some angle

C. 5 perperdicular to the road

D. 15 along the road

Answer: B

Watch Video Solution

290. A train in standing on a platform, a man inside a compartment of a train drops a stone. At the same instant train starts to move with constant acceleration. The path of the particle as seen by the person who drops the stone is:

A. parabola

B. straight line for some time & parabola for the remaining time

C. straight line

D. variable path that cannot be defined

Answer: C

Watch Video Solution

291. A man wearing a hat of extended length 12 cm is running in rain falling vertically downwards with speed $10\frac{m}{s}$. The maximum speed with which man can run, so that rain drops do not fall on his face (the length of his face below the extended part of the hat is 16 cm) will be

A. $7.5\frac{m}{s}$

B. $13.33\frac{m}{s}$

C. $10\frac{m}{s}$

D. zero

Answer: A

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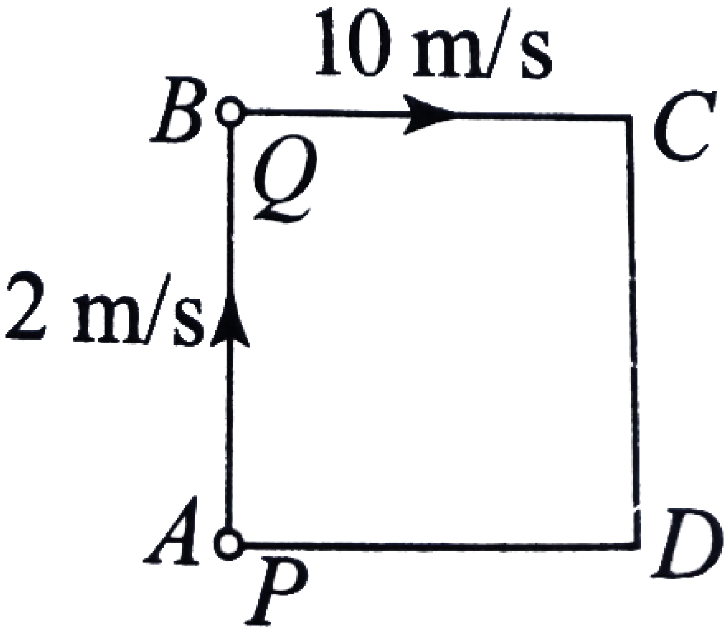

292.

Two men P & Q are standing at corners A & B of square ABCD of side 8m. They start moving along the track with constant speed $2m/s$ and $10m/s$ respectively. Find the time when they will meet for the first time

A. 2 sec

B. 3 sec

C. 1 sec

D. 6 sec

Answer: B

Watch Video Solution

293. A swimmer crosses a river with minimum possible time 10 Second. And when he reaches the other end starts swimming in the direction towards the point from where he started swimming. Keeping the direction fixed the swimmer crosses the river in 15 sec. The ratio of speed of swimmer with respect to water and the speed of river flow is (Assume contant speed of river & swimmer)

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

B. $\frac{9}{4}$

C. $\frac{2}{\sqrt{5}}$

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

Answer: C

Watch Video Solution

294. A cat runs along a straight line with constant velocity of magnitude v. A dog chases the cat such that the velocity of dog is always directed towards the cat. The speed of dog is u and always constant .At the instant both are separated by distance x and their velocities are mutually perpendicular, the magnitude of acceleration of dog is.

A. $\frac{uv}{x}$

B. $\frac{u^2}{x}$

C. $\frac{v^2}{x}$

D. $\frac{u^2 + v^2}{x}$

Answer: A

Watch Video Solution

295. Person A observes B moving in east direction with speed $10\frac{m}{s}$, B observes C moving in south direction with speed $20\frac{m}{s}$, C observes D moving in west direction with speed $30\frac{m}{s}$ & D observes a tree moving with speed $40\frac{m}{s}$ in north direction. Then the actual direction of motion of person A will be

A. north-west

B. north-east

C. south-east

D. none of these

Answer: C

Watch Video Solution

296. Two motor boats A and B move from same point along a circle of radius 10 m in still water. The boats are so designed that they can move only with constant speeds. The boats A and B take 16 and 8 sec respectively to complete one circle in stationary water. Now water starts flowing at $t = 0$ with a speed $4\frac{m}{s}$ in a fixed direction. Find the distance between the boats after $t = 8$ sec.

A. 10 m

B. 20 m

C. 100 m

D. none of these

Answer: B

Watch Video Solution

297. A man starts running along a straight road with uniform velocity observes that the rain is falling vertically downward. If he doubles his speed, he finds that the rain is coming at an angle θ to the vertical. The velocity of rain with respect to the ground is :

A. $u\hat{i} - u\tan\theta\hat{j}$

B. $u\hat{i} - u\cot\theta\hat{j}$

C. $u\hat{i} + u\cot\theta\hat{j}$

D. $\frac{u}{\tan\theta}\hat{i} - u\hat{j}$

Answer: C

Watch Video Solution

298. Four particles A, B, C and D are in motion. The velocities of one with respect to other are given as v_{DC} is $20m/s$ towards noth v_{BC} is $20m/s$ towards east and v_{BA} is $20m/s$ towards south. Then v_{DA} is

A. $20\frac{m}{s}$ towards north

B. $20\frac{m}{s}$ towards south

C. $20\frac{m}{s}$ towards east

D. $20\frac{m}{s}$ towards west

Answer: D

Watch Video Solution

299. In uniform circular motion

A. Both velcoty and acceleration are constant

B. Acceleration and speed are constant but velocity changes.

C. Both acceleration and velocity changes.

D. Both accelration and speed are constant

Answer: C

Watch Video Solution

300. A particle is revolving in a circle with increasing its speed uniformly. Which of the following is constant ?

A. centripetal acceleration

B. tangential acceleration

C. angular acceleration

D. none of these

Answer: C

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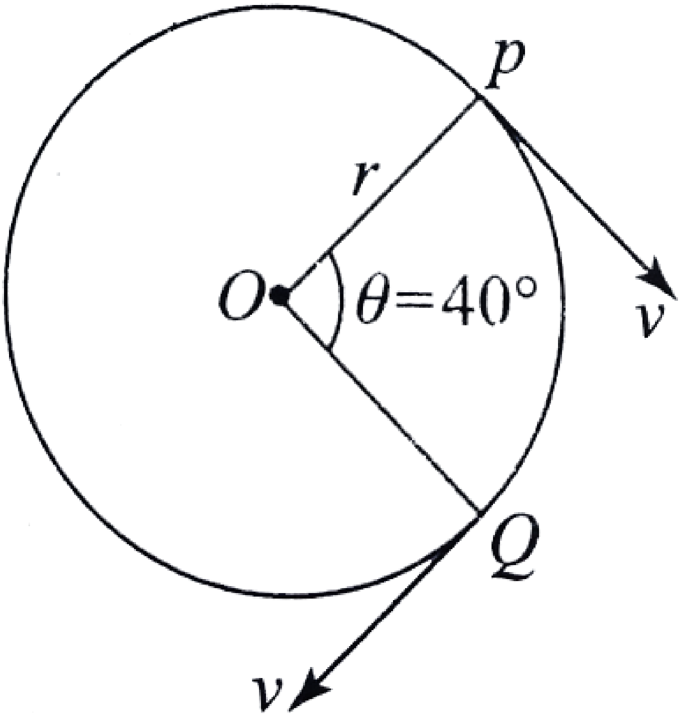


301.

A particle is moving on a circular path of radius r with uniform velocity v. The change in velocity when the particle moves from P to Q is $\left(\angle POQ = 40^\circ\right)$

A. $2v\cos 40^\circ$

B. $2v\sin 40^\circ$

C. $2v\sin 20^\circ$

D. $2v\cos 20^\circ$

Answer: C

Watch Video Solution

302. A particle 'P' is moving in a circle of radius 'a' with a uniform speed 'u' 'C' is the centre of the circle and AB is a diameter. The angular velocity of P about A and C are in the ratio

A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: B

Watch Video Solution

303. The ration of angular speeds of minute hand and hour hand of a watch is

A. $1:12$

B. $6:1$

C. $12:1$

D. $1:6$

Answer: C

Watch Video Solution

304. A body is rotating with angular velocity $\vec{\omega} = 3\hat{i} - 4\hat{j} + \hat{k}$. The linear velocity of a point having position vector $\vec{r} = 5\hat{i} - 6\hat{j} + 6\hat{k}$ is

A. $6\hat{i} + 2\hat{j} - 3\hat{k}$

B. $-18\hat{i} - 13\hat{j} + 2\hat{k}$

C. $4\hat{i} - 13\hat{j} + 6\hat{k}$

D. $6\hat{i} - 2\hat{j} + 8\hat{k}$

Answer: B

Watch Video Solution

305. When a celling fan is switched off, its angular velocity falls to half while it makes 36 rotations. How many more rotations will it make before coming to rest ?

A. 18

B. 12

C. 36

D. 48

Answer: B

Watch Video Solution

306. A motor car travelling at $30m/s$ on a circular road of radius $500m$. It is increasing its speed at the rate of $2ms^{-2}$. What its accleration at that instant ?

A. $2\frac{m}{\sec^2}$

B. $2.7\frac{m}{\sec^2}$

C. $1.8\frac{m}{\sec^2}$

D. $9.8\frac{m}{\sec^2}$

Answer: B

Watch Video Solution

307. A car is travelling with linear velocity v on a circular road of radius r. If it is increasing its speed at the rate of a metre/$\sec^2$, then the resultant acceleration will be

A. $\sqrt{\left\{\frac{v^2}{r^2}-a^2\right\}}$

B. $\sqrt{\left\{\frac{v^4}{r^2} + a^2\right\}}$

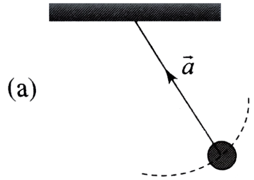
C. $\sqrt{\left\{\frac{v^4}{r^2} - a^2\right\}}$

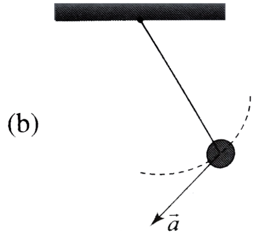
D. $\sqrt{\left\{\frac{v^2}{r^2} + a^2\right\}}$

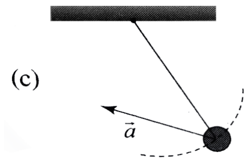
Answer: B

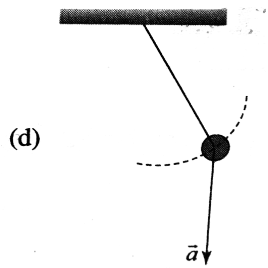
Watch Video Solution

308. A simple pendulum is oscillating without damping. When the displacement of the bob is less than maximum, its acceleration vector $\vec{a}$ is correctly shown in

A. 

B. 

C. 

D. 

Answer: C

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309. A stone is projected from level ground at $t = 0$ sec such that its horizontal and vertical components of initial velocity are $10\frac{m}{s}$ and $20\frac{m}{s}$ respectively. Then the instant of time at which tangential and normal components of acceleration of stone are same is: (neglect air resistance)$g = 10\frac{m}{s^2}$.

A. $\frac{1}{2}\text{sec}$

B. $\frac{3}{2}\text{sec}$

C. 3 sec

D. 4 sec

Answer: C

Watch Video Solution

310. A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle. The motion of the particle takes place in a plane. It follows that

A. velocity is constant

B. acceleration is constant

C. kinetic energy is constant

D. it moves in a circular path

Answer: C::D

Watch Video Solution

311. For a particle performing uniform circular motion, choose the correct statement (s) from the following.

A. Magnitude of particle velocity (speed) remains constant

B. Particle velocity remains directed perpendicular to radius vector

C. direction of acceleration keeps changing as particle moves

D. Tangential acceleration of the particle is non zero.

Answer: A::B::C

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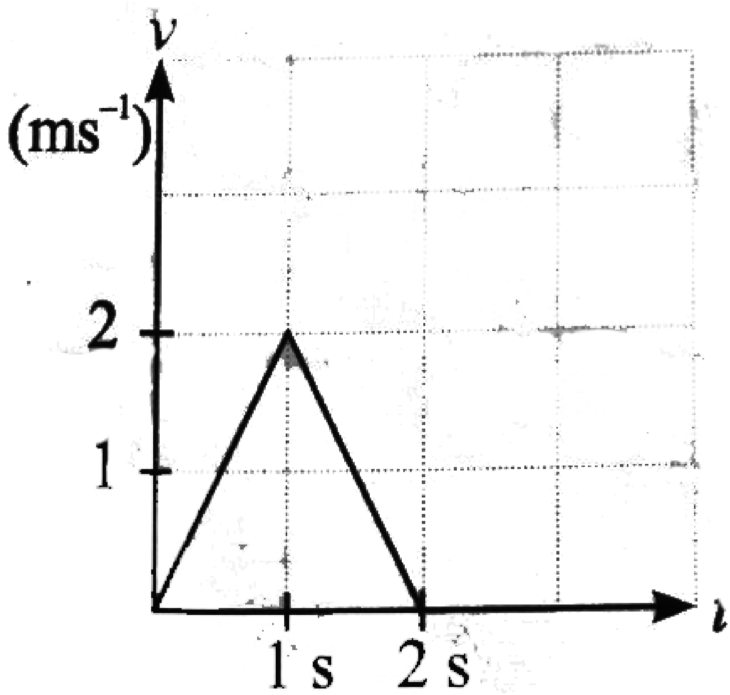
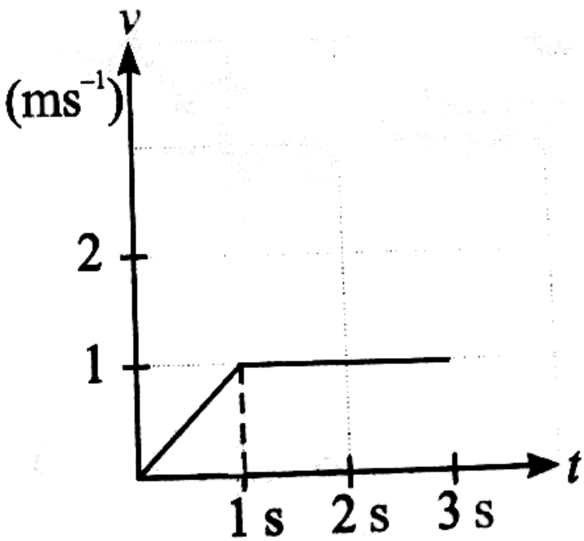


(a)

312.



(b)

Figure shows (v_x, t) and (v_y, t) diagram for a body of unit mass. Find the force as a function of time.

Watch Video Solution

313. A boy sitting on the topmost berth in the compartment of a train which is just going to stop on a railway station, drop an apple aiming at the open hand of his brother sitting vertically below his hands at a distnace of about 2 meter. The apple willl fall

A. precisely on the hand of his brother

B. slightly away from the hand of his brother in the direction of motion of the train

C. Slightly away from the hand of his brother in the direction oppsite to the direction of motion on the train

D. none of above

Answer: B

Watch Video Solution

314. A boy in an open car moving on a levelled road with constant speed tosses a ball vertically up in the air and catches it back . Sketch the motion of the ball as observed by a boy standing on the footpath. Give explanation to support your diagram.

A. outside the car

B. in the car ahead of the person

C. in the car to the side of the person

D. exactly in the hand which threw it up

Answer: D

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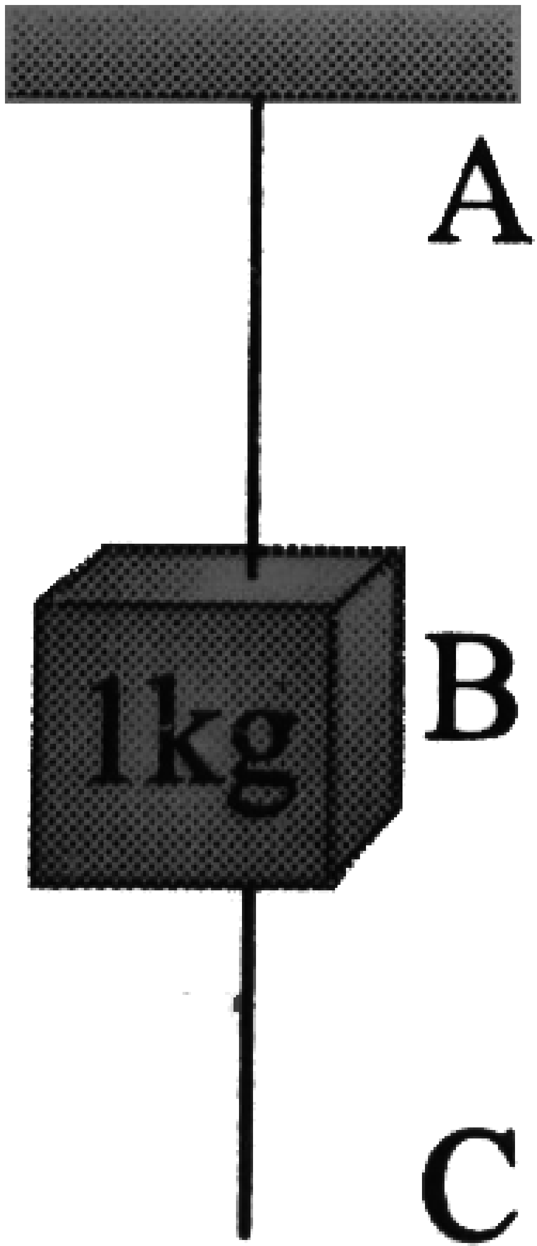

315.

A mass of 1 kg is suspended by a string A. another string C is connected to its lower end (see figure). If the string C is stretched slowly, then

A. The portion AB of the string will break

B. The portion BC of the string will break

C. None of the strings will break

D. none of the above

Answer: A

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316. A machine gun is mounted on a 2000 kg car on a horizontal frictionless surface. At some instant, the gun fires 10 bullets/second, each of mass 10 g with a velocity of $500ms^{-1}$. The acceleration of the car is

A. 550 N

B. 50 N

C. 250 N

D. 250 N

Answer: B

Watch Video Solution

317. A machine gun fires a bullet of mass 40 g with a velocity $1200ms^{-1}$. The man holding it can exert a maximum force of 144 N on the gun. How many bullets can be fire per second at the most? a) 3 b) 5 c) 6 d) 9

A. One

B. Four

C. Two

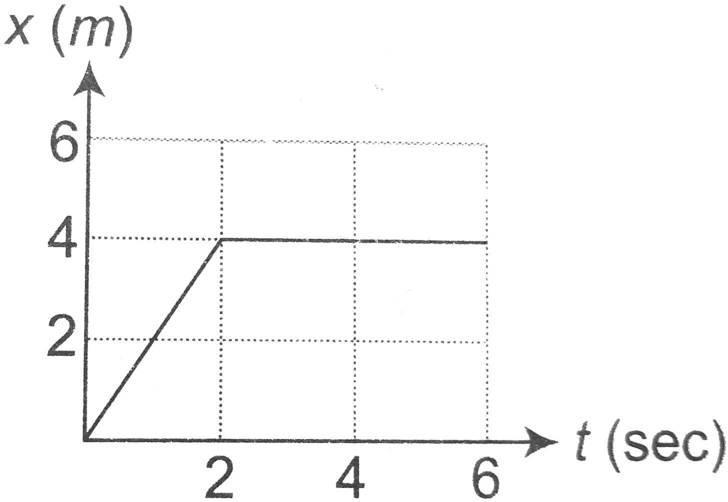
D. Three

Answer: D

Watch Video Solution

318. In the figure given below, the position-time graph of a particle of mass $0.1 kg$ is shown. The impuslse at

$t = 2$ sec is



A. $0.2 kgm\sec^{-1}$

B. $-0.2 kgm\sec^{-1}$

C. $0.1 kgm\sec^{-1}$

D. $-0.4 kgm\sec^{-1}$

Answer: B

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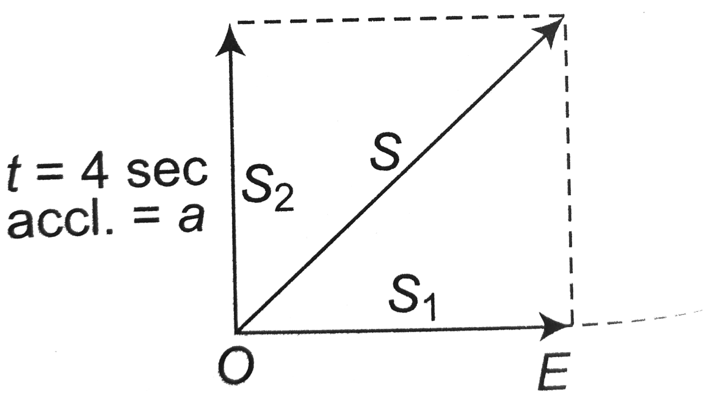
319. A body mass $2kg$ has an initial velocity of 3 metre//sec along OE and it is subject to a force of $4N$ in a direction perpendicular to OE. The distance of body from O after 4 sec will be:



A. 12 m

B. 20 m

C. 8 m

D. 48 m

Answer: B

Watch Video Solution

320. A particle moves in the xy-plane under the action of a force F such that the components of its linear momentum p at any time t and $p_x = 2\cos$ t, $p_y = 2\sin$ t. the angle between F and p at time t is

A. 90°

B. 0°

C. $180°$

D. $30°$

Answer: A

Watch Video Solution

321. The motion of a particle of mass m is given by $x = 0$ for $t < 0s, x(t) = A\sin 4\pi t$ for $0 < t < \left(\frac{1}{4}\right)s$ $(A > 0)$ and $x = 0$ for $t > \left(\frac{1}{4}\right)s.$

A. The force at $t = \left(\frac{1}{8}\right)$s on the particle is $-16\pi^2 A - m$

B. The particle is acted upon by on impulse of magnitude $4\pi^2 A \cdot m$ at $t = 0s$ and $t = \left(\frac{1}{4}\right)$s

C. The particle is not acted upon by any force

D. The particle is not acted upon by a constant force

Answer: A::B::D

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322. Two billiard balls A and B each of mass 50 g and moving in opposite directons with speed of $5ms^{-1}$ each , collide and rebound with the same speed. If the collision lasts for 10^{-3} s , which of the following statements are true ?

A. The impulse imparted to each ball is $0.25kg - ms^{-1}$ and the force on each ball is 250 N

B. The impulse imparted to each ball is $.025kg - ms^{-1}$ and the force exerted on each ball is $25 \times 10^{-5}N$

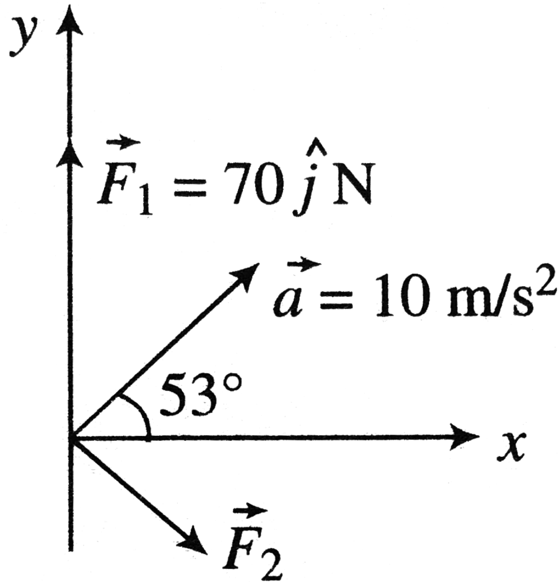
C. The impulse imparted to each ball is $0.5N - s$

D. The impulse and the force on each ball are equal in magnitude and opposite in directions

Answer: C::D

Watch Video Solution

323. A particle of $m = 5kg$ is momentarily at rest at time $t = 0$. It is acted upon by two forces $\vec{F}_1$ and $\vec{F}_2$. $\vec{F}_1$ = $70\hat{j}$ N. The direction and manitude of $\vec{F}_2$ are unknown. The particle experiences a constant acceleration, $\vec{a}$,in the direction as shown in figure. Neglect gravity.



a.Find the missing force $\vec{F}_2$.

b. What is the velocity vector of the particle at $t = 10s$?

c. What third force, $\vec{F}_3$ is required to make the acceleration of the particle zero? Either give magnitude and direction of $\vec{F}_3$ or its components.

A. $30\hat{i} + 40\hat{j}$

B. $-\left(30\hat{i} + 40\hat{j}\right)$

C. $40\hat{i} + 30\hat{j}$

D. $-\left(40\hat{i} + 30\hat{j}\right)$

Answer: B

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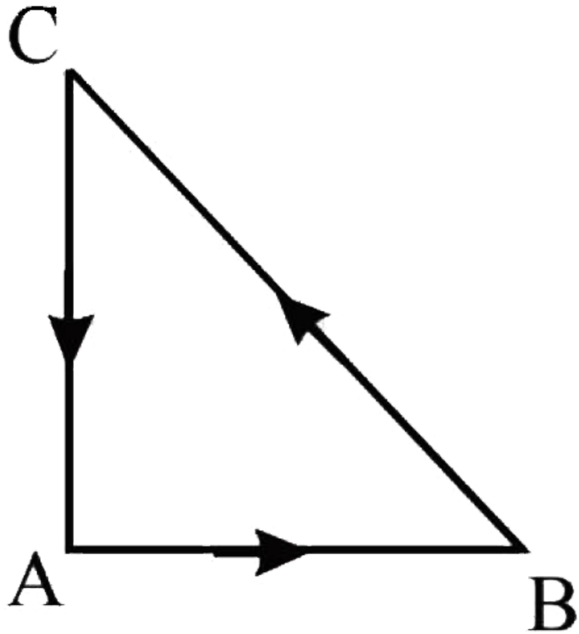
324. Three forces start acting simultaneously on a particle moving with velocity, $\vec{v}$. These forces are respresented in magnitude and direction by the three sides of a triangle ABC. The particle will now move with velocity



A. $\vec{v}$ remains unchanged

B. Less then $\vec{v}$

C. Greater than $\vec{v}$

D. $\vec{v}$ in the direction of the largest force BC.

Answer: A

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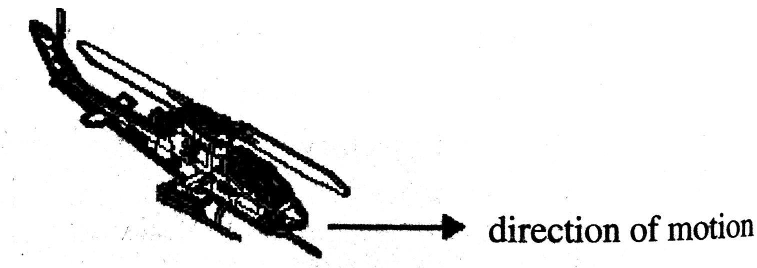
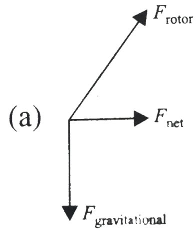
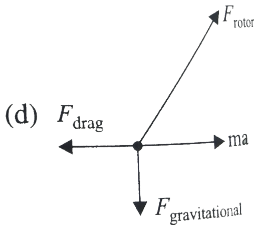
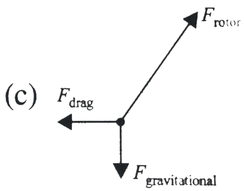
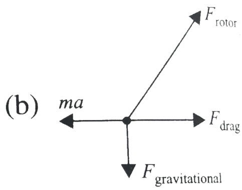
325. A helicopter is moving to the right at a constant horizontal velocity. It experiences thre forces $\vec{F}_{\text{gravitational}}, \vec{F}_{\text{drag}}$ force on it caused by rotor $\vec{F}_{\text{rotor}}$. Which of the following diagrams can be a correct free body diagram represents forces on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



A. 

B. 

C. 

D. 

Answer: C

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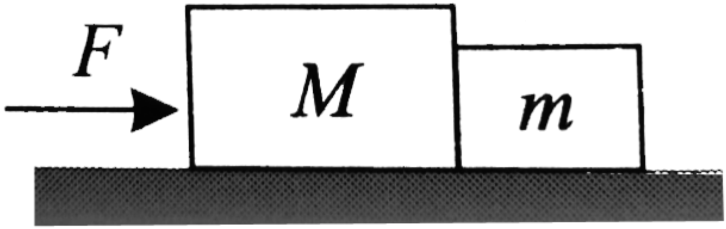
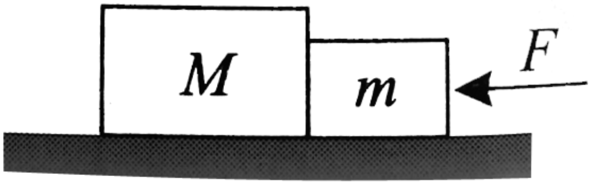
Case I

326. 

Case II



As shown to the right, two blocks with masses m and M ($M > m$) are pushed by a force F in both Case I and Case II. The surface on which blocks lie, is horizontal and frictionless. Let R_I be the force that M exerts on m in case I and R_{II} be the force that m exerts on M in case II. Which of the following statements is true?

A. $R_I = R_{II}$ and is not equal to zero or F

B. $R_I = R_{II} = F$

C. $R_I < R_{II}$

D. $R_I > R_{II}$

Answer: C

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327. Consider the three cases given in figures shown. Assume the friction to be absent everywhere and the pulleys to be light, the string connecting the blocks to other block or fixed vertical wall to be light and inextensible. Let T_A , T_B and T_C be the tension in the strings in figure A , figure B and figure C respectively.

Then pick the correct comparison between the given

tension (for the instant shown) from options below.

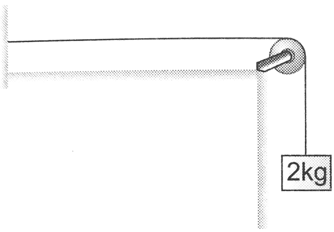


Fig. (A)

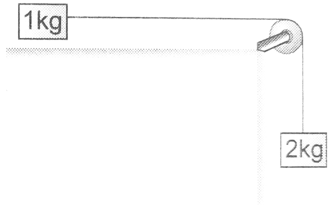
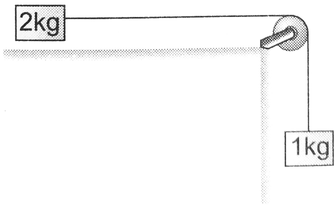


Fig. (B)



A. $T_A = T_B = T_C$

B. $T_B = T_C < T_A$

C. $T_A < T_B < T_C$

D. $T_B < T_C < T_A$

Answer: D

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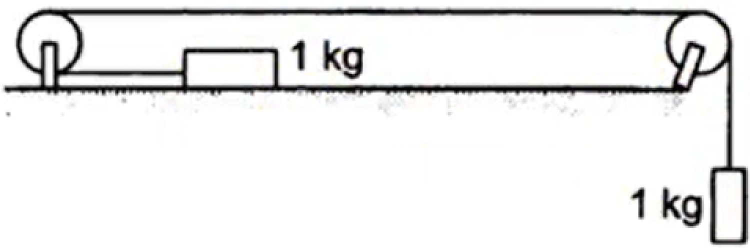
328. Calculate the tension in the string shown in figure. The pulley and the string are light and all surfaces are frictionless. Take g=10 m/s^2.



A. 0 N

B. 1 N

C. 2 N

D. 5 N

Answer: D

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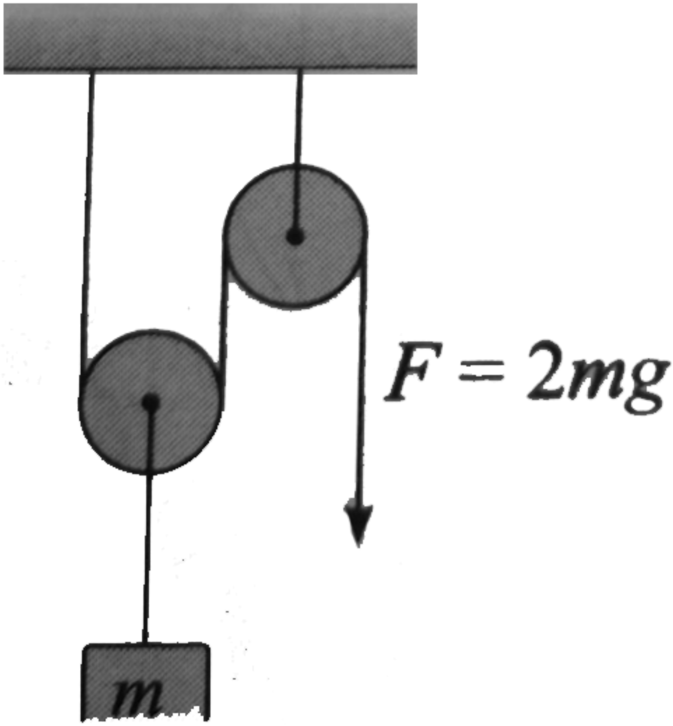

329.

In the shown mass pulley system, pulleys and string are massless. The one end of the string is pulleed by the force $F = 2mg$. The acceleration of the block will be

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

B. 0

C. Greater than $\vec{v}$

D. 3g

Answer: D

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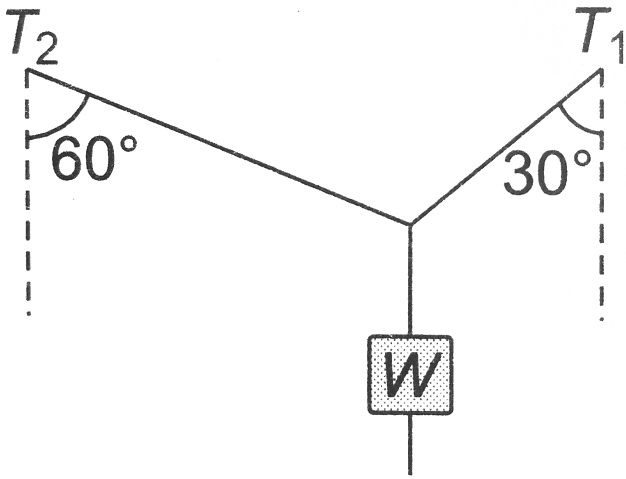
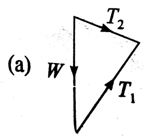
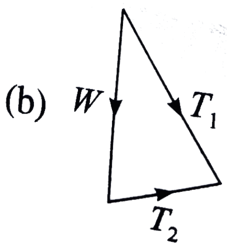
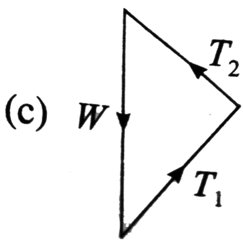
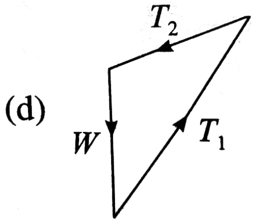
330. A weight W is supported by two strings inclined at 60° and 30° to the vertical. The tensions in the strings are T_1 and T_2 as shown. If these tensions in the strings are to be determined in terms of W using a triangle of force, which of these triangles should you draw? (block is in equilibrium)



A. 

B. 

C. 

D. 

Answer: C

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331. Which of the following sets of concurrent force may be in equilibrium?

A. $F_1 = 3, F_2 = 5N, F_3 = 9N$

B. $F_1 = 3N, F_2 = 5N, F_3 = 1N$

C. $F_1 = 3N, F_2 = 5N, F_3 = 15N$

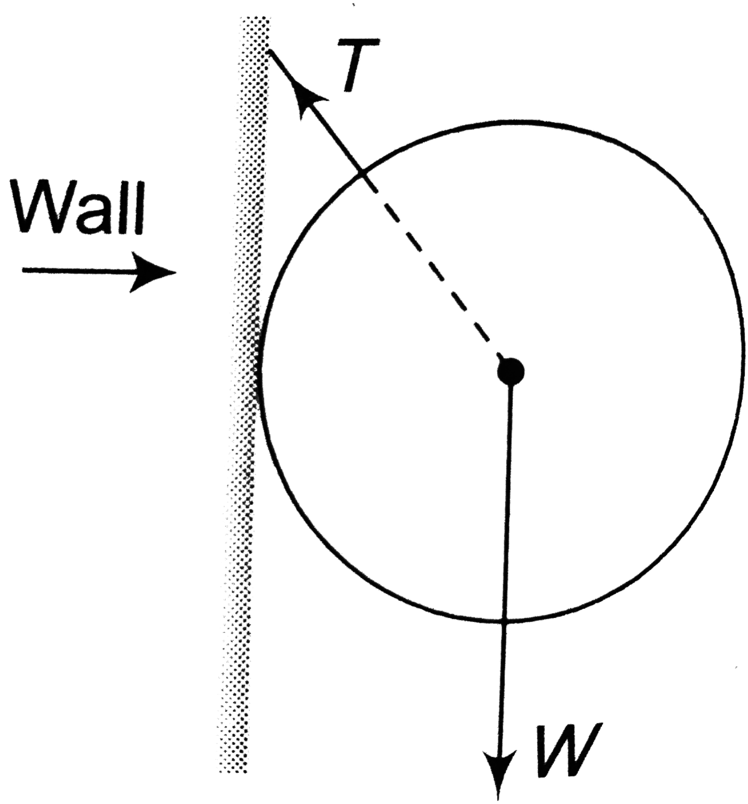
D. $F_1 = 3N, F_2 = 5N, F_3 = 6N$

Answer: D

Watch Video Solution

332. A uniform sphere of weight W and radius $3\ m$ is being held by a frictionless wall as shown in the figure. The tension in the string will be (length of the string is

2m):



A. $\frac{5w}{4}$

B. $\frac{15w}{4}$

C. $\frac{15w}{16}$

D. none of these

Answer: A

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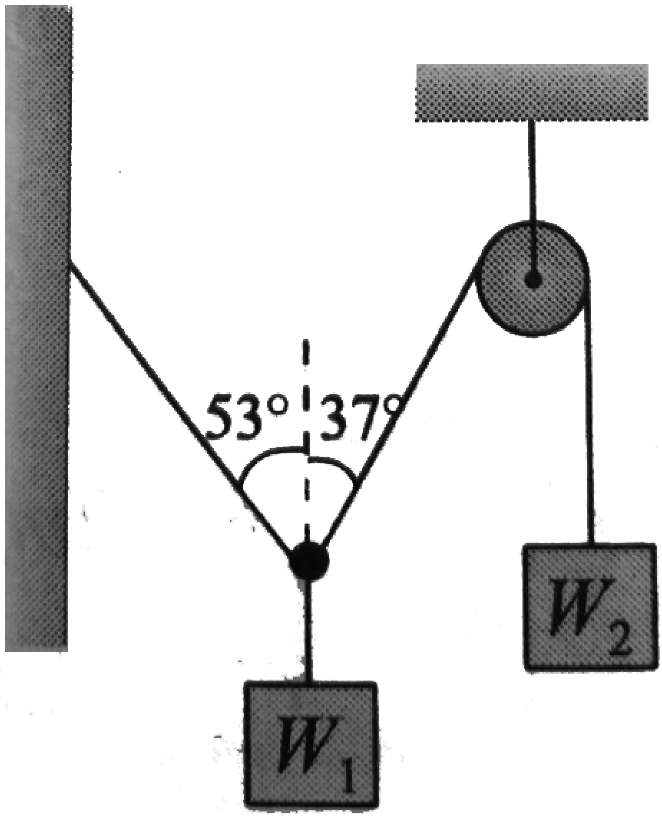

333.

Two weights W_1 and W_2 in equilibrius and at rest are suspended as shown in figure. Then the ratio $\frac{W_1}{W_2}$ is:

A. $\frac{5}{4}$

B. $\frac{4}{5}$

C. $\frac{8}{5}$

D. none of these

Answer: A

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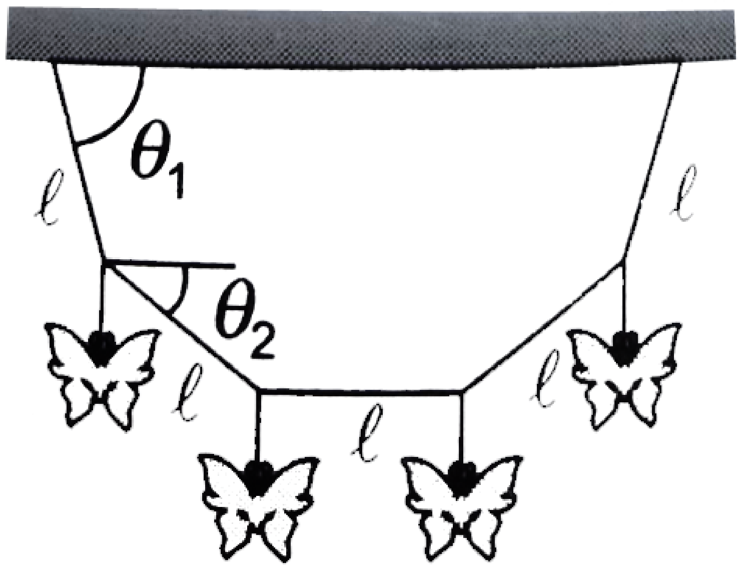

334.

Four identical metal butterflies are hanging from a light string of length 5l at equally placed points as shown. The ends of the string are attached to horizontal fixed support. The middle section of the string is horizontal . The relation between the angle θ_1 and θ_2 is given by

A. $\sin\theta_1 = 2\sin\theta_2$

B. $2\cos\theta_1 = \sin\theta_2$

C. $\tan\theta_1 = 2\tan\theta_2$

D. $\theta_2 < \theta_1$ and no other conclusion can be derived.

Answer: C

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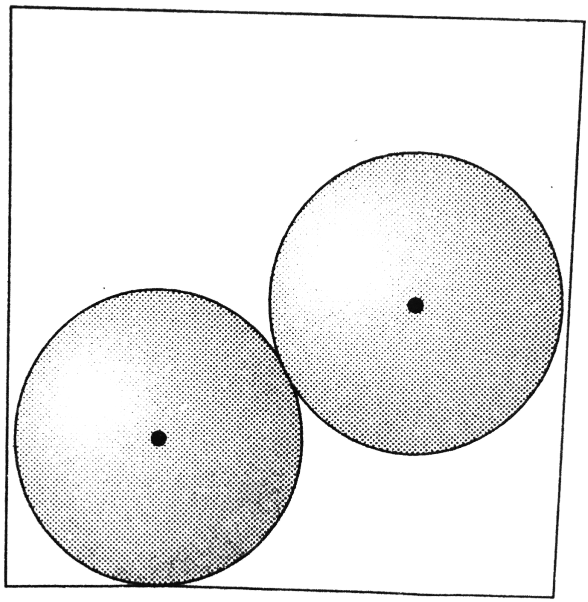
335. Two smooth sphere each of radius 5cm and weight W rest one on the other inside a fixed smooth cylinder of radius 8cm. The reaction between the sphere and the vertical side of the cylinder are:



A. $\frac{W}{4}$ and $\frac{3W}{4}$

B. $\frac{W}{4}$ and $\frac{W}{4}$

C. $\frac{3W}{4}$ and $\frac{3W}{4}$

D. W and W

Answer: C

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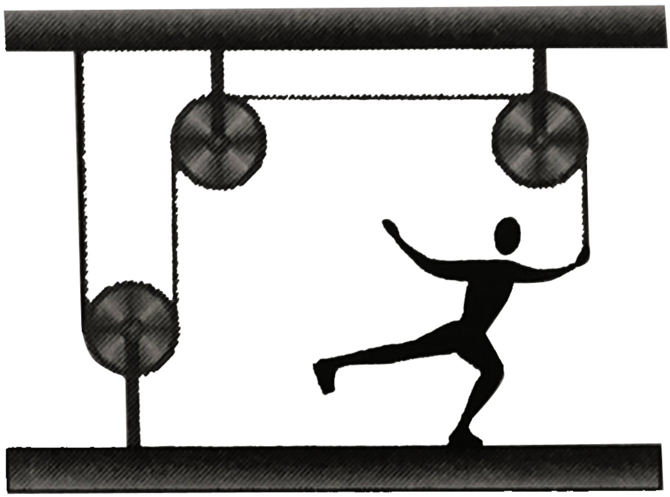
336. A $50kg$ person stand on a $25kg$ platform. He pulls on the rope which is connected to the rope which is attached to the platform *via* the frictionless pulley as shown in the figure. The platform moves upwards at a steady rate if the force with which the person pulls the rope is



A. 500 N

B. 250 N

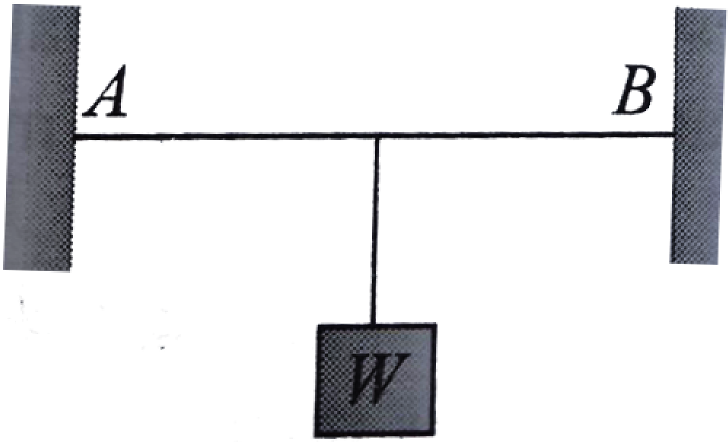
C. 25 N

D. 50 N

Answer: B

Watch Video Solution

337. Find the tension in the string AB loaded with weight W at the middlw, when AB is horizontal:



A. zero

B. W

C. $\frac{W}{2}$

D. infinity

Answer: D

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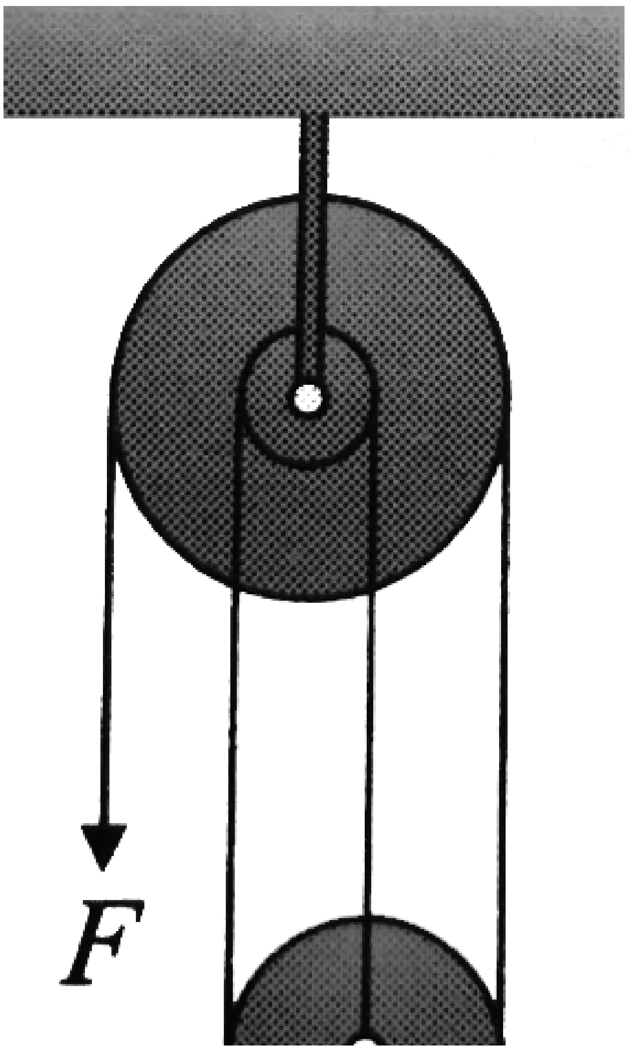

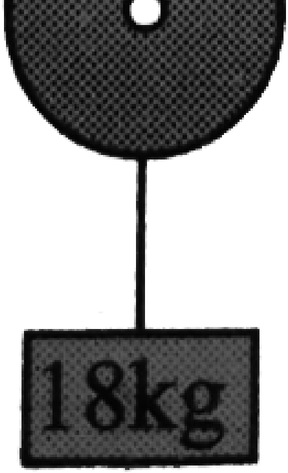

338.

In the figure, at the free end of the light string, a force F is supplied to keep the suspended mass of 18 kg at rest. Then the force exerted by the ceiling on the system (assume that the string segments are vertical and the pulleys are light and smooth) is:($g = 10\frac{m}{s^2}$)

A. 60 N

B. 120 N

C. 180 N

D. 240 N

Answer: D

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339. A car is moving on a plane inclined at 30° to the horizontal with an acceleration of $10m/s^2$ parallel to the plane upward. A bob is suspended by a string from the roof. The angle in degrees which the string makes with the vertical is: (Assume that the bob does not move relative to car) $\left[g = 10m/s^2\right]$

A. 20°

B. 30°

C. 45°

D. 60°

Answer: B

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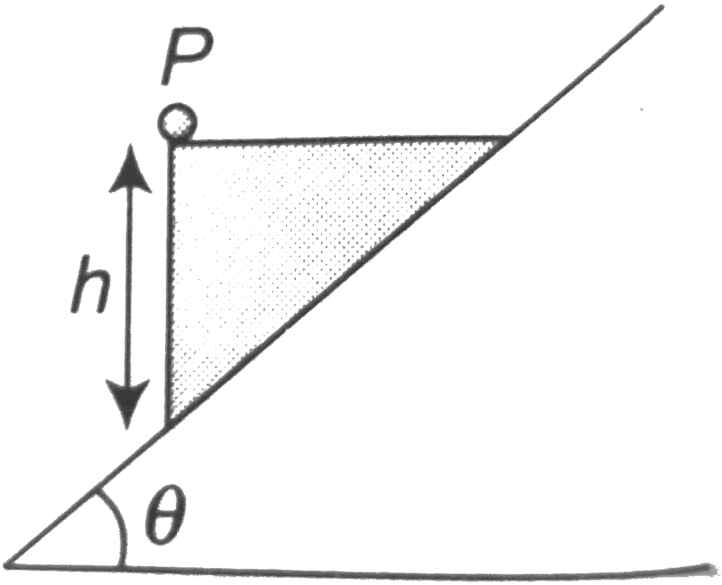
340. A wedge of height 'h' is released from rest with a light particle P placed on it as shown. The wedge slides down an incline which makes an angle theta with the horizontal. All the surface are smooth, P will reach the surface of the incline in time:



A. $\sqrt{\dfrac{2h}{g\sin^2\theta}}$

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

C. $\sqrt{\dfrac{2h}{g\tan\theta}}$

D. $\sqrt{\dfrac{2h}{g\cos^2\theta}}$

Answer: A

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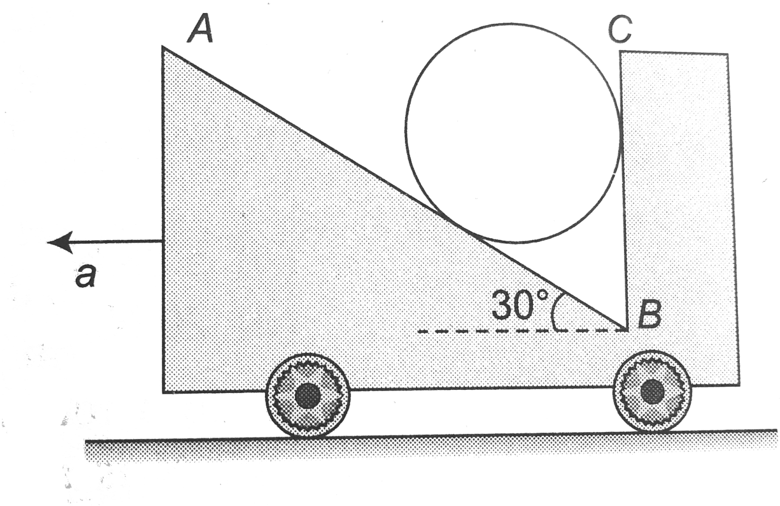
341. A cylinder rests in a supporting carriage as shown. The side AB of carriage makes an angle 30° with the horizontal and side BC is vertical. The carriage lies on a fixed horizontal surface and is being puplled towards left with an horizontal acceleration a. The magnitude of normal reactions exerted by side AB and BC of carriage on the cylinder be N_{AB} and N_{BC}resectively. Neglect friction everywhere. Then as the magnnitude of acceleration a of the carriage is increased, pick up the correct statement:



A. N_{AB} increases and N_{BC} decreses.

B. Both N_{AB} and N_{BC} increase.

C. N_{AB} remains constant and N_{BC} increases.

D. N_AB increases and N_{BC} remains constant.

Answer: C

Watch Video Solution

342. A ball is suspended on a thread from the ceiling of a car. The brakes are applied and the speed of car changes from $5m/\sec$ to $5/3m/\sec$ during the time interval of 3 seconds. Find the angle that the thread with the ball will deviate from vertical.

A. $\theta = \tan^{-1}\left(\frac{1}{9}\right)$

B. $\theta = \tan^{-1}\left(\frac{8}{9}\right)$

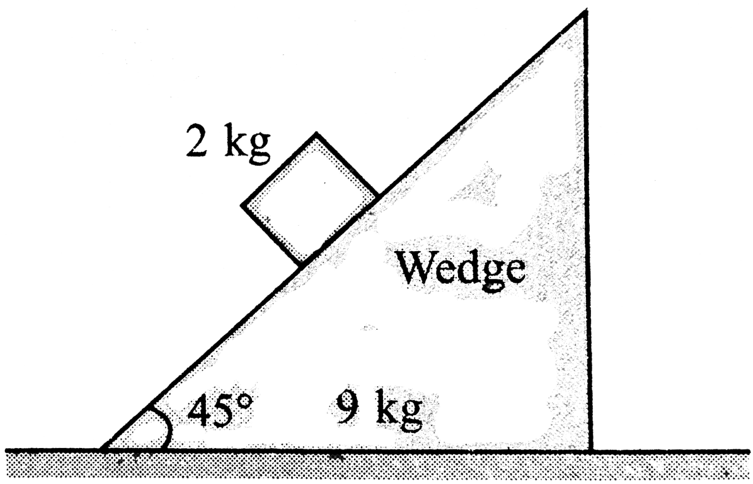
C. $\theta = \cos^{-1}\left(\frac{1}{9}\right)$

D. $\theta = \sin^{-1}\left(\frac{1}{9}\right)$

Answer: A

Watch Video Solution

343. 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. $2\frac{m}{\sec^2}$

B. $\frac{11}{\sqrt{2}}\frac{m}{s^2}$

C. $1\frac{m}{s^2}$

D. none of these

Answer: C

Watch Video Solution

344. A body of mass m is placed over a smooth inclined plane of inclination θ. Which iis placed over a lift which is moving up with an acceleration a_0 . Base length o f the inclined plane is L . Calculate the velocity of the block with respect to lift at the bottom, if it is allowed to slide down from the top of the plane from rest.

A. $\sqrt{2\left(a_0 + g\right)L\sin\theta}$

B. $\sqrt{2\left(a_0 + g\right)L\cos\theta}$

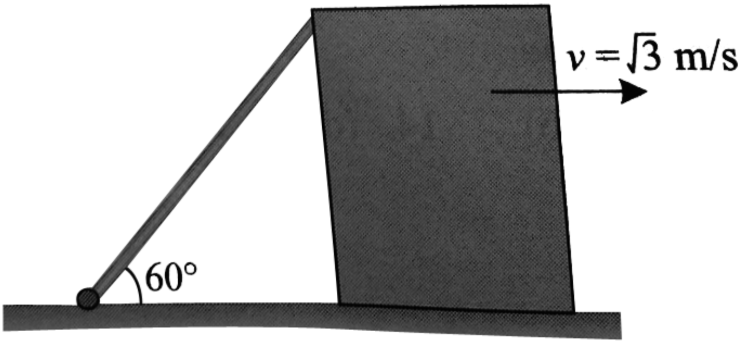
C. $\sqrt{2\left(a_0 + g\right)L\tan\theta}$

D. $\sqrt{2\left(a_0 + g\right)L\cot\theta}$

Answer: C

Watch Video Solution

345.



A rod AB is shown in figure. End A of the rod is fixed on ground. Block is moving with velocity $\sqrt{3}$ m/s towards right. The velocity of end B of rod when rod makes an angle of 60° with ground is :

A. $\sqrt{3}\frac{m}{s}$

B. $2\frac{m}{s}$

C. $2\sqrt{3}\frac{m}{s}$

D. $3\frac{m}{s}$

Answer: B

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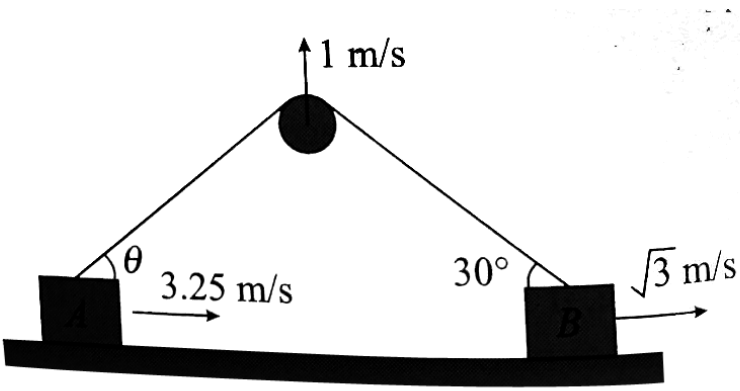
346. 

In the figure shown, find out the value of θ[assume string to be tight]

A. $\frac{\tan^{-1}(3)}{4}$

B. $\frac{\tan^{-1}(4)}{3}$

C. $\frac{\tan^{-1}(3)}{8}$

D. none of these

Answer: A

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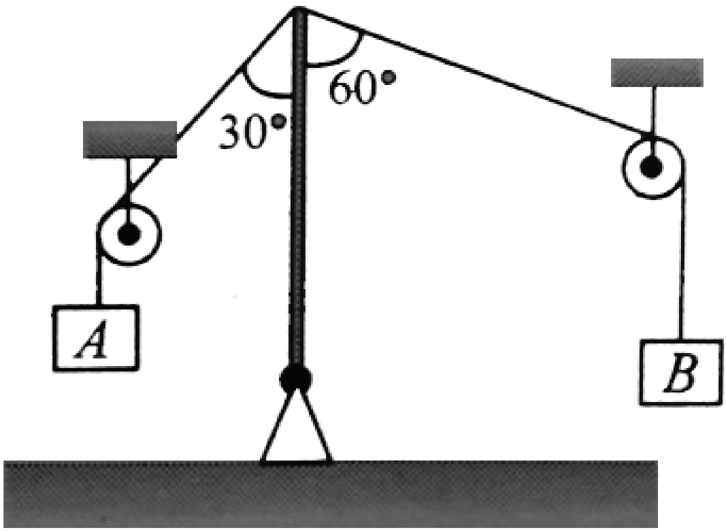


347.

A rod can freely rotate in vertical plane about the hinge at its bottom. Two strings tie the top of the rod with blocks A and B as shown in the figure. At the instant shown,, the rod is vertical and the speed of block A is u$\frac{m}{s}$ downwards. Find the speed of block B.

A. $\sqrt{3}u$

B. u

C. $\frac{u}{2\sqrt{2}}$

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

Answer: A

Watch Video Solution

348.

A lift is moving upwards with a constant speed of $5\frac{m}{s}$. The speed of one of the pulleys is $5\frac{m}{s}$ as shown. Then the speed of second pulley is:

A. $5\frac{m}{s}$

B. zero

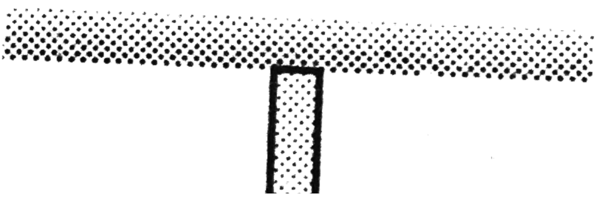
C. $7.5\frac{m}{s}$

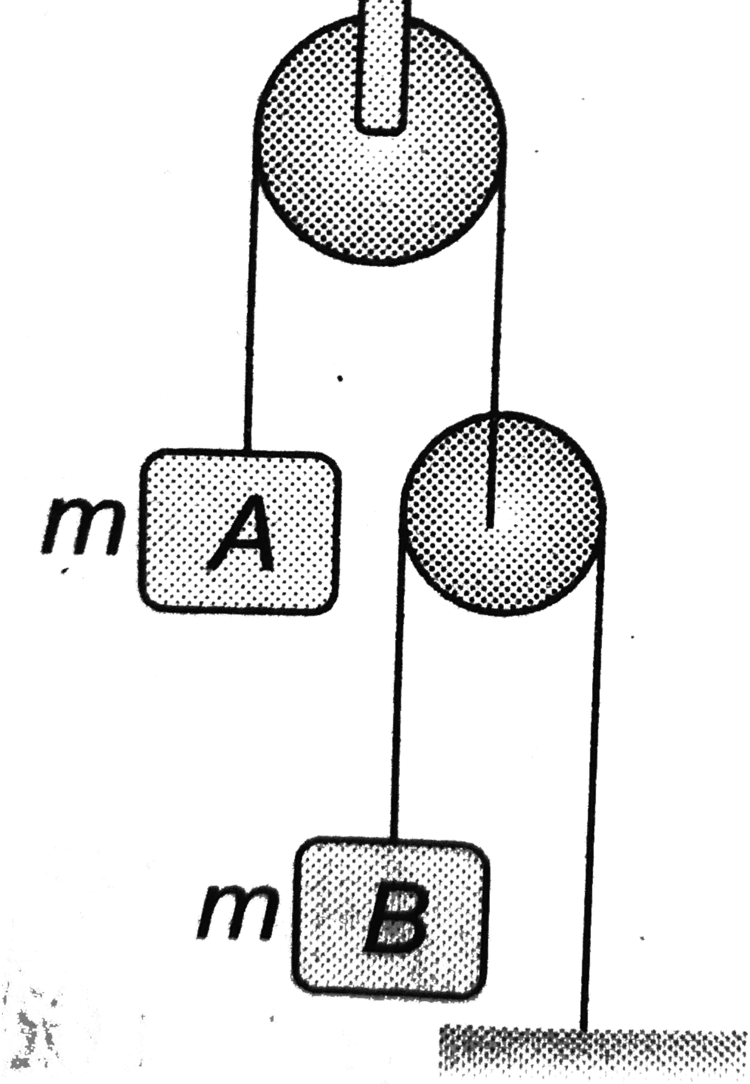
D. $10\frac{m}{s}$

Answer: A

Watch Video Solution

349. In the figure shown neglecting friction and mass of pulley, what is the acceleration of mass B ?





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

B. $\frac{5g}{2}$

C. $\frac{2g}{2}$

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

Answer: D

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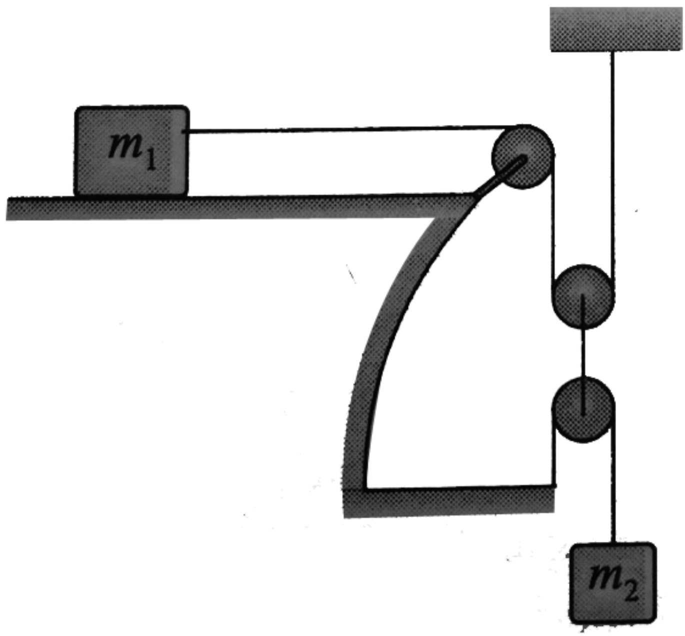

350.

Two blocks of masses m_1 and m_2 are connected as shown in the figure. The acceleration of the block m_2 is :

A. $\frac{m_2 g}{m_1 + m_2}$

B. $\frac{m_1 g}{m_1 + m_2}$

C. $\dfrac{4m_2g - m_1g}{m_1 + m_2}$

D. $\dfrac{m_2g}{m_1 + 4m_2}$

Answer: A

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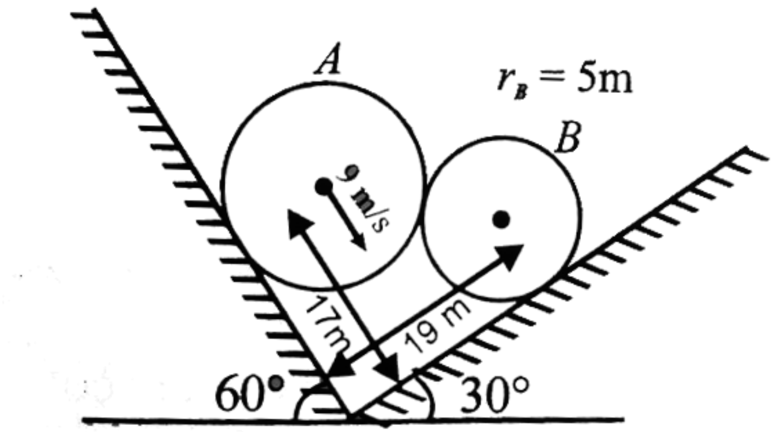
351. 

System is shown in the figure. Velocity of sphere A is 9 $\frac{m}{s}$. Find the speed of sphere B.

A. $9\frac{m}{s}$

B. $12\frac{m}{s}$

C. $9 \times \frac{5}{4}\frac{m}{s}$

D. none of these

Answer: B

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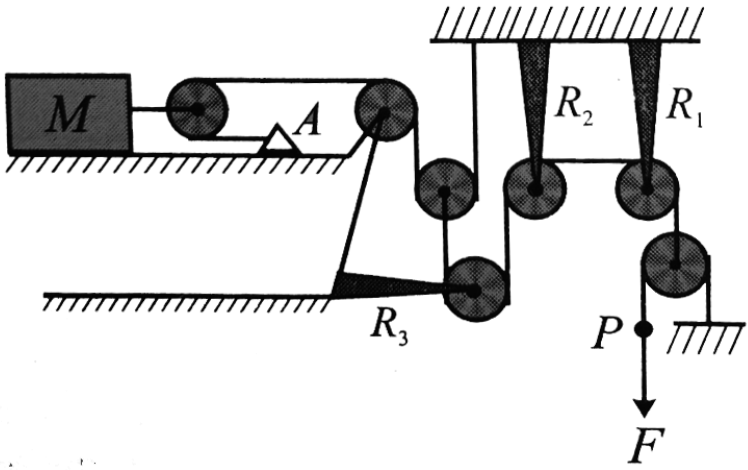

352.

In the given arrangement, mass of the block is M and the surface on which the block is placed is smooth. Assuming all pulleys to be massless and frictionless, strings to be inelastic and light, R_1,R_2 and R_3 to be light supporting rods, then acceleration of point P will be (A is fixed):

A. 0

B. ∞

C. $\frac{4F}{m}$

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

Answer: C

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353. In the above question, find out the magnitude of net force exerted by the pulley on the rod R_1:

A. 2F

B. F

C. $2\sqrt{2}F$

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

Answer: C

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354. A perfectly straight protion of a uniform rope has mass M and length L . At end A of the segment, the tension in the rope is T_A and at end B it is $T_B\left(T_B > T_A\right)$. Neglect effect of gravity and no contact force acts on the rope in between points A and B . The tension in the rope at a distance $L/5$ from end A is.

A. $T_B - T_A$

B. $\dfrac{\left(T_A + T_B\right)}{5}$

C. $\frac{\left(4T_A + T_B\right)}{5}$

D. $\frac{\left(T_A - T_B\right)}{5}$

Answer: C

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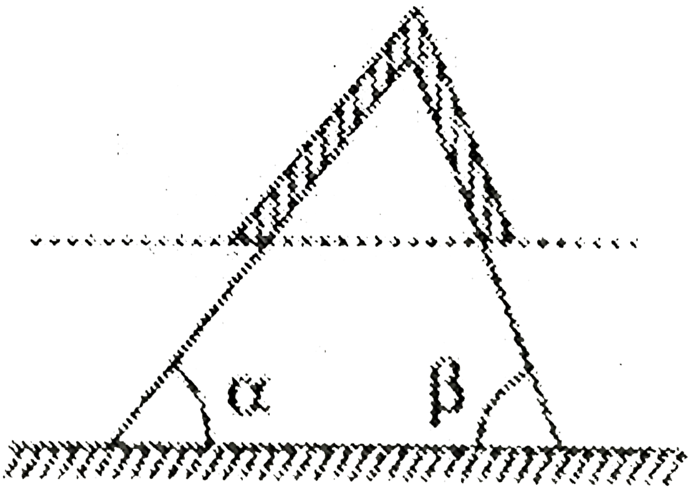
355. A uniform rope of length L and mass M is placed on a smooth fixed wedge as shown. Both ends of the rope are at same horizontal level. The rope is initially released from rest, then the magnitude of initiate acceleration of rope is



A. zero

B. $M(\cos\alpha - \cos\beta)g$

C. $M(\tan\alpha - \tan\beta)g$

D. none of these

Answer: A

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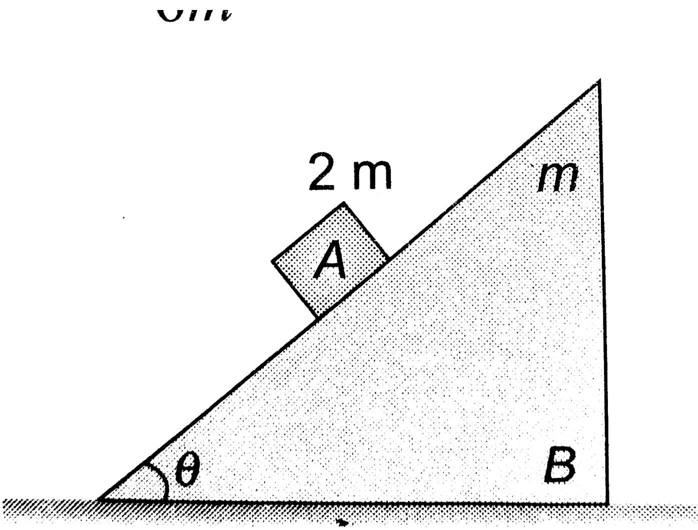
356. In the figure if block A and wedge b will move with same acceleration, then the magnitude of normal reaction between the block and the wedge will be (There is no friction between block and the wedge and the wedge moves on horizontal surface as shown.)



A. $\frac{2mg}{\cos\theta}$

B. $2mg\cos\theta$

C. $mg\cos\theta$

D. none of these

Answer: A

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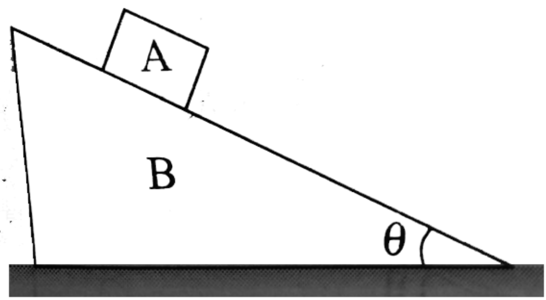

357.

A block is placed on a smooth wedge of inclination angle θ with the horizontal. What minimum acceleration should be given to the wedge in the horizontal direction so that the block starts moving up along the incline?

A. $> g\cot\theta$

B. $> \; > an\theta$

C. $> g\sin\theta$

D. $> g\cos\theta$

Answer: B

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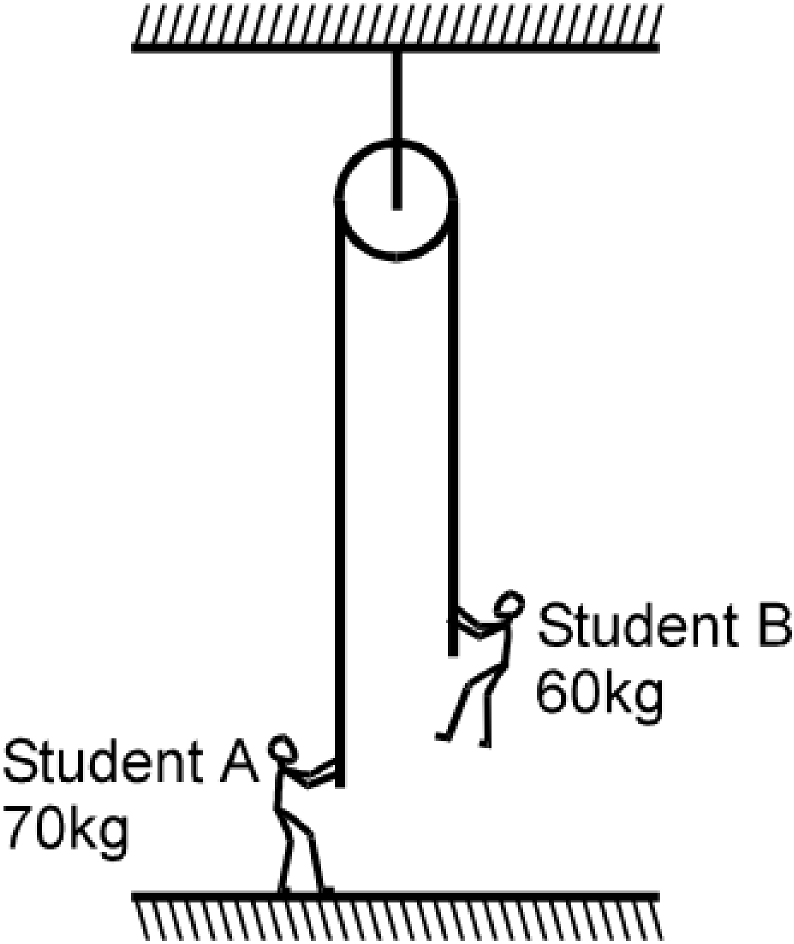
358. A rope of negligible mass passes over a pulley of negligible mass attached to the ceiling, as shown in figure. One end of the rope is held by Student A of mass $70kg$, who is at rest on the floor. The opposite end of the rope is held by Student B of mass $60kg$, who is suspended at rest above the floor. The minimum acceleration a_0 with which the Student B should climb up the rope to lift the Student A upward off the floor.

$\left(g = 10m/s^2\right)$



A. $\frac{1}{3}\frac{m}{s^2}$

B. $\frac{2}{3}\frac{m}{s^2}$

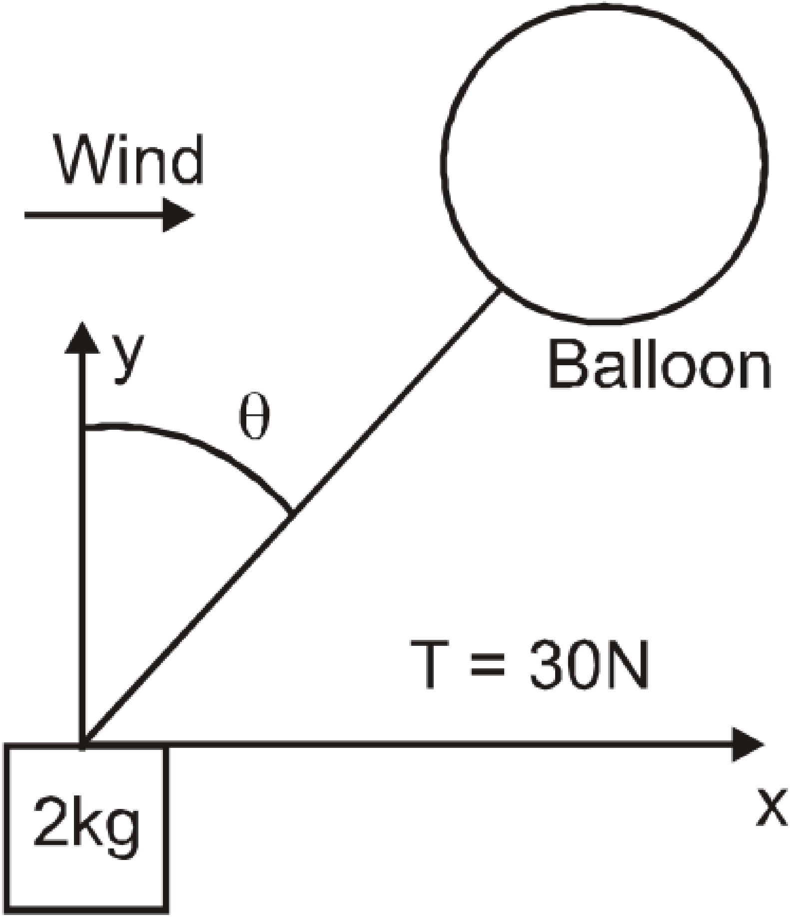
C. $\frac{4}{3}\frac{m}{s^2}$

D. $\frac{5}{3} \frac{m}{s^2}$

Answer: D

Watch Video Solution

359. A balloon is tied to a block. The mass of the block is $2kg$. The tension of the string between the balloon and the block is $30N$. Due to the wind, the string has an angle 0 relative to the vertical direction. $\cos\theta = 4/5$ and $\sin\theta = 3/5$. Assume the acceleration due to gravity is $g = 10m/s^2$. Also assume the block is small so the force on the block from the wind can be ignored. Then the x-component and the y-component of the acceleration a of the block.



A. $9\frac{m}{s^2}, 2\frac{m}{s^2}$

B. $9\frac{m}{s^2}, 12\frac{m}{s^2}$

C. $18\frac{m}{s^2}, 2\frac{m}{s^2}$

D. $18\frac{m}{9}s^2\Big),12\frac{m}{s^2}$

Answer: A

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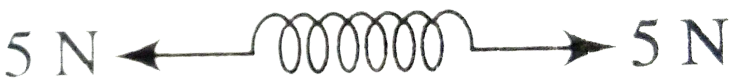
360.



The tension is the spring is

A. zero

B. 2.5 N

C. 5 N

D. 10 N

Answer: C

Watch Video Solution

361. A spring balance and a physical balance are kept in a lift. In these balance equal masses are placed. If now the lift starts moving upward with constant acceleration, then.

A. the reading of spring balance will increase and the equilibrium position of the physical balance will disturb

B. the reading of spring balance will remain unchanged and physical balance will remain in equilibrium

C. the reading of spring balance will decrease and physical balance will remain in equilibrium

D. the reading of spring balance will increase and the phusical balance will remain in equilibrium

Answer: D

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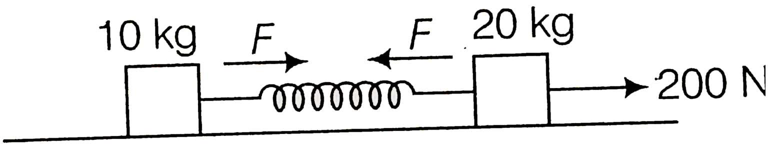
362. Two masses 10 kg and 20kg resplectivley are connected by a massless spring as shown in figure. A force of 200 N acts one the 20 kg mass.At the instant shown is figure the 10 kg mass has acceleration of 12 m/s^2.The vlalue of acceleration of 20 kg mass is



A. $12\frac{m}{\sec^2}$

B. $4\frac{m}{\sec^2}$

C. $10\frac{m}{\sec^2}$

D. zero

Answer: B

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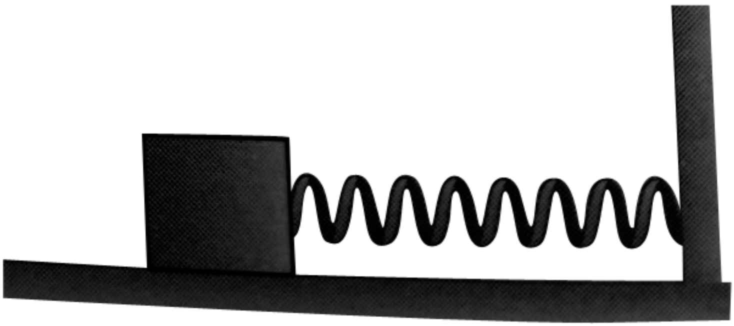
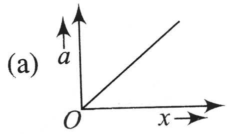
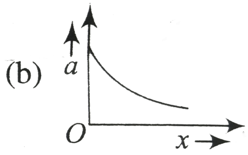
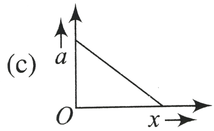


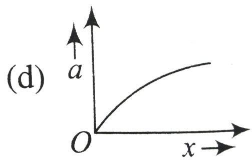
363.

An ideal spring is compressed and placed horizontally between a vertical fixed wall and a block free to slide over a smooth horizontal table to as shown in the figure. The system is released from rest. The graph which represents the relation between the magnitude of acceleration a of the block and the distance x travelled by it (as long as the spring is compressed) is

A. 

B. 

C. 

D. 

Answer: C

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364.

Two blocks of masses m_1 and m_2, which are connected with a light string, are placed over a friction less pulley. This set up is placed over a weighing machine, as shown. Three combination of masses m_1 and m_2 are used, in first case $m_1 = 6kg$ and $m_2 = 2kg$, in second case $m_1 = 5kg$ and $m_2 = 3kg$ and in third case $m_1 = 4kg$ and $m_2 = 4kg$. masses are held stationary initially and then released if the readings of the weighing machine after the release in three cases are W_1,W_2 and W_3 respectively then:

A. $W_1 > W_2 > W_3$

B. $W_1 < W_2 < W_3$

C. $W_1 = W_2 = W_3$

D. $W_1 = W_2 < W_3$

Answer: B

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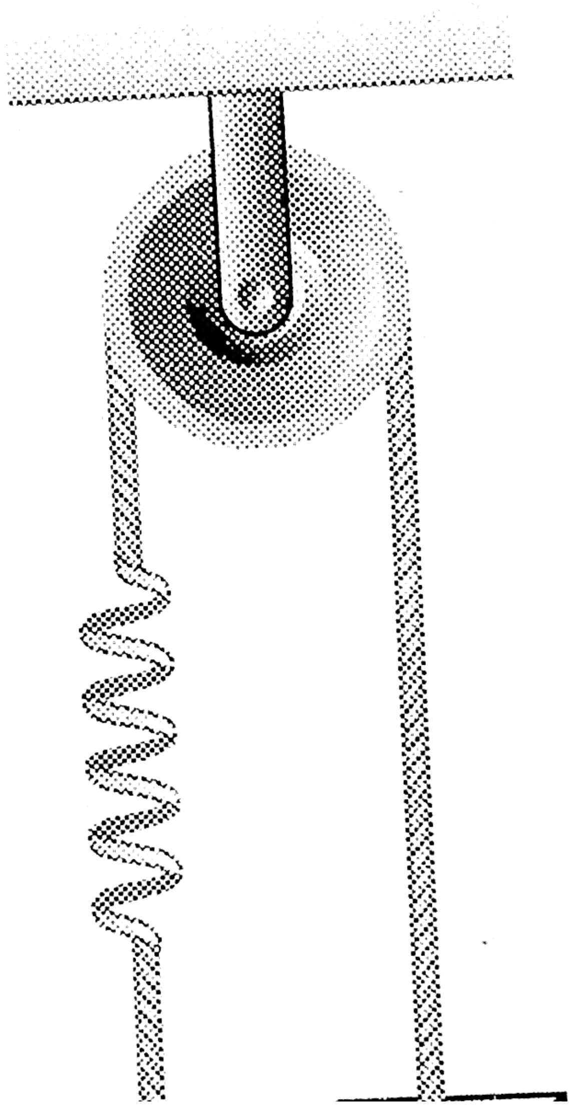
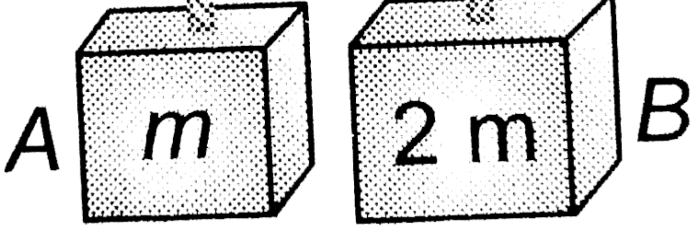
365. A block A of mass m is attached at one end of a light spring and the other end of the spring is connected to another block B of mass $2m$ through a light string as shown in the figure. A is held and B is in static equilibrium. Now A is released. The acceleration of A just after that instant is a . In the next case, B is held and A is in static equilibrium. Now when B is released, its acceleration immediately after the releas

is b . The value of a/b is (pulley, string and the spring

are massless).





A. 0

B. undefined

C. 2

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

Answer: C

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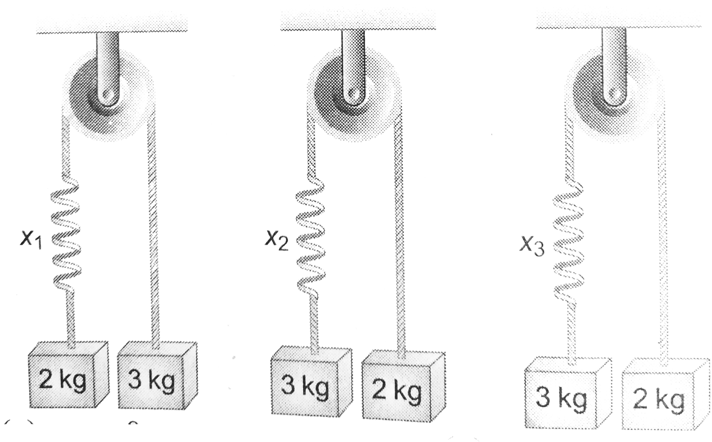
366. Same spring is attached with $2kg$, $3kg$ and $1kg$ blocks in three different cases as shown in figure. If x_1 , x_2 and x_3 be the extensions in the spring in these cases then (Assume all the block s to move with uniform acceleration).



A. $x_1 = 0, x_3 > x_2$

B. $x_2 > x_1 > x_3$

C. $x_3 > x_1 > x_2$

D. $x_1 > x_2 > x_3$

Answer: B

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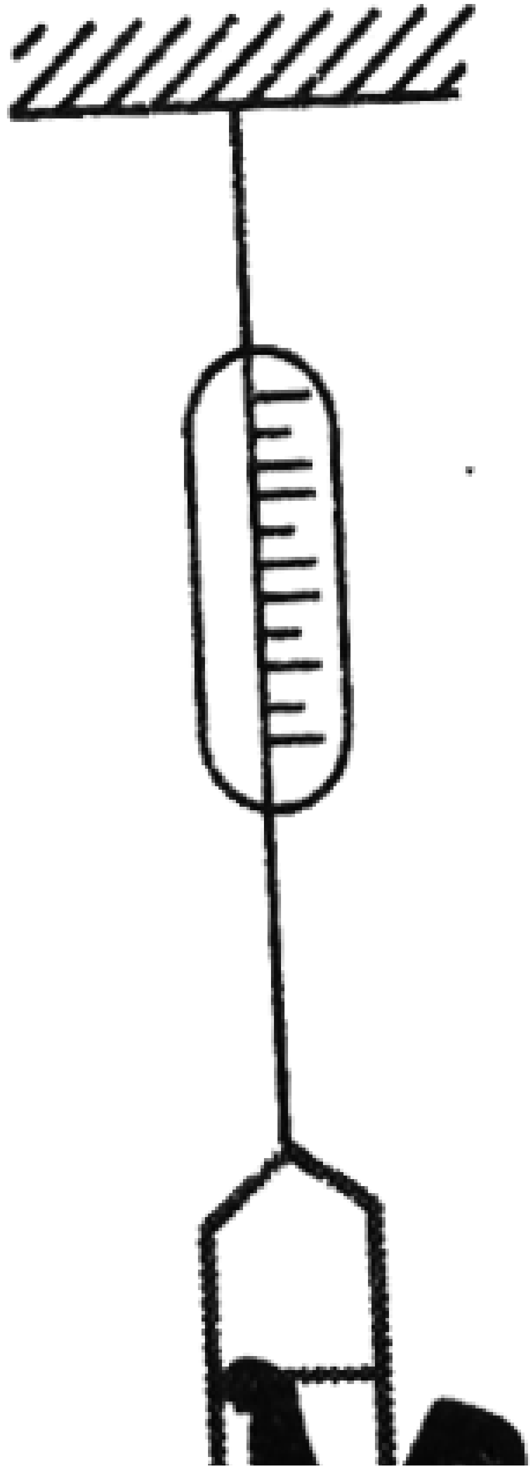

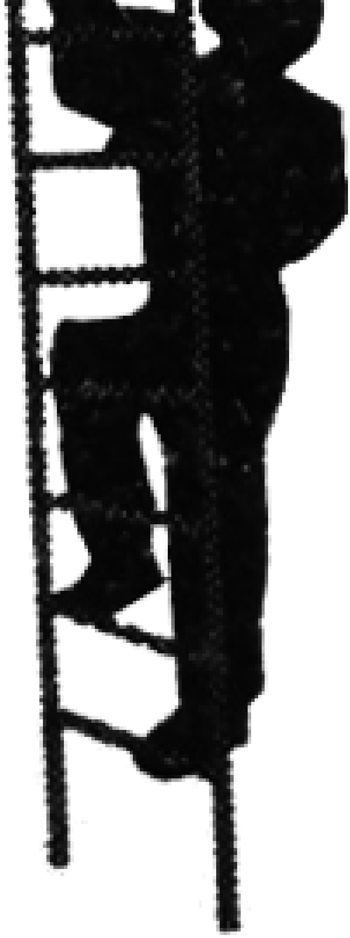

367.

Figure shows a 5 kg ladder hanging from a string that is connected with a ceiling and is having a spring balance connected in between. A boy of mass 25 kg is climbing up the ladder at acceleration $1\frac{m}{s^2}$. Assuming the spring balance and the string to be massless and the spring to show a constant reading, the reading of

thespring balance is: (Take$g = 10\frac{m}{s^2}$)

A. 30 kg

B. 32.5 kg

C. 35 kg

D. 37.5 kg

Answer: B

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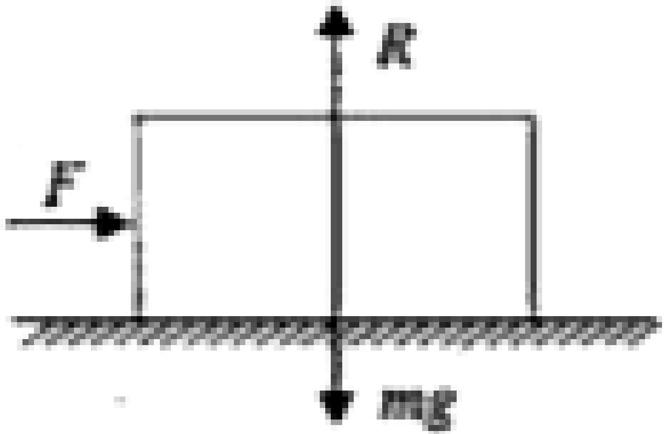
368. A block of mass 2 kg is placed on the floor. The

coefficient of static friction is 0.4. A force F of 2.5 N is applied on the block as shown in Fig. 15.4.4. The force of friction between the block and the floor is $\left(g = 9.8 m/s^2\right)$



A. 2.5 N

B. 5 N

C. 7.84 N

D. 10 N

Answer: A

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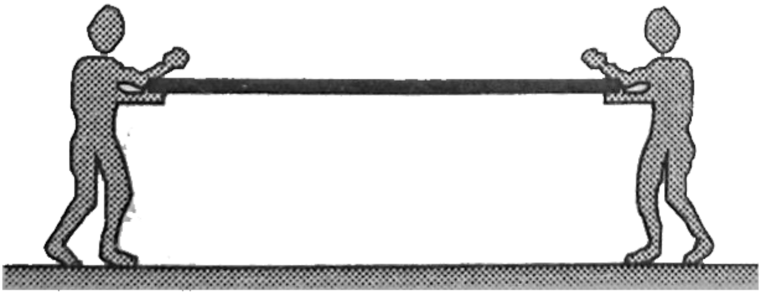
369. 

Two persons pull each other through a massless rope in *tugofwar* game. Who will win?

A. one whose weight is more

B. one who pulls the rope with greater force

C. one who applies more friction force on ground

D. one who applies more normal force on ground

Answer: C

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370. A block A of mass $4kg$ is kept on ground. The coefficient of friction between the block and the ground is 0.8. The external force of magnitude $30N$ is applied parallel to the ground. The resultant force exerted by the ground on the block is $\left(g = 10m/s^2\right)$ a) 40 N b) 30 N c) zero d) 50 N

A. 40 N

B. 30 N

C. 0 N

D. 50 N

Answer: D

Watch Video Solution

371. A block weighs W is held against a vertical wall by applying a horizontal force F. The minimum value of F needed to hold the block is

A. less tha W

B. Equal to W

C. Greater than W

D. Data is insufficient

Answer: C

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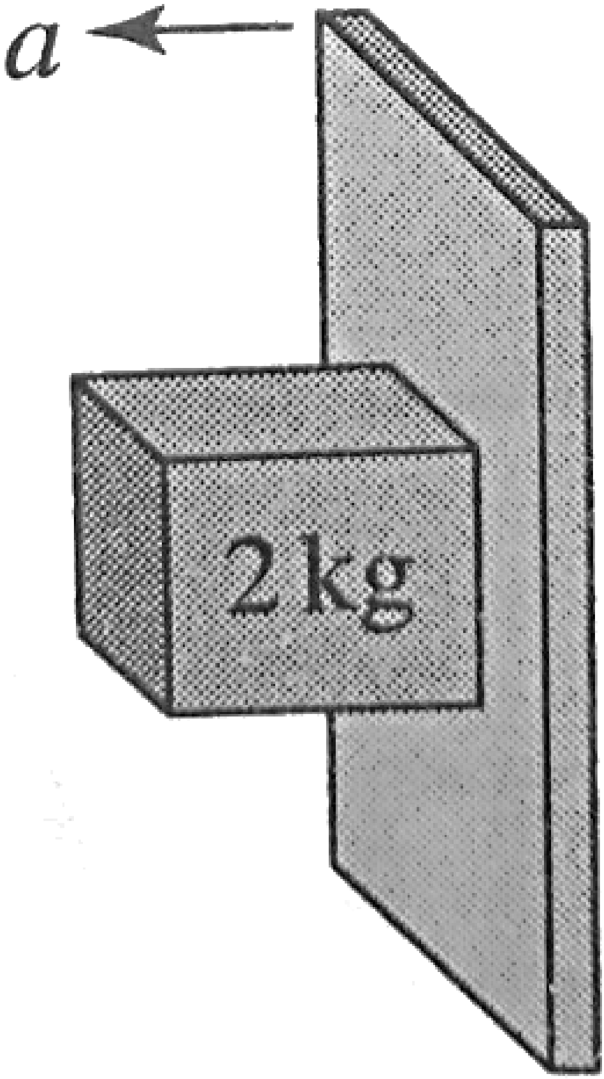

372.

A rough vertical board has an acceleration a so that a 2 kg block pressing against it dows not fall. The coefficient of friction between the block and the board should be

A. $\frac{> g}{a}$

B. $\frac{< g}{a}$

C. $\frac{= g}{a}$

D. $\frac{> a}{g}$

Answer: A

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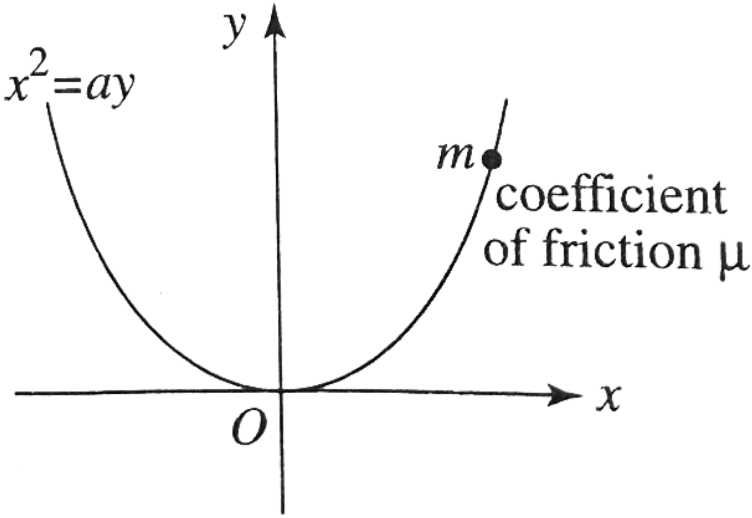

373.

A bead of mass m is located on a parabolic wire with its axis vertical and vertex directed towards downwards as in figure and whose equation is $x^2 = ay$. If the coefficient of friction is μ, the highest distance above the x-axis at which the particle will be in equilibrium is

A. μa

B. $\mu^2 a$

C. $\frac{\mu^2 a}{4}$

D. $2\mu a$

Answer: C

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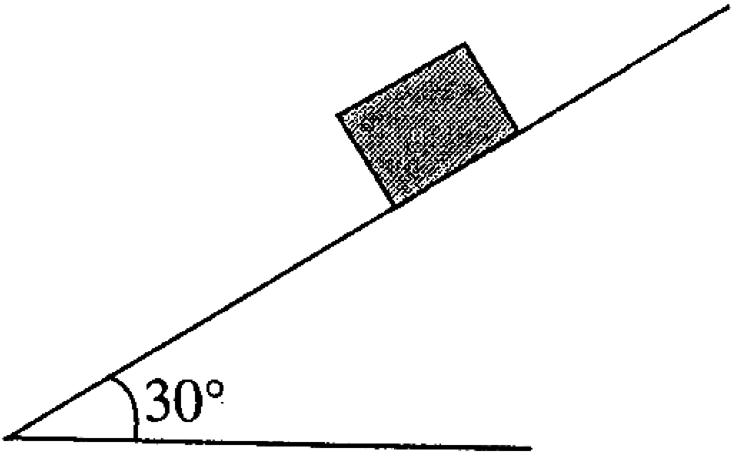
374. 

Figure shows a block kept on a rough inclined plane. The maximum external force down the incline for which the block remains at rest is 1 N while the maximum external force up the incline for which the block is at rest is 7 N. The coefficient of static friction μ is:

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

B. $\frac{1}{\sqrt{6}}$

C. $\sqrt{3}$

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

Answer: D

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375. A block of mass 20 kg is acted upon by a force $F = 30N$ at an angle 53° with horizontal in downward direction as shown. The coefficient of friction between the block and the forizontal surface is 0.2. The friction force acting on the block by the ground is $\left(g = 10\frac{m}{s^2}\right)$

A. 40.0 N

B. 30.0 N

C. 18.0 N

D. 44.8 N

Answer: C

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376. A heavy body of mass $25kg$ is to be dragged along a horizontal plane ($\mu = \frac{1}{\sqrt{3}}$. The least force required is $(1kgf = 9.8N)$

A. 25 kgf

B. 2.5 kgf

C. 12.5 kgf

D. 6.25 kgf

Answer: C

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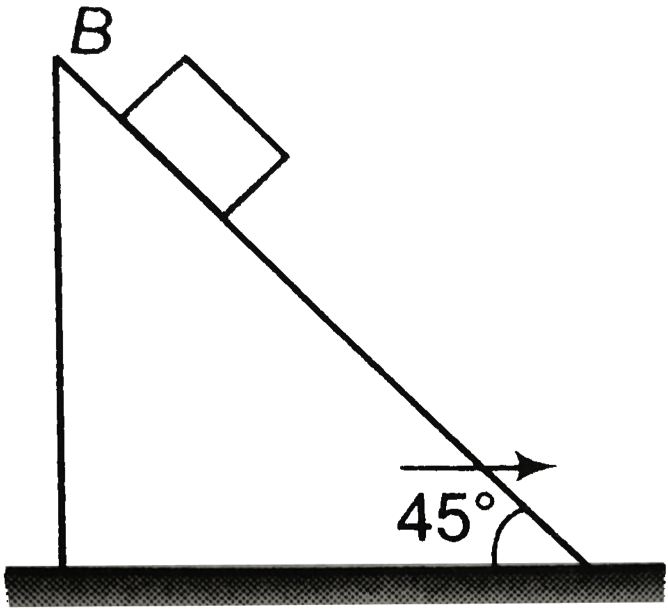
377. If the coefficient of friction between A and B is μ, the maximum acceleration of the wedge A for which B

will remain at rest with respect to the wedge is



A. μg

B. $g\left(\frac{1+\mu}{1-\mu}\right)$

C. $\frac{g}{\mu}$

D. $g\left(\frac{1-\mu}{1+\mu}\right)$

Answer: B::C::D

Watch Video Solution

378. A 60kg is pushed horizontaly with just enough force to start it moving across a floor and the same force continues to act afterwards. The coefficient of static friction and sliding friction are 0.5and 0.4 respectively the accleration of the body is

A. $6\frac{m}{s^2}$

B. $4.9\frac{m}{s^2}$

C. $3.92\frac{m}{s^2}$

D. $1\frac{m}{s^{20}}$

Answer: D

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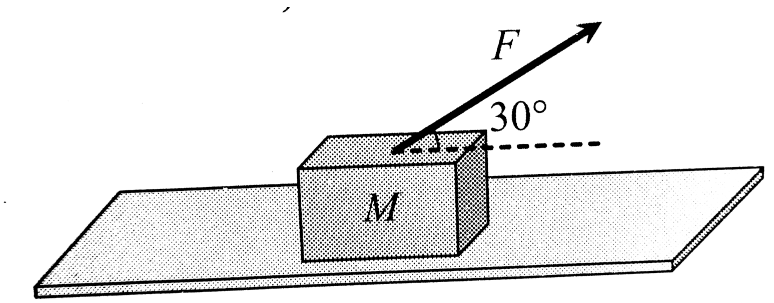
379. A block of mass $m = 5kg$ is resting on a rough horizontal surface for which the coefficient of friction is 0.2 . When a force $F = 40N$ is applied, the acceleration of the block will be $\left(g = 10m/s^2\right)$.



A. $5.73\frac{m}{\sec^2}$

B. $8.0\frac{m}{\sec^2}$

C. $3.17\frac{m}{\sec^2}$

D. $10.0\frac{m}{\sec^2}$

Answer: A

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380. A fireman of mass 60 kg slides down a pole. He is pressing the pole with a force of 600N. The coefficient of friction between the hands and the pole is 0.5, with what acceleration will the fireman slide down $\left(g = 10\frac{m}{s^2}\right)$

A. $1\frac{m}{s^2}$

B. $2.5\frac{m}{s^2}$

C. $10\frac{m}{s^2}$

D. $5\frac{m}{s^2}$

Answer: D

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381. The force required just to move a body up an inclined plane is double the force required just to prevent the body sliding down. If the coefficient of friction is 0.25, what is the angle of inclination of the plane ?

A. $37°$

B. 45°

C. 30°

D. 53°

Answer: A

Watch Video Solution

382. A force of 750 N is applied to a block of mass 102 kg to prevent it from sliding on a plane with an inclination angle 30° with the horizontal. If the coefficients of static friction and kinetic friction between the block and the plane are 0.4 and 0.3

respectively, then the frictional force acting on the block is

A. 750 N

B. 500 N

C. 345 N

D. 250 N

Answer: D

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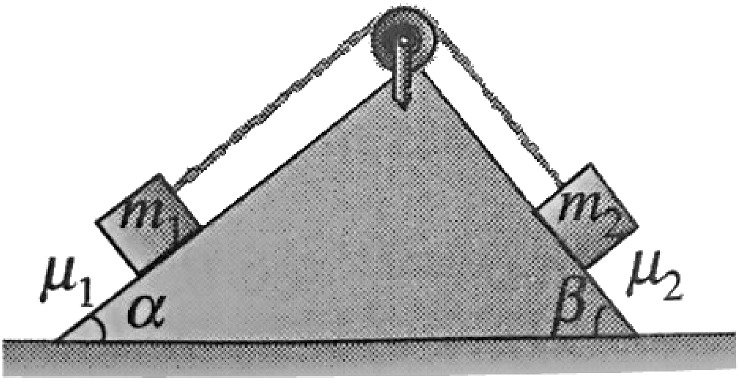
383. 

Two blocks of masses m_1 and m_2 connected by a string are placed gently over a fixed inclined plane, such that the tension in the connecting string is initially zero. The coefficient of friction between $m1$ and inclined plane is μ_1, between $m2$ and the inclined plane is μ_2. The tension in the string shall continue to remain zero if

A. $\mu_1 > \tan\alpha$ and $\mu_2 \tan\beta$

B. $\mu_1 < \tan\alpha$ and $\mu_2 > \tan\beta$

C. $\mu_1 > \tan\alpha$ and $\mu_2 \tan\beta$

D. $\mu_2 > \tan\alpha$ and $\mu_2 > \tan\beta$

Answer: C

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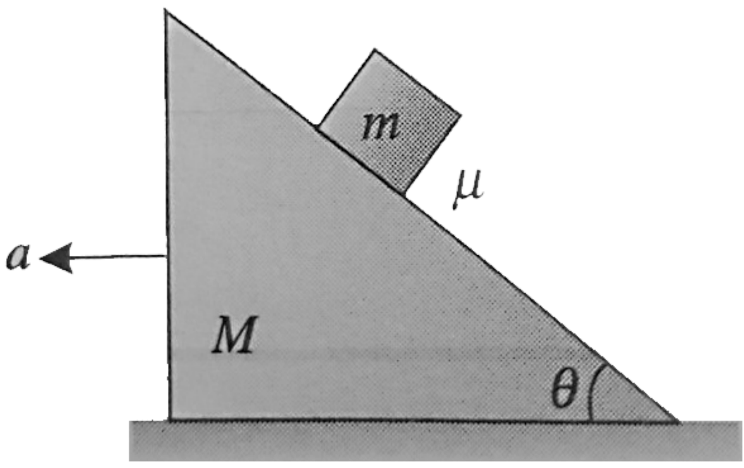

384.

A block of mass m is at rest relative to the stationary wedge of mass M. The coefficient of friction between block and wedge is μ. The wedge is now pulled horizontally with acceleration a as shown in figure. Then the minimum magnitude of a for the friction between block and wedge to be zero is:

A. $g\tan\theta$

B. $\mu g\tan\theta$

C. $g\cot\theta$

D. $\mu g\cot\theta$

Answer: C

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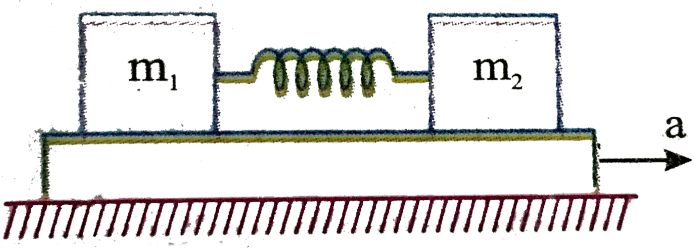
385. Two block of masses $m1$ and $m2$ are connected with a massless unstretched spring and placed over a plank moving with an acceleration $'a'$ as shown in figure. The coefficient of friction between the blocks and platform is μ



A. spring will be stretched if $a > \mu g$

B. spring will be compressed if $a \leq \mu g$

C. spring will neither be compressed nor be stertched for $a \leq \mu g$

D. spring will be in its natural length under all conditions

Answer: D

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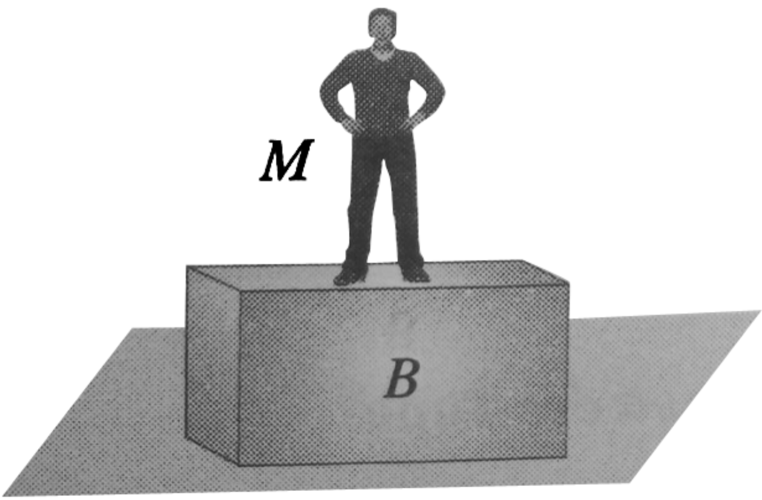
386. 

As shown in the figure, M is a man of mass 60 kg standing on a block of mass 40 kg kept on ground. The co-efficient of friction between the feet of the man and the block is 0.3 and that between B and the ground is 0.1. If the man accelerates with an acceleration $2\frac{m}{s^2}$ in the forward direction, then,

A. it is not possible

B. B will move backwards with an acceleration $0.5\frac{m}{s^2}$

C. B will not move

D. B will move forward with an acceleration $0.5\frac{m}{s^2}$.

Answer: B

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387. The coefficient of friction between the block and the horizontal surface is μ. The block moves toward right under action of horizontal force F (figure-a). Sometime later another force P is applied to the block making an angle theta (such that $\tan\theta=\mu$) with vertical as shown in (figure-b). After application of force P , the acceleration of block shall.

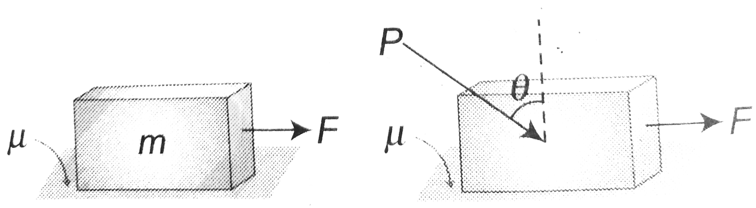

Figure-a Figure-b

A. increase

B. decrease

C. remain same

D. information insufficient to draw inference

Answer: C

Watch Video Solution

388.

In the figure shown if friction co-efficient of block 1 and 2 with inclined plane is $\mu_1 = 0.5$ and $\mu_2 = 0.4$ respectively, then find out the correct statement.

A. both block will move together

B. both block will move separately

C. there is a non-zero contact force between two blocks

D. none of these

Answer: B

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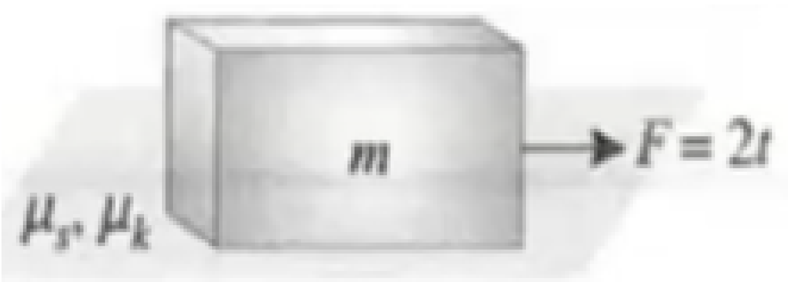
389. 

A force $F = 2t$ is spplied at $t = 0$ sec to the block of mass m placed on a rough horizontal surface. The coefficient of static and kinetic friction between the block and surface are μ_S and μ_k rspectively. Which of the following graphs best represents the acceleration vs time of the block$\left(\mu_S > \mu_k\right)$?

A.

B.

C.

D.

Answer: D

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390.

A block A (5kg) rests over another block B (3kg) placed over a smooth horizontal surface. There is friction between A and B. A horizontal force F_1 gradually increasing from zero to a maximum is supplied to A so that the blocks move together without relative motion. Instead of this another horizontal force F_2, gradually increasing from zero to a maximum is supplied to B so that the blocks move together without relative motion. Then

A. $F_1(\max) = \; = f_2(\max)$

B. $F_1(\max) > F_2(\max)$

C. $F_1(\max) < F_2(\max)$

D. $F_1(\max):F_2(\max) = 5:3$

Answer: B::D

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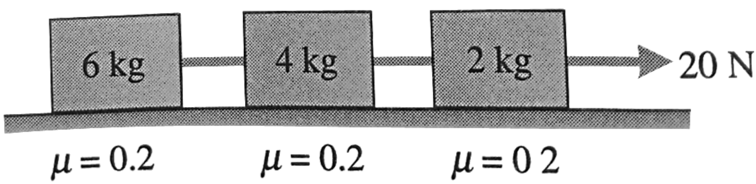
391. 

Three blocks of masses 6 kg, 4 kg and 2 kg are pulled on a rough surface by applying a constant force 20 N. The values of coefficient of friction between blocks and suface are shown in figure.

Q. In the arrangement shoen tension in the string connecting 4 kg and 6 kg masses is

A. 8N

B. 12N

C. 6N

D. 4N

Answer: A

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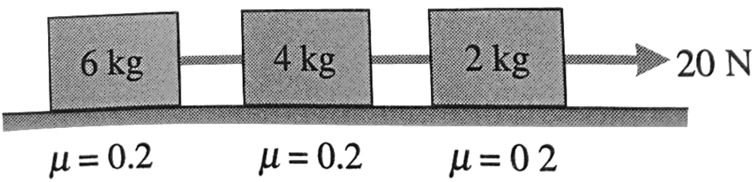

392.

Three blocks of masses 6 kg, 4 kg and 2 kg are pulled on a rough surface by applying a constant force 20 N.

The values of coefficient of friction between blocks and suface are shown in figure.

Q. Friction force on 4 kg block is

A. 4N

B. 6N

C. 12N

D. 8N

Answer: D

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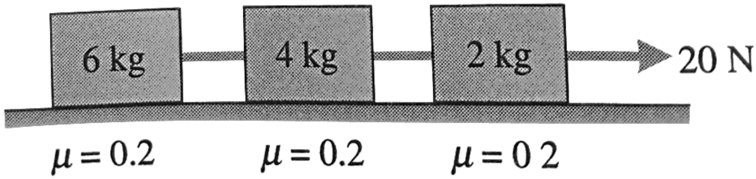
393. 

Three blocks of masses 6 kg, 4 kg and 2 kg are pulled on a rough surface by applying a constant force 20 N. The values of coefficient of friction between blocks and suface are shown in figure.

Q. Friction force on 6 kg block is

A. 12N

B. 8N

C. 6N

D. 4N

Answer: B

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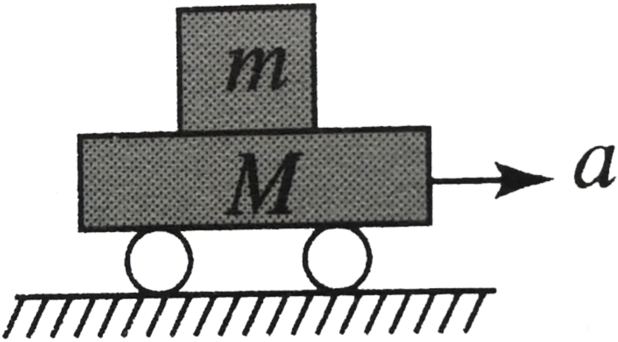
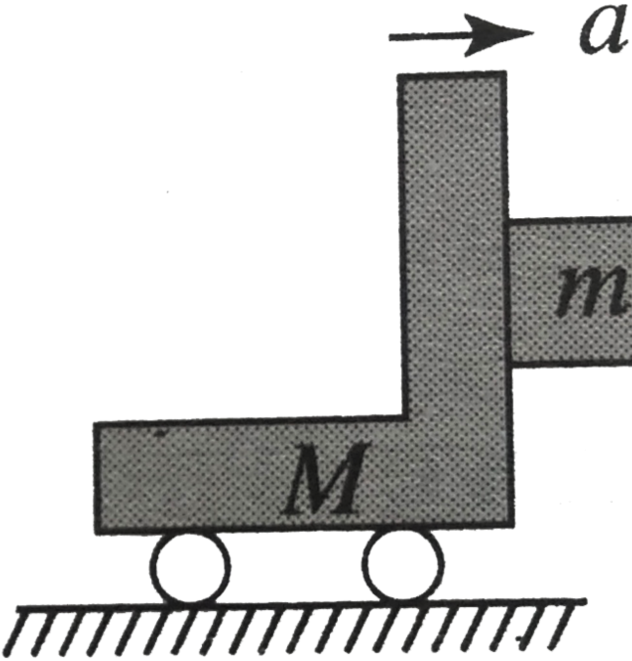
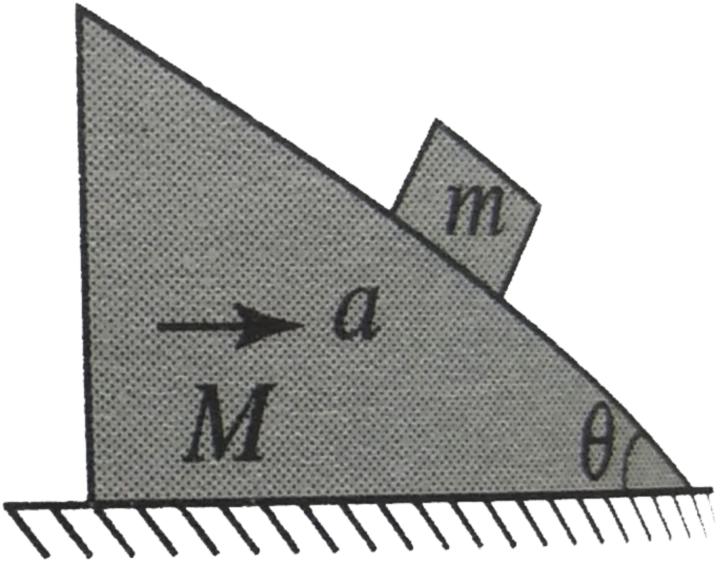


(a)

394.



(b)



(c)

In the situation given in figures (a) (b) and (c) the block of mass m does not slide relative to the accelerating frame. If μ_S = coefficient of static friction between the block and accelerating frame, in each case, find the range of accelerations.

Q. In case (a)

A. $a \leq \mu_s g$

B. $a \leq \dfrac{g}{\mu_S 0}$

C. $a \leq \dfrac{gm}{\mu_S M}$

D. $a \leq \dfrac{gM}{\mu_S m}$

Answer: A

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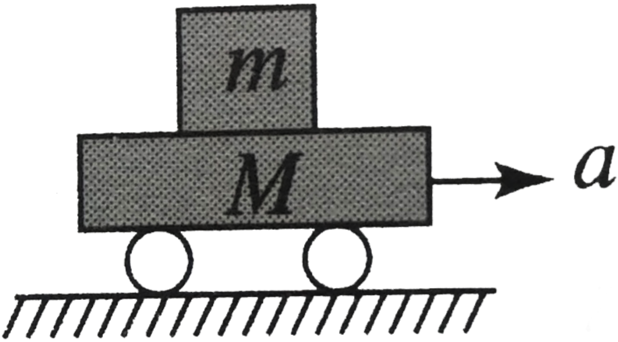
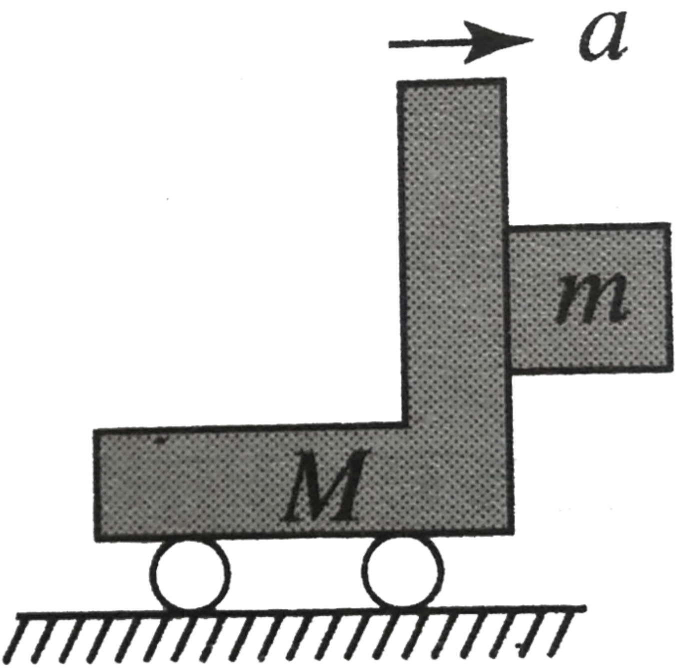
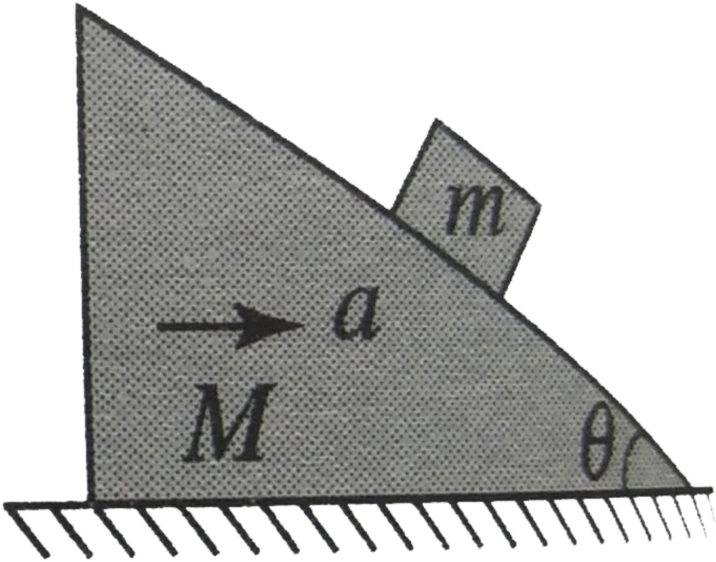


(a)

395.



(b)



(c)

In the situation given in figures (a) (b) and (c) the block of mass m does not slide relative to the accelerating frame. If μ_S = coefficient of static friction between the block and accelerating frame, in each case, find the range of accelerations.

Q. In case (a)

A. $a \leq \mu_S g$

B. $a \geq \dfrac{g}{\mu_S}$

C. $a \leq \dfrac{gm}{\mu_S M}$

D. $a \leq \dfrac{gM}{\mu_S m}$

Answer: B

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396.

In the situation given in figures (a) (b) and (c) the block of mass m does not slide relative to the accelerating frame. If $\mu_S =$ coefficient of static friction between the block and accelerating frame, in each case, find the range of accelerations.

Q. in case (c)

A. $a \leq g\left(\frac{\sin\theta - \mu\cos\theta}{\cos\theta + \mu\sin\theta}\right)$

B. $a \leq g\left(\frac{\cos\theta + \mu\sin\theta}{\sin\theta - \mu\cos\theta}\right)$

C. $a \leq g\left(\frac{\cos\theta - \mu\sin\theta}{\sin\theta + \mu\cos\theta}\right)$

D. $a \leq g\left(\frac{\sin\theta + \mu\cos\theta}{\cos\theta - \mu\sin\theta}\right)$

Answer: D

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397.

A boy of mass 50 kg produces an acceleration of $2\frac{m}{s^2}$ in a block of mass 20 kg by pushing it in horizontal direction. The boy moves with the block such that boy and the block have same acceleration. There is no friction between the block and fixed horizontal surface but there is friction between foot of the boy and horizontal surface. Find friction force (in Newton) exerted by the horizontal surface on the boy.

A. 120

B. 140

C. 160

D. 200

Answer: B

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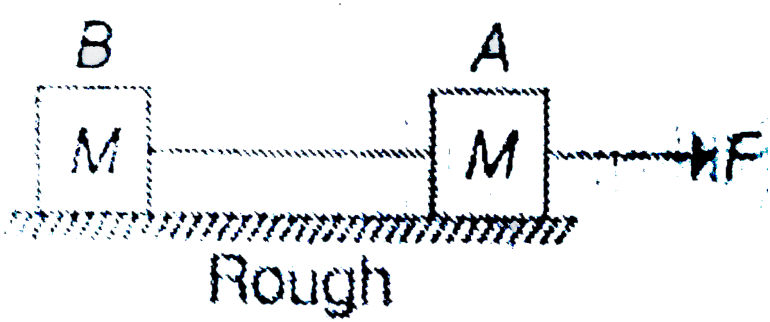
398. A force F=t is applied to block A as shown in figure. The force is applied at t=0 seconds when the system was at rest and string is just straight without tension. Which of the following graphs gives the friction force between B and horizontal surface as a function of time 't'.



A.

B.

C.

D.

Answer: C

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399.

With reference to the figure shown, if the fcoefficient of friction at the surfaces is 0.42, then the force required to pull out the 6.0 kg block with an acceleration of $1.50\frac{m}{s^2}$ will be:

A. 36N

B. 24N

C. 84N

D. 51N

Answer: D

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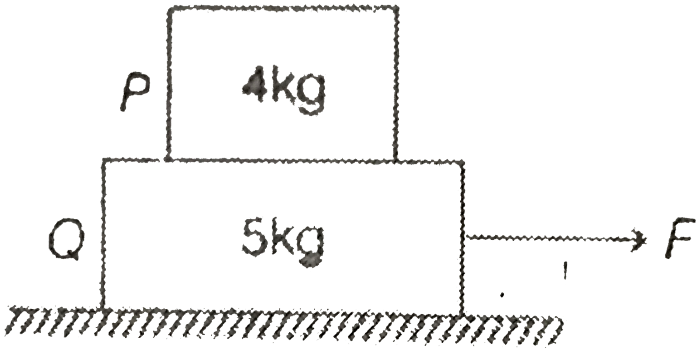
400. The coefficient of friction between 4 kg and 5kg blocks is 0.2 and between 5kg block and grond is 0.1 respectively Choose the correct statements.



A. minimum force needed to cause system to move

is 17 N

B. Whebn force is 4N static friction at all surfaces is

4 N to keep system at rest

C. Maximum acceleration of 4 kg block is $2\frac{m}{s^2}$

D. Slipping between 4 kg and 5 kg blocks start when F is 17 N

Answer: C

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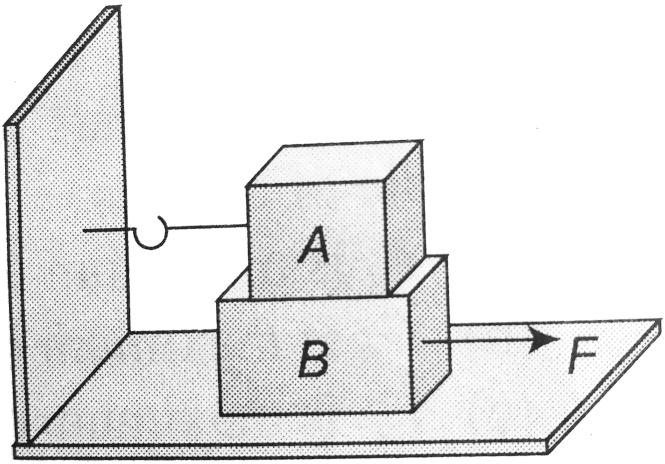
401. A block A with mass 100kg is resting on another block B of mass 200kg. As shown in figure a horizontal rope tied to a wall hold it. The coefficient of friction between A and B is 0.2 while coefficient of friction between B and the ground is 0.3 . the minimum required force F to start moving B will be.



A. 900N

B. 100N

C. 1100N

D. 1200N

Answer: C

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402. A body B lies on a smooth horizontal table and another body A is placed on B. The coefficient of friction between A and B is μ. What acceleration given to B will cause slipping to occur between A and B

A. μg

B. $\frac{g}{\mu}$

C. $\frac{\mu}{g}$

D. $\sqrt{\mu g}$

Answer: A

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403. A 40kg slab rest on a frictionless floor as shown in . A 10kg blocks rests on the top of the slab. The static coefficient of friction between the block and the slab is 0.60, while kinetic friction is 0.40. The 10kg block is acted upon by a horizontal force of 100N. What is the resulting acceleration of the slab ?

A. $1\frac{m}{s^2}$

B. $1.5\frac{m}{s^2}$

C. $2\frac{m}{s^2}$

D. $6\frac{m}{s^2}$

Answer: A

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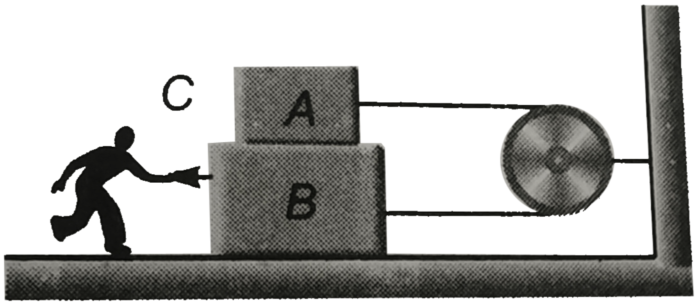
404. In the figure $m_A = m_B = m_C = 60kg$. The coefficient of friction between C and ground is $0.5B$ and ground is 0.3, A and B is 0.4. C is pulling the string with the maximum possible force without moving. Then the tension in the string connected to A will be



A. 120N

B. 60N

C. 100N

D. zero

Answer: D

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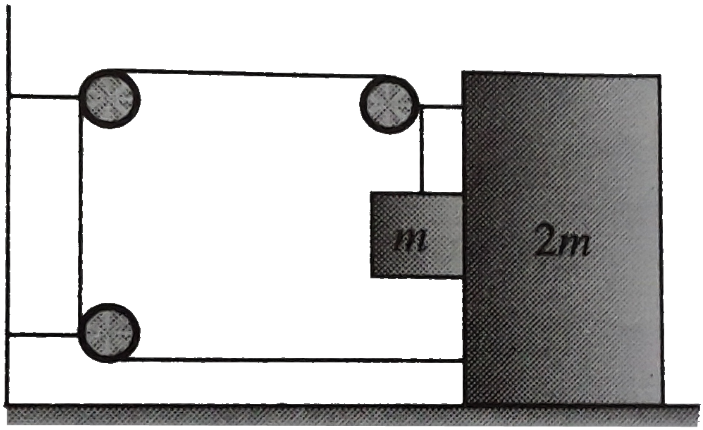
405. In the system shown in Fig the friction coefficient between ground and bigger block is μ There is no friction between both the block .The string connecting both the block is light all three pulley are light and frictionless Then the minimum limiting value of μ so that the system remain in equilibrium , is



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

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

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

D. $\frac{3}{2}$

Answer: C

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406.

Block B of mass 2 kg rests on block A of mass 10 kg. All surfaces are rough with the value of coefficient of friction as shown in the figure. Find the minimum force F that should ber appplied on blocks A to cause relative motion between A and B. $\left(g = 10\frac{m}{s^2}\right)$

A. 24 N

B. 30 N

C. 48 N

D. 60 N

Answer: C

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407.

Two blocks A and B are shown in figure. The minimum horizontal force F applied on Blocks B for which slipping begins at B and ground is

A. 100 N

B. 120 N

C. 50 N

D. 140 N

Answer: A

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408.

In given diagram what is the minimum value of a horizontal external force F on block A so that block B will slide on ground is .

A. 30 N

B. 20 N

C. 10 N

D. not possible

Answer: D

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409. In the previous quiestion the minimum force F required so that block A will slip on block B is:

A. 30 N

B. 20 N

C. 10 N

D. not possible

Answer: B

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410.

Two blocks A (1 kg) and B (2 kg) are connected by a string passing over a smooth pulley as shown in the figure. B rests on rough horizontal surface and A rest on B. The coefficient of friction between A and B is the same as that between B and the horizontal surface. The minimum horizontal force F required to move A to the left is 25 N. The coefficient of friction is:

A. 0.67

B. 0.5

C. 0.4

D. 0.25

Answer: B

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411. In which of the following cases the friction force between A and B is maximum in all cases $\mu_1 = 0.5$, $\mu_2 = 0$.

A.

B.

C.

D.

Answer: D

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412.

In the situation shown in figure a wedge of mass m is placed on a rough surface, on which a block of equal mass is placed on the inclined plane of wedge.Friction coefficient between plane and the block and the ground and the wedge (μ). An external force F is applied horizontally on the wedge. Given the m does not slide on incline due to its weight. The value of F at which wedge will start slipping is:

A. $= \mu mg$

B. $= \left(\frac{3}{2}\right)\mu mg$

C. $> 2\mu mg$

D. $< \mu mg$

Answer: C

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413. The value of F at which no friction will act on block on inclined plane , is :

A. $2\mu mg$

B. $2\mu mg + 2m > an\theta$

C. $2\mu mg + m > an\theta$

D. $2\mu mg + mg\sin\theta$

Answer: B

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414. The minimum value of acceleration of wedge for which the block start sliding on the wedge, is:

A. $g\left(\dfrac{\cos\theta + \mu\sin\theta}{\sin\theta - \mu\cos\theta}\right)$

B. $g\left(\dfrac{\sin\theta + \mu\cos\theta}{\cos\theta - \mu\sin\theta}\right)$

C. $g\left(\dfrac{\sin\theta - \mu\cos\theta}{\sin\theta + \mu\cos\theta}\right)$

D. $g\left(\frac{\cos\theta - \mu\sin\theta}{\sin\theta + \mu\cos\theta}\right)$

Answer: B

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415.

All the blocks shoen in the figure are at rest.The pulley is smooth and the strings are light. Coefficient of friction at all the contacts in 0.2 A frictional force of 10 N acts between A and B. The blocks A is about to slide on block B. The normal reaction and frictinal force exerted by the ground on the blocks B is.

A. The normal reaction exerted by the ground on the block B is 110 N

B. The normal reaction exerted by the ground on the block B is 50 N

C. The frictional force exerted by the ground on the block B is 20 N

D. The frictional force exerted by the ground on the block B is zero

Answer: A::D

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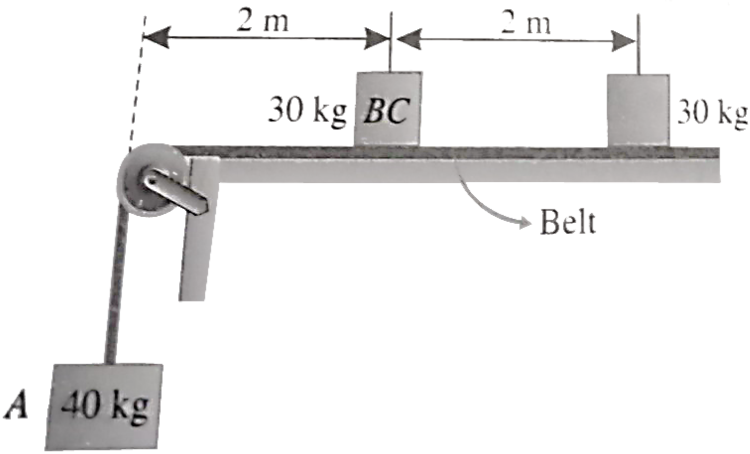

416.

Two 30 kg blocks rest on a massless belt which passes over a fixed pulley and is attached to a 40 kg block. If coefficient of friction between the belt and the table as well as between the belt and the blocks B and C is μ and the system is released from rest from the position shown, the speed with which the block B falls off the belt is

A. $2\sqrt{2}\frac{m}{s}$ if $\mu = 0.2$

B. $\sqrt{2}\frac{m}{s}$ if $\mu = 0.2$

C. $2\frac{m}{s}$ if $\mu = 0.5$

D. $2.5\frac{m}{s}$ if $\mu = 0.5$

Answer: A::C

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417. 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 fluctuates

D.

Answer: A

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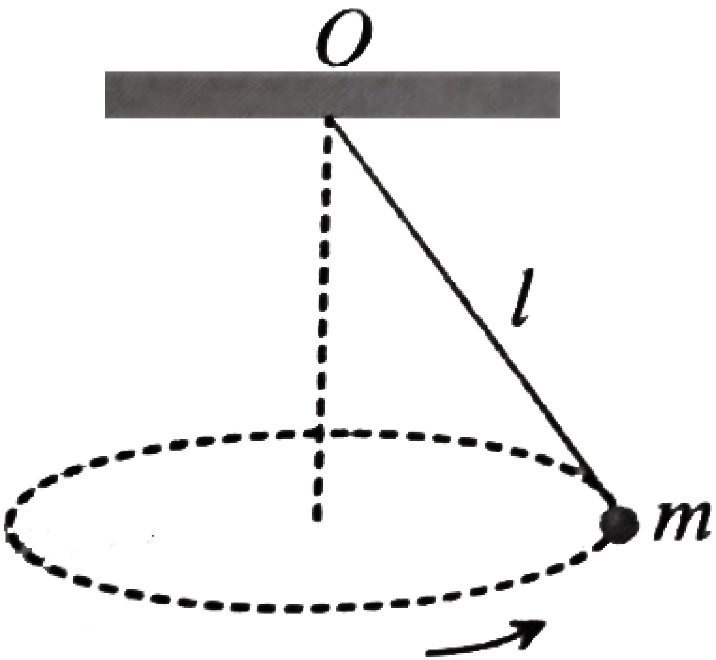
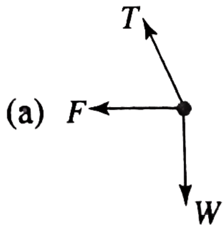
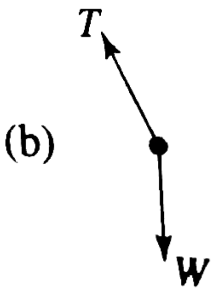
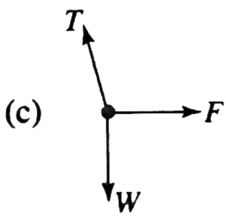


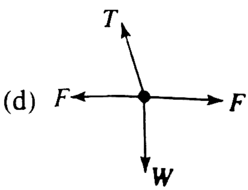
418.

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

A. 

B. 

C. 

D. 

Answer: C

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419. A particle describes a horizontal circle in a conical funne whoses inner surface is smooth with speed of $0.5m/s$. What is the height of the plane of circle from vertex the funnel?

A. 0.25 cm

B. 2 cm

C. 4 cm

D. 2.5 cm

Answer: D

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

A. $T_1 = T_2$

B. $T_2 > T_1$

C. $T_1 > T_2$

D. Tension in the string always remains the same

Answer: C

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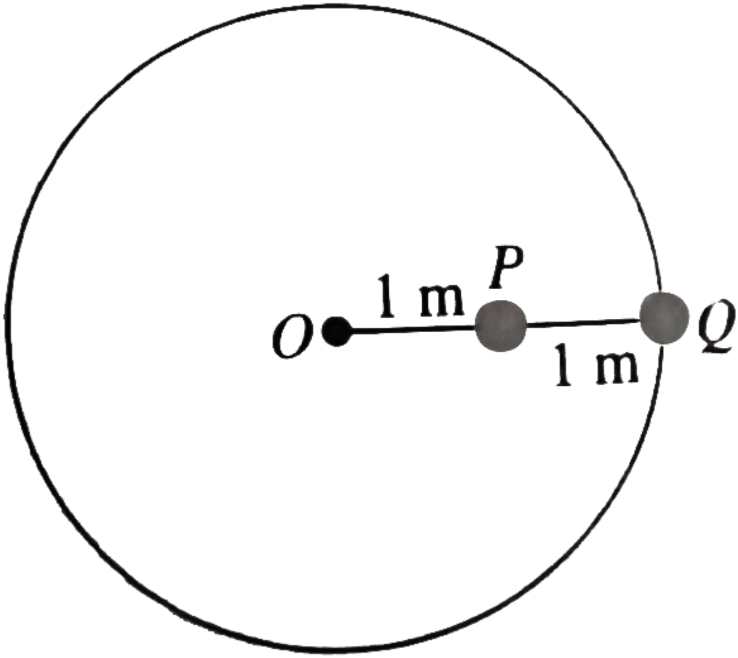
421. 

Two spheres of equal masses are attached to a string of length 2 m as shown in figure. The string and the spheres are then whirled in a horizontal circle about O at a constant rate. What is the value of the ratio of their tension:

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

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

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

D. 2

Answer: B

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

A. $10\frac{m}{s}$

B. $7\frac{m}{s}$

C. $15\frac{m}{s}$

D. $5\frac{m}{s}$

Answer: A

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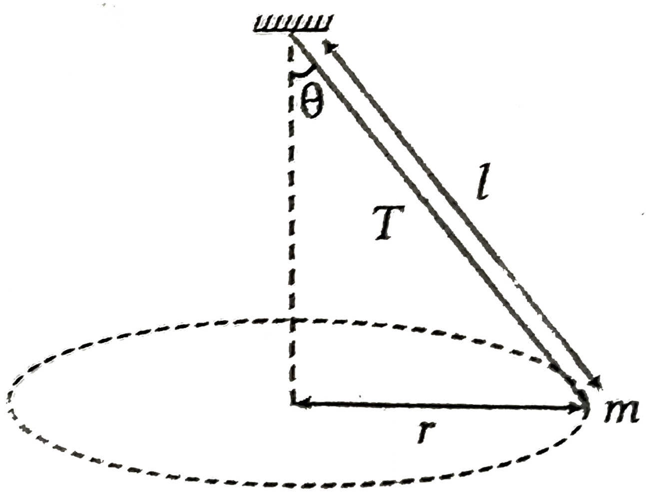
423. A string of lenth l fixed at one end carries a mass m at the other end. The strings makes $\frac{2}{\pi}revs^{-1}$ around the axis through the fixed end as shown in the figure, the tension in the string is



A. ML

B. 2 ML

C. 4 ML

D. 16 ML

Answer: D

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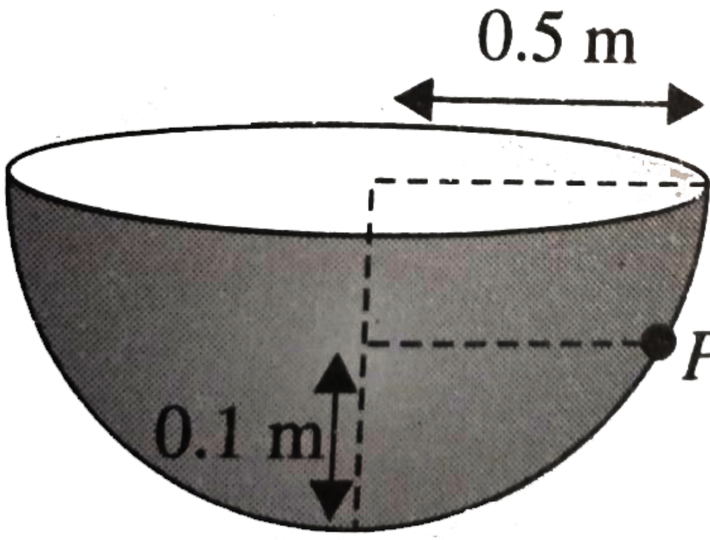


424.

A small mass of 10 g lies in a hemispherical bowl of radius 0.5 m at a height of 0.1 m from the bottom of the bowl. The mass will be in equilibrius if the bowl rotates at an

A. $\frac{10}{\sqrt{3}}\frac{rad}{s}$

B. $10\sqrt{3}\frac{rad}{s}$

C. $5\frac{rad}{s}$

D. none of these

Answer: C

Watch Video Solution

425. 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. The net acceleration of the car is towards the centre of its path.

B. The magnitude of the frictional force on the car is greater than $\frac{Mv^2}{R}$.

C. The friction coefficient between the ground and the car in not less than $\frac{\beta}{g}$.

D. The friction coefficient between the ground and the car is not less than $\frac{v^2}{Rg}$.

Answer: B::C::D

Watch Video Solution

426. A body is revoving with a constant speed along a circle. If its direction of motion is reversed but the speed remains the same, then which of the following statement is true

A. the cetripetal force will not surffer any change in magnitude

B. the centripetal force will have its direction reversed

C. the centripetal force will not suffer any change in direction

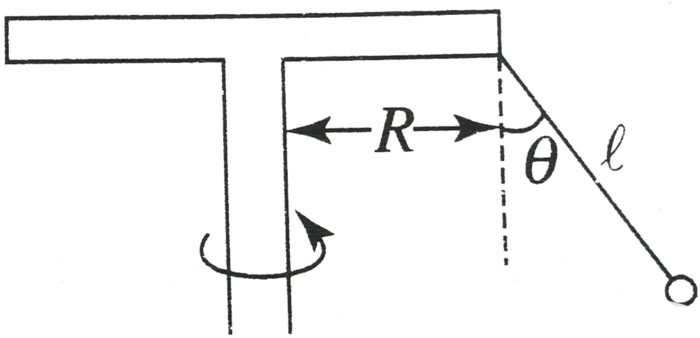
D. the centripetal force would be doubled

Answer: A::C

Watch Video Solution

427. A pendulum bob of mass m hangs from one end of a horizontal rod which is rotating about vertical axis with an unknown angular speed ω such that the light inextensible string of length l of the pedulum makes a constant angle θ with vertical. Find the

Q. angular speed ω



A. $\omega = \sqrt{\dfrac{g(\tan\theta)}{R + l\sin\theta}}$

B. $\omega = \sqrt{\dfrac{g(\tan\theta)}{R + l(\tan\theta)}}$

C. $\omega = \sqrt{\dfrac{g\cot\theta}{R + l\sin\theta}}$

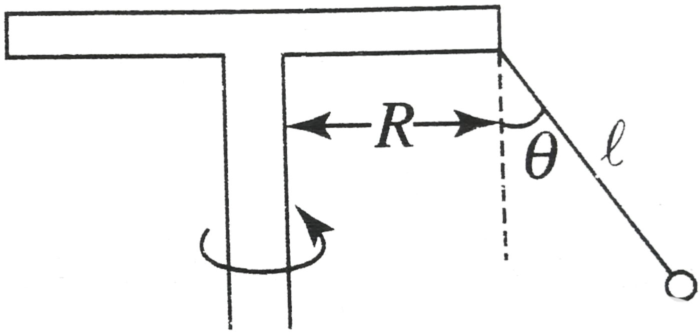
D. $\omega = \sqrt{\dfrac{g(\tan\theta)}{R + l\cos\theta}}$

Answer: A

Watch Video Solution

428. A pendulum bob of mass m hangs from one end of a horizontal rod which is rotating about vertical axis with an unknown angular speed ω such that the light inextensible string of length l of the pedulum makes a constant angle θ with vertical. Find the

Q. tension in the string



A. $T = mg(\tan\theta)$

B. $T = mg\sec\theta$

C. $T = mg\sin\theta\cos\theta$

D. $T = mg\cot\theta$

Answer: B

Watch Video Solution

429. A body of mass mkg lifted by a man to a height of one metre in $30\sec$. Another mass lifted the same mass to the same height in $60\sec$. The work done by then are them are in the ratio.

A. $1:2$

B. $1:1$

C. $2:1$

D. $4:1$

Answer: B

Watch Video Solution

430. A body of mass m is moving in a circle of radius r with a constant speed v, The force on the body is $\frac{mv^2}{r}$ and is directed towards the centre what is the work done by the from in moving the body over half the circumference of the circle?

A. $\frac{mv^2}{\pi r^2}$

B. zero

C. $\frac{mv^2}{r^2}$

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

Answer: B

Watch Video Solution

431. A body of mass $6kg$ is under a force which causes displacement in it given by $S = \frac{t^2}{4}$ maters where t is time . The work done by the force in 2 sec is

A. 12 J

B. 9 J

C. 6 J

D. 3 J

Answer: D

Watch Video Solution

432. A particale moves under the effect of a force $F = Cx$ from $x = 0$ to $x = x_1$. The work down in the process is

A. Cx_1^2

B. $\frac{1}{2}Cx_1^2$

C. Cx_1

D. zero

Answer: B

Watch Video Solution

433. A cord is used to lower vertically a block of mass M, a distance d at a constant downward acceleration of $\frac{g}{4}$, then the work done by the cord on the block is

A. $M\frac{g(d)}{4}$

B. $3M\frac{g(d)}{4}$

C. $-3M\frac{g(d)}{4}$

D. Mgd

Answer: C

Watch Video Solution

434. Two springs have their force constant as k_1 and $k_2\left(k_1 > k_2\right)$. When they are streched by the same force.

A. No work is done in case of both the springs

B. Equal work is done in case of both the spriongs

C. More work is done in case of second spring

D. more work is done in case of first spring

Answer: C

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435. A body of mass 3 kg is under a force which causes a displacement given by $s = t^2/3$ (in m). Work done by force in 2 s is

A. 2 J

B. 3.8 J

C. 5.2 J

D. 24 J

Answer: D

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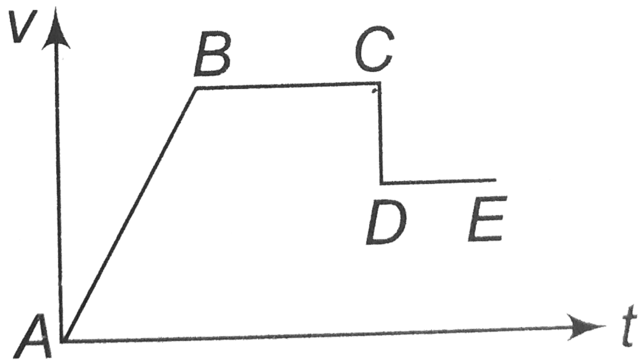
436. The adjoining diagram shows the velocity versus time plot for a particle . The work done by the force on the particel is positive from



A. A to B

B. B to C

C. C to D

D. D to E

Answer: A

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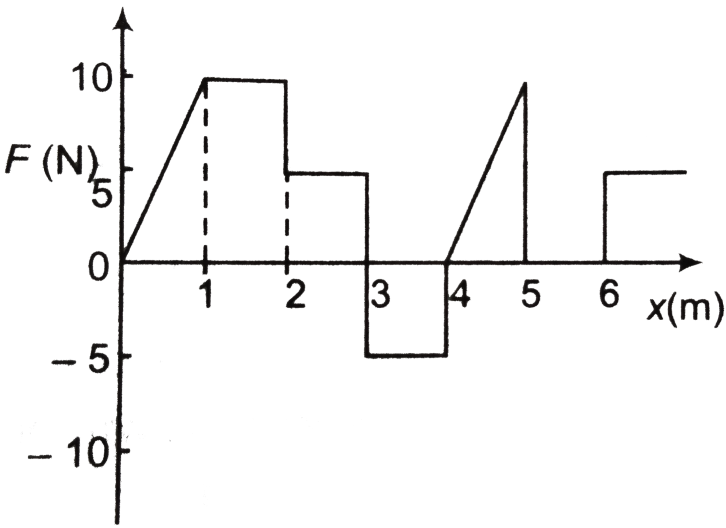
437. The relationship between the force F and position x of body is as shown in figure. The work done in displacing the body in displacing the body from ($x = 1m$ to $x = 5m$) will be



A. 30 J

B. 15 J

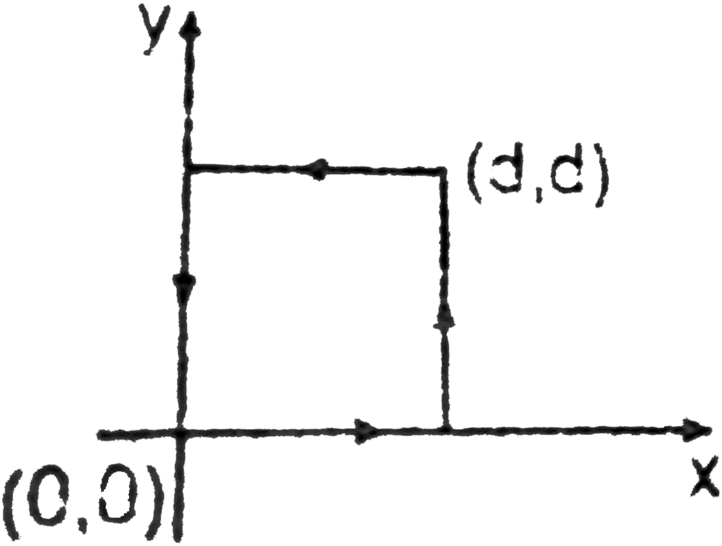
C. 25 J

D. 20 J

Answer: B

Watch Video Solution

438. The work done by the force $F = A\left(y^2\hat{i} + 2x^2\hat{j}\right)$, where A is a constant and x & y are in meters around the path shown in



A. zero

B. Ad

C. Ad^2

D. Ad^3

Answer: D

Watch Video Solution

439. A force $F = -k\hat{i} + x\hat{j}$ where k is a positive constant, acts on a praricle moving in the xy plane. Starting from the origin, the particle is taken along the positive x - axis to the point (a,0) and then parallel to the y-axis to the point (a,a) the total work done by the formce on the particle is

A. $-2Ka^2$

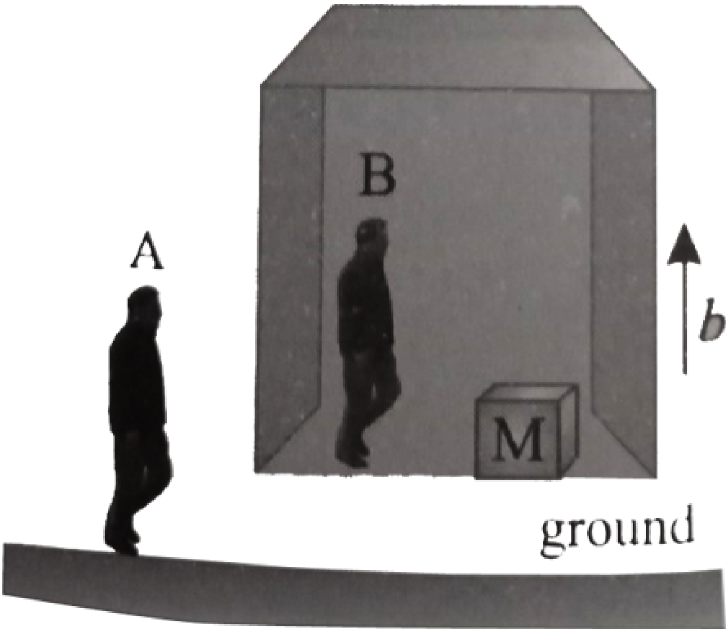
B. $2Ka^2$

C. $-Ka^2$

D. Ka^2

Answer: C

Watch Video Solution



440.

A block of mass M is kept in elevator (lift) which starts moving upward with constant acceleration b as shown in figure. Initially elevator at rest. The block is observed by two observers A and B for a time interval $t = 0$ to $t = T$. Observer B is at rest with respect to elevator and observer A is standing on the ground.

Q. The observer A finds that the work done by gravity on the block is

A. $\frac{1}{2}Mg^2T^2$

B. $-\frac{1}{2}Mg^2T^2$

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

D. $-\frac{1}{2}MgbT^2$

Answer: D

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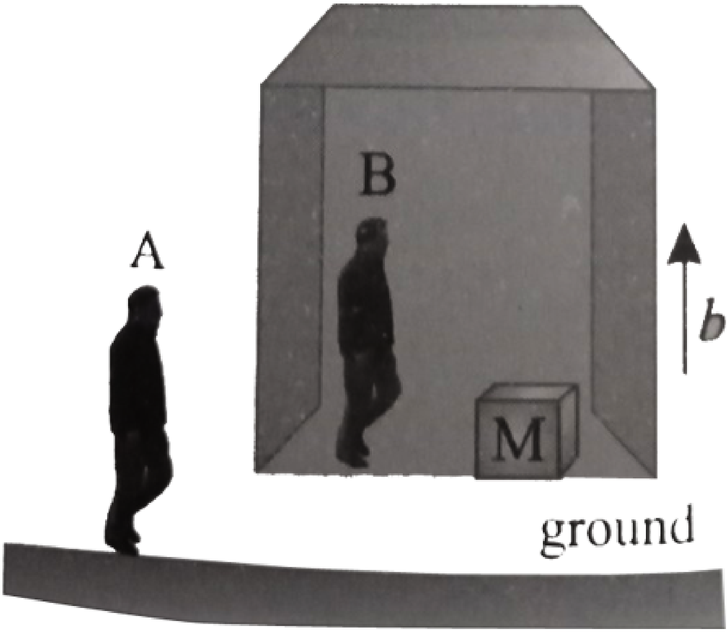

441.

A block of mass M is kept in elevator (lift) which starts moving upward with constant acceleration b as shown in figure. Initially elevator at rest. The block is observed by two observers A and B for a time interval $t = 0$ to $t = T$. Observer B is at rest with respect to elevator and observer A is standing on the ground.

Q. The observer A finds that work done by normal reaction acting on the blocks is

A. $\frac{1}{2}(Mg + b)^2 T^2$

B. - $\frac{1}{2}(Mg + b)^2 T^2$

C. $\frac{1}{2}M(g + b)bT^2$

D. - $\frac{1}{2}M(g + b)bT^2$

Answer: C

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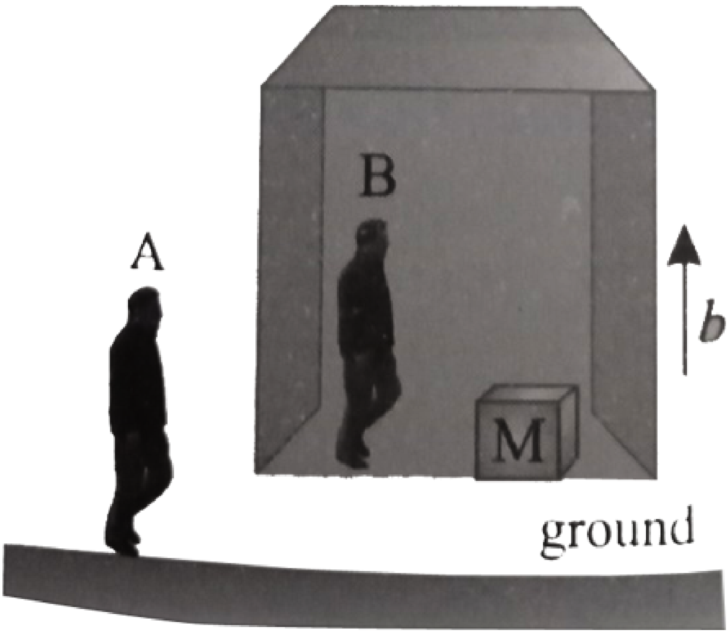

442.

A block of mass M is kept in elevator (lift) which starts moving upward with constant acceleration b as shown in figure. Initially elevator at rest. The block is observed by two observers A and B for a time interval $t = 0$ to $t = T$. Observer B is at rest with respect to elevator and observer A is standing on the ground.

Q. According to observer B

A. The work done by gravity on the block is zero

B. the work done by normal reaction on the block is zero

C. the work done by pseudo force on the block is zero

D. all the above are correct

Answer: D

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443. A particle of mass m is moving with speed u. It is stopped by a force F in distance x if the stopping force is 4 F then

A. work done by stopping force in second case will be same as that in first case.

B. work done by stopping force in second case will be 2 times of that in first case.

C. work done by stopping force in second case will be $\frac{1}{2}$ of that in first case.

D. work done by stopping force in second case will be $\frac{1}{4}$ of that in first case.

Answer: A

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444. Two object are initially at rest on a frictionless surface. Object 1 has a greater mass than object 2. The same constant force start to act on each object. The force is removed from each object after it accelerates over a distance d. after the force is removed from both objects, which statement is correct (p:momentum, K: kinetic energy)?

A. $p_1 < p_2$

B. $p_1 > p_2$

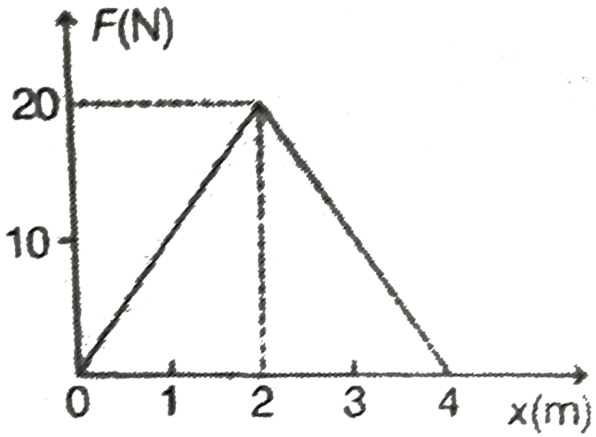
C. $K_1 > K_2$

D. $K_1 < K_2$

Answer: B

Watch Video Solution

445. The graph between the resistance force F acting on a body and the distance covered by the body is shown in the figure. The mass of the body is 25kg and initial velocity is $2m/s^2$. When the distance covered by the body is 4m, its kinetic energy would be



A. 50 J

B. 40 J

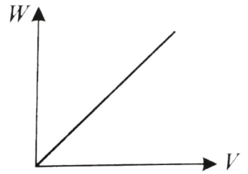
C. 20 J

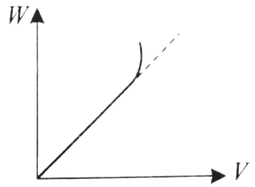
D. 10 J

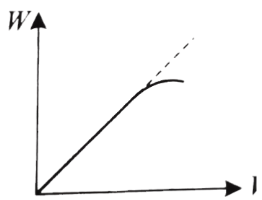
Answer: D

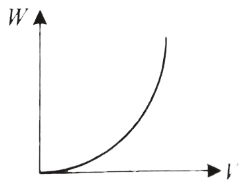
Watch Video Solution

446. A particle initially at rest on a frictionless horizontal surface, is acted upon by a horizontal force which is constant is size and direction. A graph is plotted between the work done (W) on the particle, against the speed of the particle, (v). If there are no other horizontal forces acting on the particle the graph would look like

A. 

B. 

C. 

D. 

Answer: D

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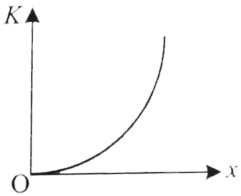
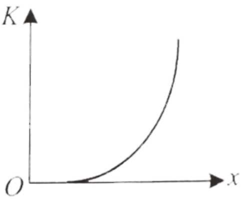
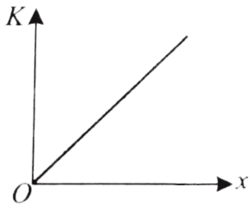
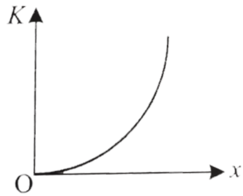
447. A body moves from rest with a constant acceleration. Which one of the following graphs represents the variation of its kinetic energy K with the distance travelled x?

A. 

B. 

C. 

D. 

Answer: C

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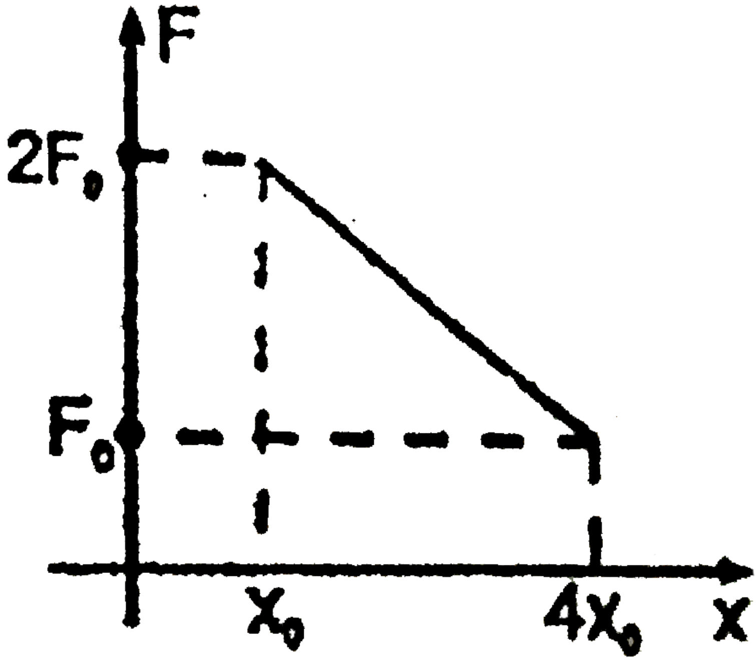
448. A particle of mass m moving along a straight line experiences force F which varies with the distance x travelled as shown in the figure. If the velocity of the particle at $x_0\sqrt{\frac{2F_0x_0}{m}}$, then velocity at $4x_0$ is



A. $2\sqrt{\frac{2F_0x_0}{m}}$

B. $2\sqrt{\frac{F_0x_0}{m}}$

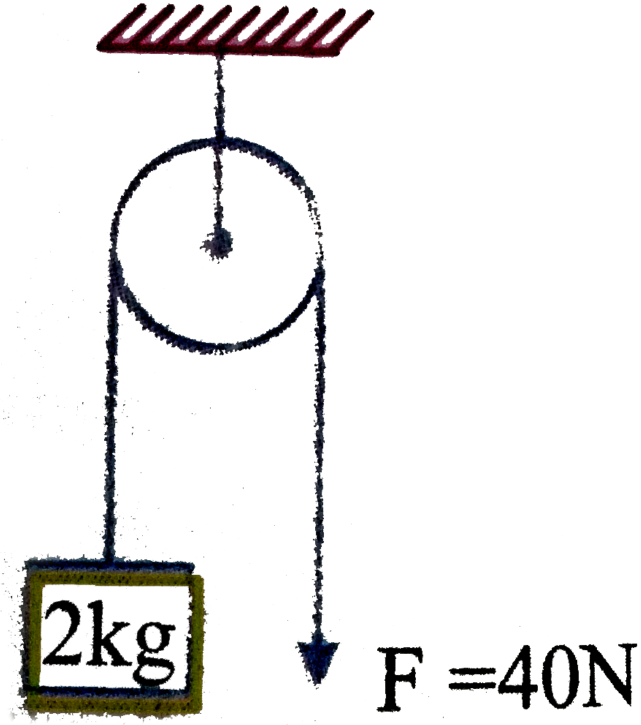
C. $\sqrt{\frac{F_0x_0}{m}}$

D. none of these

Answer: D

View Text Solution

449. A block of mass $2kg$ is hanging over a smooth and light pulley through a light string. The other end of the string is pulled by a constant force $F = 40N$. The kinetic energy of the particle increase $40J$ in a given interval of time. Then : $\left(g = 10m/s^2\right)$.



A. tension in the string is 40 N

B. displacement of the block in the given interval of

time is 2m

C. work done by gravity is $-20J$

D. work done by tension is 80 J

Answer: A::B::D

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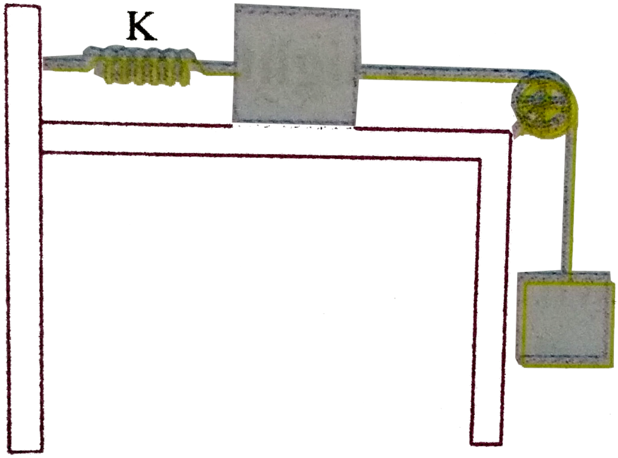
450. Two blocks, of masses M and $2M$, are connected to a light spring of spring constant K that has one end fixed, as shown in figure. The horizontal surface and the pulley are frictionless. The blocks are released from when the spring is non deformed. The string is light.



A. Maximum extension in the spring is $\frac{4Mg}{K}$.

B. Maximum kinetic energy of the system is $\frac{2M^2g^2}{K}$

C. Maximum energy stored in the spring is four times that of maximum kinetic energy of the system.

D. When kinetic energy of the system is maximum, energy is the spring is $\frac{4M^2g^2}{K}$

Answer: A::B::C

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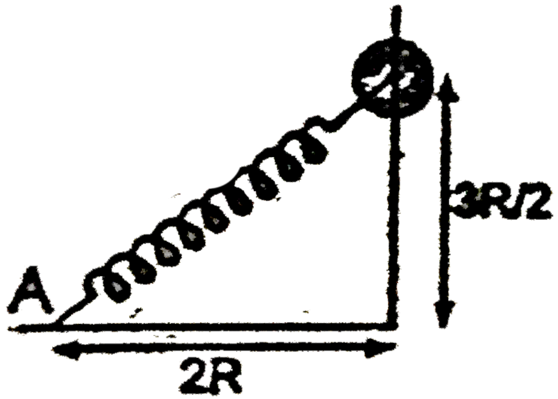
451. A ring of mass m can slide over a smooth vertical rod. The ring is connected to a spring of force constant $K = \frac{4mg}{R}$ where 2R is the natural length of the spring. The other end spring is fixed to the ground at a horizontal distance 2R from the base of the rod.

the mass is released at a height of 1.5 R from ground.



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

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

C. $\frac{3mgR}{5}$

D. mgR

Answer: A

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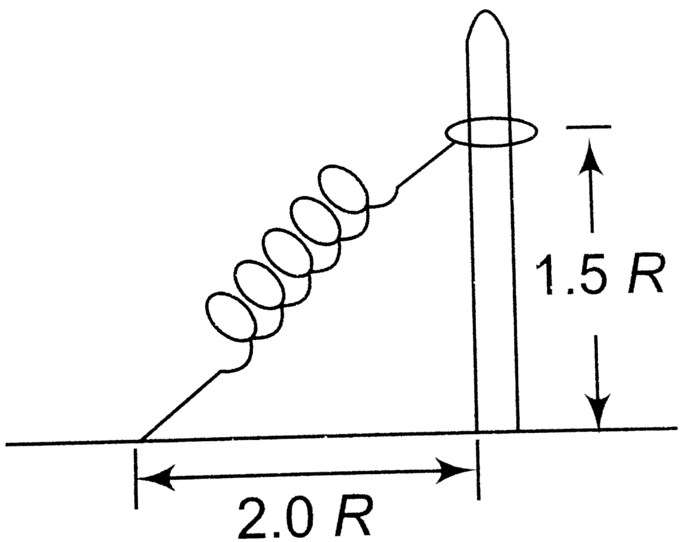
452. A ring of mass m can slide over a smooth vertical rod as shown in figure. The ring is connected to a spring of force constant $k = 4mg/R$, where $2R$ is the natural length of the spring . The other end of spring is fixed to the ground at a horizontal distance $2R$ from base of the rod . If the mass is released at a height $1.5J$ then the velocity of the ring as it reaches the ground is



A. $2\sqrt{gR}$

B. $\sqrt{gR}$

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

D. $\frac{3\sqrt{gR}}{2}$

Answer: A

Watch Video Solution

453. The potential energy of a body is given by $U = A - Bx^2$ (where x is the displacement). The magnitude of force acting on the partical is

A. constant

B. Proportional to x

C. proportional to x^2

D. `inversely proportional to x

Answer: B

Watch Video Solution

454. The potential energy between two atoms in a molecule is given by $U(x) = \frac{a}{x^{12}} - \frac{b}{x^6}$, where a and b are positive constants and x is the distance between the atoms. The atom is in stable equilibrium when

A. $x = 6\sqrt{\frac{11a}{5b}}$

B. $x = 6\sqrt{\dfrac{a}{2b}}$

C. $x = 0$

D. $x = 6\sqrt{\dfrac{2a}{b}}$

Answer: D

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455. Two cylindrical vessels of equal cross-sectional area A contain water up to heights h_1 and h_2. The vessels are interconnected so that the levels in them are equal.Calculate the work done by the force of gravity during the process. The density of water is p.

A. $\left(h_1 - h_2\right)g\rho$

B. $\left(h_1 - h_2\right)gA\rho$

C. $\frac{1}{2}\left(h_1 - h_2\right)^2 gA\rho$

D. $\frac{1}{4}\left(h_1 - h_2\right)gAp$

Answer: D

Watch Video Solution

456. A particle of mass m is moving in a horizontal circle of radius r, under a centripetal force equal to $-\left(k/r^2\right)$ where k is constant. The total energy of the particle is

A. $\frac{K}{2r}$

B. - $\frac{K}{2r}$

C. - $\frac{K}{r}$

D. $\frac{K}{r}$

Answer: B

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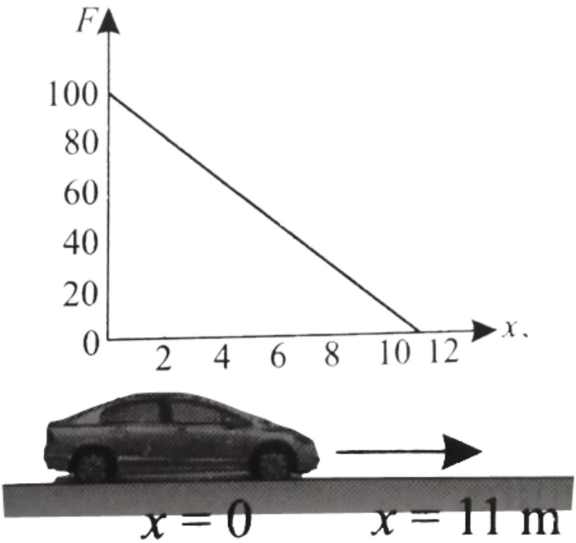
457.



A toy car of mass 5 kg moves up a ramp under the influence of force F plotted against displacement x. The maximum height attained is given by

A. $v_{\max} = 20M$

B. $v_{\max} = 15M$

C. $v_{\max} = 11M$

D. $v_{\max} = 5M$

Answer: C

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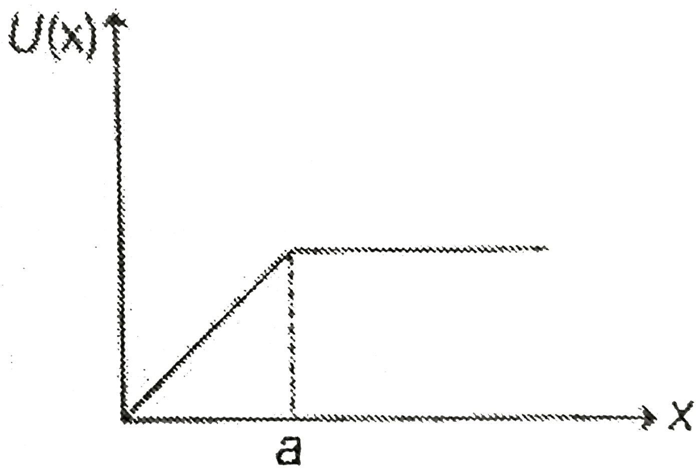
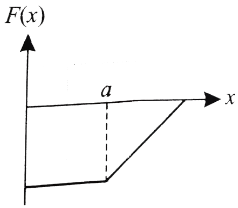
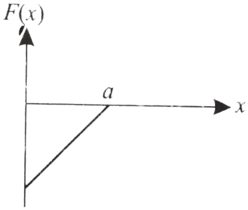
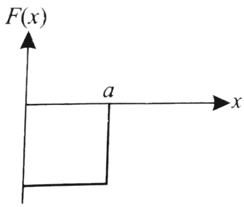
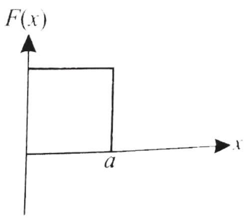
458. The potential energy of a system is represented in the first figure, the force acting on the system will be represented by



A. 

B. 

C. 

D. 

Answer: C

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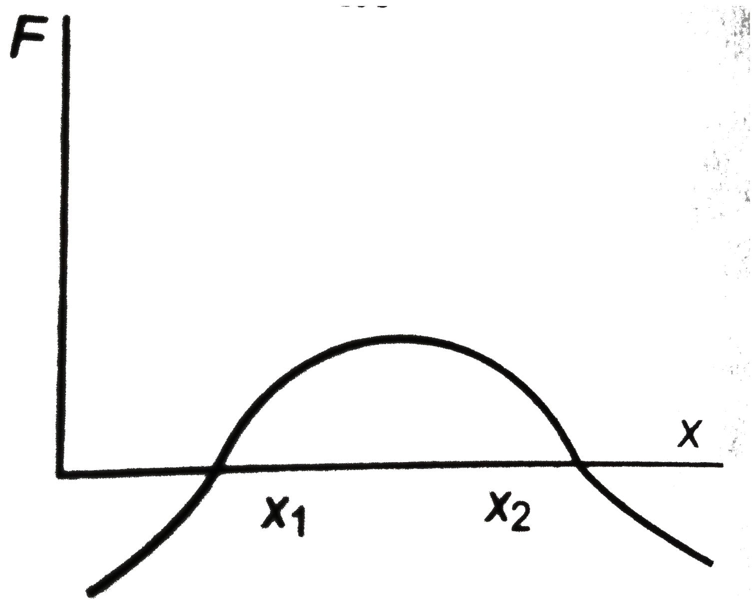
459. The force acting on a body moving along x-axis variation of the particle particle shown in the figure. The body is in stable equilibrium at



A. $x = x_1$

B. $x = x_2$

C. both x_1 and x_2

D. neither x_1 nor x_2

Answer: B

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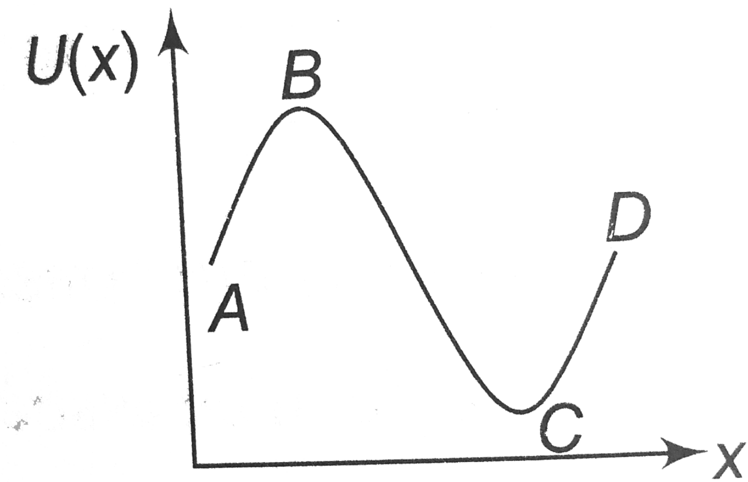
460. The potential energy of a partical veries with distance x as shown in the graph.



The force acting on the partical is zero at

A. C

B. B

C. B and C

D. A and D

Answer: C

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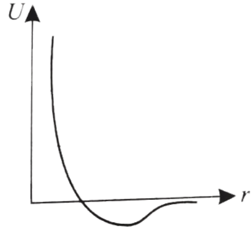
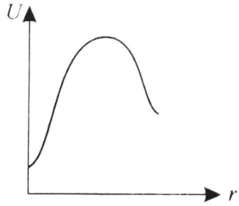
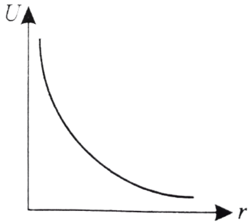
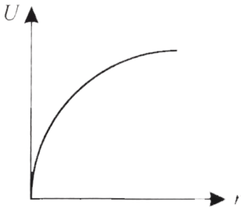
461. These diagrams represent the potential energy U of a diatomic molecule as a function of the inter-atomic distance r. The diagram corresponds to stable molecule found in nature is.

A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

462. One end of an unstretched vertical spring is attached to the ceiling and an object attached to the other end is slowly lowered to its equilibrium position. If S is the gain in spring energy and G is the loss in gravitational potential energy in the process, then

A. $S = G$

B. $S = 2G$

C. $G = 2S$

D. none of these

Answer: C

Watch Video Solution

463. Select the correct alternative.

A. Work done by kinetic friction on a body always results in a loss of its kinetic energy.

B. Work done on a body, in the motion of that body over a close loop is zero for every force in nature.

C. Total mechanical energy of a system is always conserved no matter what type of internal and external forces on the body are present.

D. When total work done by a conservetive force on the system is positive then the potential energy associated with this force decreses.

Answer: D

Watch Video Solution

464. A particle is moved from (0, 0) to (a, a) under a force a $F = \left(3\hat{i} + 4\hat{j}\right)$ from two paths. Path 1 is OP and path 2 is OPQ. Let W_1 and W_2 be the work done by this force in these two paths. Then,

A. $W_1 = W_2$

B. $W_1 = 2W_2$

C. $W_2 = 2W_2$

D. $W_2 = 4W_1$

Answer: A

Watch Video Solution

465. A spherical ball of mass 20 kg is stationary at the top of a hill of height 100 m. It rolls down a smooth surface to the ground then climbs up another hill of height 30 m and finally rolls down to a horizontal base at a height of 20 m above the ground. Find the velocity attained by the ball, when moving at horizontal base.

A. $10\frac{m}{s}$

B. $10\sqrt{30}\frac{m}{s}$

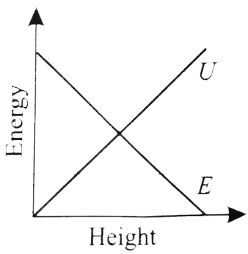
C. $40\frac{m}{s}$

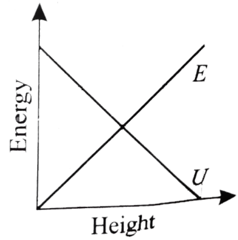
D. $20\frac{m}{s}$

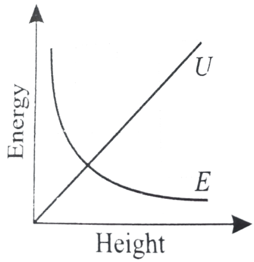
Answer: C

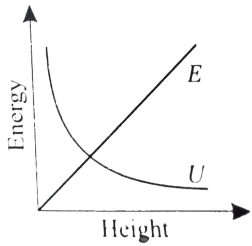
Watch Video Solution

466. Which of the following graph is correct between kinetic energy E, potential energy (U) and height (h) from the ground of the partical

A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

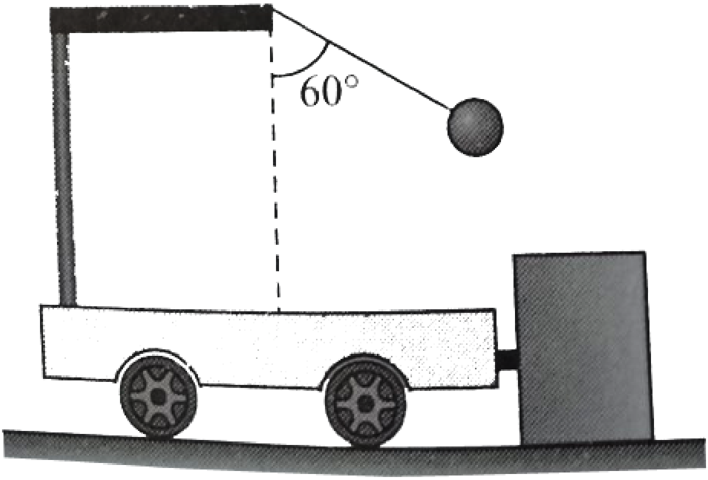


Figure (2) Bumper

467.

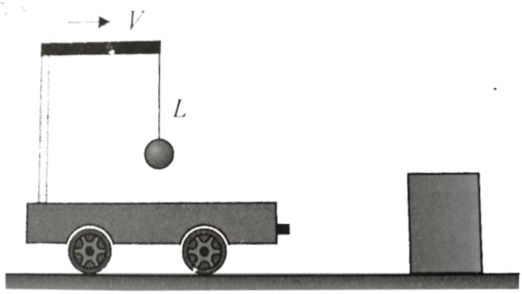


Figure (1) Bumper

A ball is suspended from the top of a cart by a string of length 1.0m. The cart and the ball are initially moving to the right at constant speed V, as shown in figure I. The cart comes to rest after colliding and sticking to a fixed bumper, as in figure II. The suspended ball swings through a maximum angle 60°. The initial speed V is (takeg=10(m)/(s^2)`)

A. $\sqrt{10}\frac{m}{s}$

B. $2\sqrt{5}\frac{m}{s}$

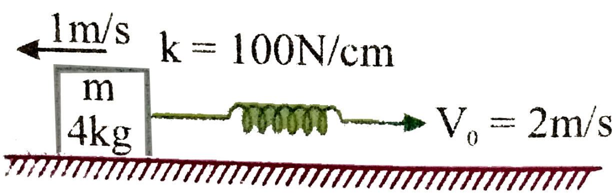
C. $5\sqrt{2}\frac{m}{s}$

D. $4\frac{m}{s}$

Answer: A

Watch Video Solution

468. The spring block system lies on a smooth horizontal surface. The free endof the spring is being pulled towards right with constant speed $v_0 = 2m/s$. At $t = 0\text{sec}$, the spring of constant $k = 100N/cm$ is unsttretched and the block has a speed $1m/s$ to left. The maximum extension of the spring is.



(A) 2 cm (B) 4 cm (C) 6 cm

A. 2 cm

B. 4 cm

C. 6 cm

D. 8 cm

Answer: C

Watch Video Solution

469. The potential energy of a particle of mass m free to move along the x-axis is given by $U = (1/2)kx^2$ for $x < 0$ and $U = 0$ for $x \geq 0$ (x denotes the x-coordinate of the particle and k is a positive constant). If the total mechanical energy of the particle is E, then its speed at $x = -\sqrt{2E/k}$ is

A. zero

B. $\sqrt{\frac{2E}{m}}$

C. $\frac{\sqrt{E}}{m}$

D. $\sqrt{\frac{E}{2m}}$

Answer: A

Watch Video Solution

470. In a shotput event an athlete throws the shotput of mass $10kg$ with an initial speed of $1ms^{-1}$ at 45° from a height $1.5m$ above ground. Assuming air resistance to be negligible and acceleration due to gravity to be $10ms^{-2}$, the kinetic energy of the shotput when it just reaches the ground will be

A. 2.5 J

B. 5.0 J

C. 52.5 J

D. 155.0 J

Answer: D

Watch Video Solution

471. A body of mass m accelerates uniformly from rest to v_1 in time t_1. As a function of time t, the instantaneous power delivered to the body is

A. $\frac{mv_1 t}{t_1}$

B. $\frac{mv_1^2 t}{t_1}$

C. $\frac{mv_1 t^2}{t_1}$

D. $\frac{mv_1^2 t}{t_1^2}$

Answer: D

Watch Video Solution

472. A man is riding on a cycle with velocity $7.2\frac{km}{hr}$ up a hill having a slope 1 in 20. The total mass of the man and cycle is 100kg. The power of the man is

A. 200 W

B. 175 W

C. 125 W

D. 98 W

Answer: D

Watch Video Solution

473. The power of a water pump is 2 kW. If $g = 10ms^{-2}$, the amount of water it can raise in one minute to a height of 10 m is

A. 2000 litre

B. 1000 litre

C. 100 litre

D. 1200 litre

Answer: D

Watch Video Solution

474. An engine develops 10 kW of power. How much time will it take to lift a mass of 200 kg to a height of 40 m $(g = 10\frac{m}{\sec^2})$`?

A. 4 sec

B. 5 sec

C. 8 sec

D. 10 sec

Answer: C

Watch Video Solution

475. A car of mass m is driven with acceleration a along a straight level road against a constant external resistive force R. When the velocity of the car V, the rate at which the engine of the car is doing work will be

A. RV

B. maV

C. $(R + ma)V$

D. $(ma - R)V$

Answer: C

Watch Video Solution

476. A force applied by an engine of a train of mass 2.05×10^6kg changes its velocity from 5 m/s to 25 m/s in 5 minutes. The power of the engine is

A. 1.025 MW

B. 2.05 MW

C. 5 MW

D. 6 MW

Answer: B

Watch Video Solution

477. An engine pumps up $100kg$ of water through a height of $10m$ in $5s$. Given that the efficiency of the engine is 60%, what is the power of the engine? Take $g = 10ms^{-2}$.

A. 3.3 KW

B. 0.33 KW

C. 0.033 KW

D. 33 KW

Answer: A

Watch Video Solution

478. From an automatic gun a man fires 360 bullet per minute with a speed of 360 km/hour. If each weighs 20 g, the power of the gun is

A. 600 W

B. 300 W

C. 150 W

D. 75 W

Answer: A

Watch Video Solution

479. An engine pumps liquid of density ρ continuously through a pipe of cross-section area A. If the speed with which liquid passes through the pipe is v, then the rate at which kinetic energy is being imparted to the liquid by the pump is

A. $\frac{1}{2}A\rho v^3$

B. $\frac{1}{2}A\rho v^2$

C. $\frac{1}{2}A\rho v$

D. $A\rho v$

Answer: A

Watch Video Solution

480. A man does a given amount of work in 10 sec. Another man does the same amount of work in 20 sec. The ratio of the output power of first man to the second man is

A. 1

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

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

D. none of these

Answer: C

Watch Video Solution

481. An engine can pull four coaches at a maximum speed of $20ms^{-1}$. The mass of the engine is twice the mass of every coach. Assuming resistive forces to be proportional to the weight, approximate maximum speeds of the engine, when it pulls 12 and 6 coaches, are

A. 8.5 m/s and 15 m/s respectively

B. 6.5 m/s and 8 m/s respectively

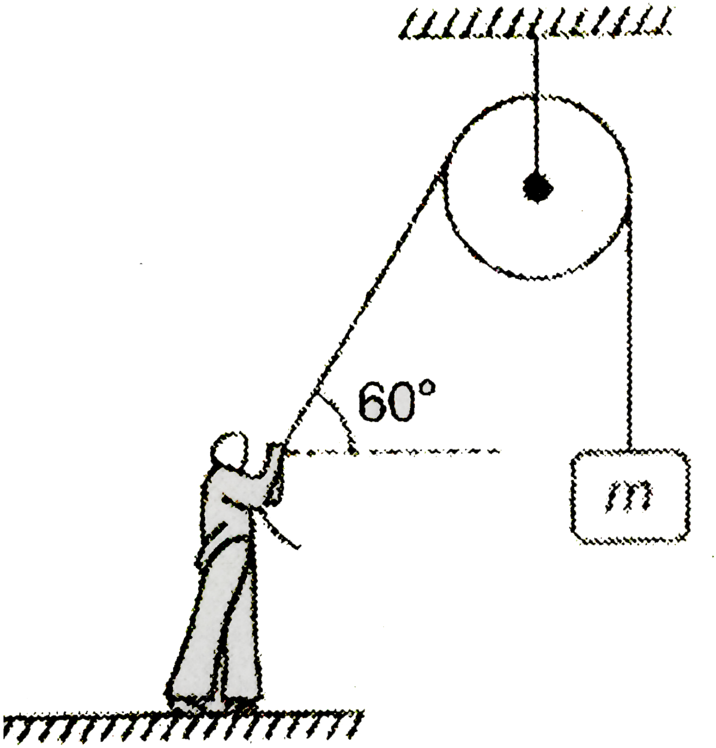
C. 8.5 m/s and 13 m/s respectively

D. 10.5 m/s and 15 m/s respectively

Answer: A

Watch Video Solution

482. A man is supplying a constant power of $500 J/s$ to a massless string by pulling it at a constant speed of $10 m/s$ as shown. It is known that kinetic energy of the block is increasing at a rate of $100 J/s$. Then, the mass of the block is



A. 5 kg

B. 3 kg

C. 10 kg

D. 4 kg

Answer: D

Watch Video Solution

483. A block of mass m at the end of a string is whirled round in a vertical circle of radius R. The critical speed of the block at top of its swing below which the string would slacken before the block reaches the bottom is?

A. Rg

B. $(Rg)^2$

C. $\frac{R}{g}$

D. $\sqrt{Rg}$

Watch Video Solution

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

A. `gl

B. $2gl$

C. $\sqrt{gl}$

D. $\sqrt{2gl}$

Watch Video Solution

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

A. $20\frac{m}{\sec}$

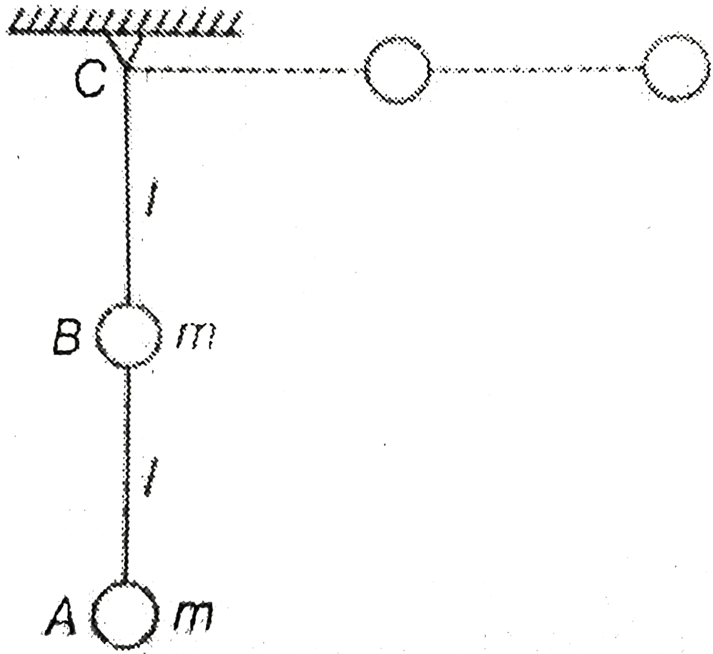
B. $10\sqrt{3}\frac{m}{\sec}$

C. $5\sqrt{2}\frac{m}{\sec}$

D. $10\frac{m}{\sec}$

Watch Video Solution

486. A weightless rod of length 2l carries two equal masses 'm', one tied at lower end A and the other at the middle of the rod at B. The rod can rotate in vertical plane about fixed horizontal axis passing through C. The rod is released from rest in horizontal position. The speed of the mass B at the instant rod become vertical is



A. $\sqrt{\frac{3gl}{5}}$

B. $\sqrt{\frac{4gl}{5}}$

C. $\sqrt{\frac{6gl}{5}}$

D. $\sqrt{\frac{7gl}{5}}$

Watch Video Solution

487. A particle is rotated in a vertical circle by connecting it to a string of length l and keeping the other end of the string fixed. The minimum speed of the particle when the string is horizontal for wich the particle will complete the circle is

A. $\sqrt{gl}$

B. $\sqrt{2gl}$

C. $\sqrt{3gl}$

D. none

Watch Video Solution

488. A particle originally at rest at the highest point of a smooth vertical circle is slightly displaced. It will leave the circle at a vertical distance h below the highest points, such that h is equal to

A. R

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

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

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

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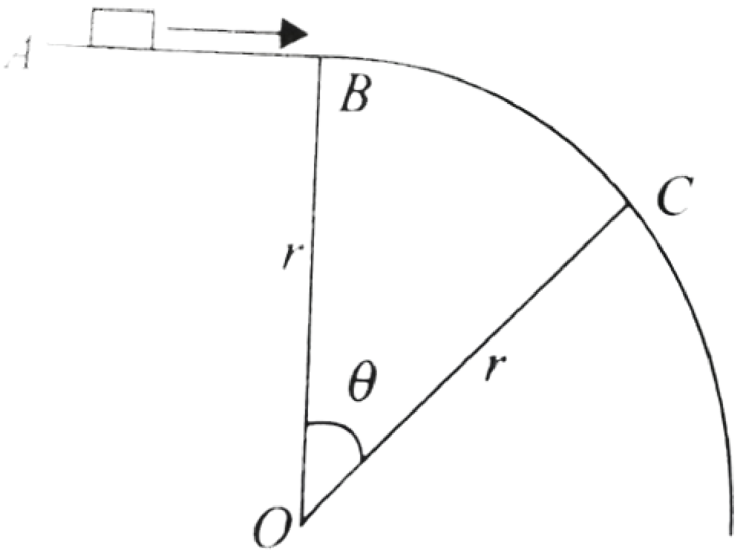

489.

A small block slides with velocity $v_0 = 0.5\sqrt{gr}$ on the horizontal frictiohnless surface as shown in the fig. the block leaves the surface at point C. The angle θ in the figure is:

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

B. $\cos^{-1}\left(\frac{3}{4}\right)$

C. $\cos^{-1}\left(\frac{1}{4}\right)$

D. $\cos^{-1}\left(\frac{4}{5}\right)$

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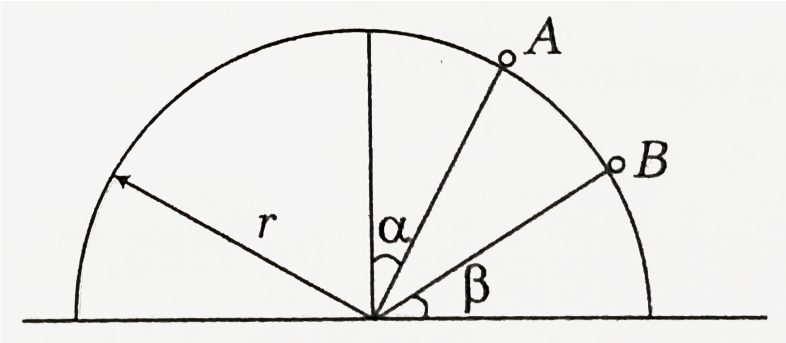
490. A particle moves from rest at A on the surface of a smooth circular cylinder of radius r as shown. At B it leaves the cylinder. The equation relating α and β is



A. $3\sin\alpha = 2\cos\beta$

B. $2\sin\alpha = 3\cos\beta$

C. $3\sin\beta = 2\cos\alpha$

D. $2\sin\beta = 3\cos\alpha$

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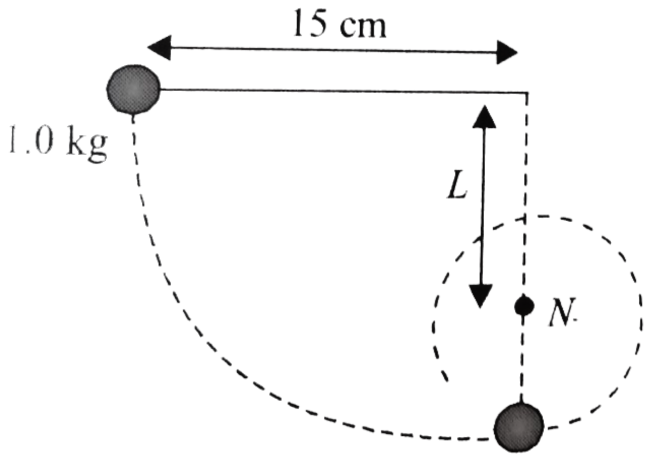

491.

A ball weighing 1.0 kg is tied to a string 15 cm long initially the ball is held in position such that the string is horizontal. The ball is now released. A nail N is situated vertically below the support at a distance L. The minimum value of L such that the string will be would round the nail is.

A. 15 cm

B. 4 cm

C. 9 cm

D. None of these

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Fill in the blanks type

1. The dimensional formula for latent heat is

Watch Video Solution

2. The dimensions of universal gravitational constant are ____

Watch Video Solution

3. The dimesional formla of angylar velocity is ______

Watch Video Solution

4. The dimensions of power are _____

Watch Video Solution

5. The dimensions of couple are ______

Watch Video Solution

6. The dimesional formula for impulse is _____

Watch Video Solution

7. the dimensional formula for planck's constant and angular momentum are

Watch Video Solution

8. The dimensions of calorie are ________

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9. If $y = f(x) = 3x^2 + 2x + 4$, then value of y at $x = f(2)$ will be

Watch Video Solution

10. Differentiation of x^2 w.r.t. x is

Watch Video Solution

11. If $y = \frac{1}{x^4}$, then $\frac{dy}{dx}$ will be

Watch Video Solution

12. Differentiation of $2x^2 + 3x$ w.r.t. x is

Watch Video Solution

13. If square of x varies as cube of y and $x = 3$ when $y = 4$, the value of y at $\frac{1}{\sqrt{3}}$ will be..

Watch Video Solution

14. If $y = 2\sin x$,then $\frac{dy}{dx}$ will be

Watch Video Solution

15. If $y = \sin x$, then $\frac{d^2y}{dx^2}$ will be

Watch Video Solution

16. Double differentiation of displacement w.r.t. time is..

Watch Video Solution

17. If $y = x^3$ then $\frac{d^2y}{dx^2}$ is..

Watch Video Solution

18. If velocity of particle is given by $v = 2t^4$, then its acceleration $\left(\frac{dv}{dt}\right)$ at any time t will be given by..

Watch Video Solution

19. If $y = 2\sin(\omega t + \phi)$ where ω and ϕ constants then $\frac{dy}{dt}$ will be

Watch Video Solution

20. If $y = x^2 \sin x$,then $\frac{dy}{dx}$ will be..

Watch Video Solution

21. If $y = \tan x \cos^2 x$then $\frac{dy}{dx}$ will be..

Watch Video Solution

22. $\int x^2 dx$ is equal to ..

Watch Video Solution

23. $\int x^3 dx$ is equal to ...

Watch Video Solution

24. $\int \left(\frac{1}{5} - \frac{2}{x^5} + 2x\right) dx$ is equal to ...

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25. if $y = 3x^3 + 2x + 4$, then $\int y dx$ will be

Watch Video Solution

26. Find $\int \frac{dx}{ax+b}$

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Comprehension Type

1. If a particle starts moving along a straight ine withinitial velocity u under contact acceleration a, its displacement with time is given by the relation $x = ut + \frac{1}{2}at^2$

Q. Differentiation of x w.r.t. t will be

A. $y = \frac{at}{2}$

B. $u + at$

C. $u + 2at$

D. $\frac{ut^2}{2} + \frac{at^3}{6}$

Answer: B

Watch Video Solution

2. If a particle starts moving along a straight ine withinitial velocity u under contact acceleration a, its displacement with time is given by the relation

$x = ut + \frac{1}{2}at^2$

Q. Differentiation of x w.r.t. t will be

A. a

B. $u + a$

C. u

D. none

Answer: A

Watch Video Solution

3. If charge flown through a wire is given by $q = 3\sin(3t)$, then

Q. Find out the amount of charge flown through the wire at $t = \left(\frac{\pi}{6}\right)$ seconds.

A. 3 coulombs

B. 6 coulombs

C. 1 coulomb

D. zero coulomb

Answer: A

Watch Video Solution

4. If charge flown through a wire is given by $q = 3\sin(3t)$, then

Q. Find out the current flown through the wire at $t = \frac{\pi}{9}$ second.

A. 4.5 amp

B. $4.5\sqrt{3} amp$

C. $\frac{\sqrt{3}}{2} amp$

D. $9 amp$

Answer: A

Watch Video Solution

5. Velocity of a particle varies as $v = 2t^3 - 3t^2$ in $\frac{km}{hr}$ If $t = 0$ is taken at 12:00 noon

Q. Find the expression for the acceleration of the particle.

A. $3t^2 + 3t$

B. $6t(t - 1)$

C. $6t^2 + 3t$

D. none

Answer: B

Watch Video Solution

6. Velocity of a particle varies as $v = 2t^3 - 3t^2$ in $\frac{km}{hr}$ If $t = 0$ is taken at 12:00 noon

Q. What is the velocity of the particle at 12:00 noon?

A. 12:00 noon

B. 0.5416666666667

C. 0.4583333333333

D. 0.5833333333333

Answer: A

Watch Video Solution

7. Velocity of a particle varies as $v = 2t^3 - 3t^2$ in $\frac{km}{hr}$ If $t = 0$ is taken at 12:00 noon

Q. The time at which speed of the particle is minimum.

A. 12:00 noon

B. 0.5416666666667

C. 0.4583333333333

D. 0.5833333333333

Answer: B

Watch Video Solution

8. Velocity of a particle varies as $v = 2t^3 - 3t^2$ in $\frac{km}{hr}$ If $t = 0$ is taken at 12:00 noon

Q. What is the velocity of the particle at 12:00 noon?

A. $0.5\frac{km}{hr}$

B. `zero

C. 1km $\frac{km}{hr}$

D. $2\ \frac{km}{hr}$

Answer: B

Watch Video Solution

9. If $a = \left(3t^2 + 2t + 1\right)\frac{m}{s^2}$ is the expression according to which the acceleration of a particle varies. Then-

The expression for instantaneous velocity at any time t will be (if the particle was initially at rest)-

A. $t^3 + 2t + 1$

B. $t^3 + t + 1$

C. $t^3 + t^2 + 1$

D. $t^3 + t^2 + t + C$

Answer: C

Watch Video Solution

10. If $a = \left(3t^2 + 2t + 1\right) \frac{m}{s^2}$ is the expression according to which the acceleration of a particle varies. Then-

The change in velocity after 3 seconds of its start is:

A. 30 m/s

B. 39 m/s

C. 3 m/s

D. 20 m/s

Answer: B

Watch Video Solution

11. If $a = \left(3t^2 + 2t + 1\right)\frac{m}{s^2}$ is the expression according to which the acceleration of a particle varies. Then-

Find displacement of the particle after 2 seconds of start.

A. 26 m

B. $\frac{26}{3}$ m

C. $\frac{30}{7}$ m

D. $\frac{26}{7}$ m

Answer: B

Watch Video Solution

12. A man is standing on top of a building 100 m high. He throws two ball vertically, one at t=0 and after a time interval (less than 2 seconds). The later ball is thrown at a velocity of half the first. At t=2, both the balls reach to their and second ball is +15m.

Q. The speed of first ball is

A. 20 m/s

B. 10 m/s

C. 5 m/s

D. 15 m/s

Answer: A

Watch Video Solution

13. A man is standing on top of a building 100 m high. He throws two ball vertically, one at $t = 0$ and after a time interval (less than 2 seconds). The later ball is thrown at a velocity of half the first. At $t = 2$, both the balls reach to their maximum heights at this time the vertical gap between first and second ball is $+15m$.

Q. The speed of first ball is

A. 1.2 sec

B. 0.5 sec

C. 0.8 sec

D. 1 sec

Answer: D

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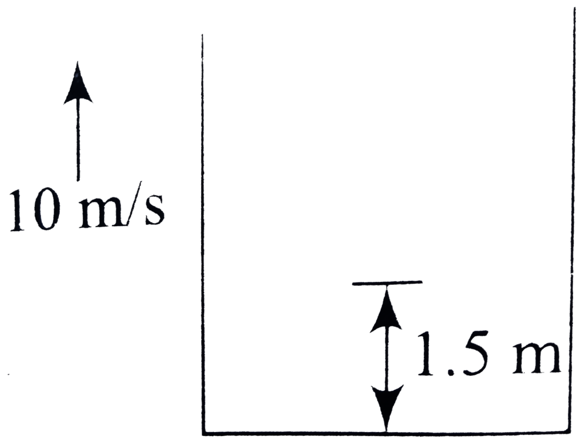
14.



A boy in the elevator shoots a bullet in a vertical upward direction from a height of 1.5 m above the floor of the elevator. There is no roof in the elevator. The floor of the elevator is at 50 m from ground at the instant when velocity of the elevator is 10 m/s in upward direction. The bullet strikes the floor of the elevator in 2 seconds. The initial speed of the bullet is 15 m/s relative to the elevator.

Q. Find the acceleration of the elevator in upward direction, $\left(\frac{ms}{s^2}\right)$:

A. 5

B. 5.25

C. 5.75

D. 6.25

Answer: C

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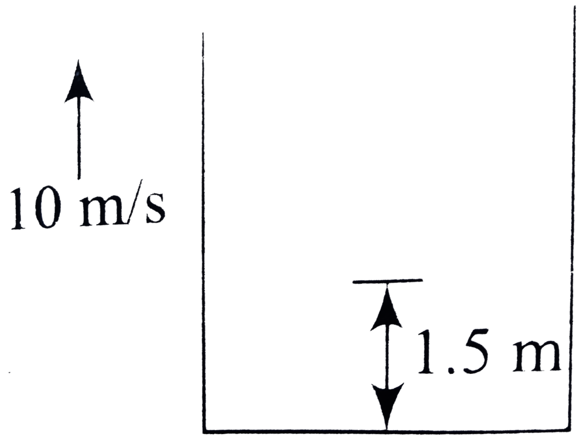

15.

A boy in the elevator shoots a bullet in a vertical upward direction from a height of 1.5 m above the floor of the elevator. There is no roof in the elevator. The floor of the elevator is at 50 m from ground at the instant when velocity of the elevator is 10 m/s in upward direction. The bullet strikes the floor of the elevator in 2 seconds. The initial speed of the bullet is 15 m/s relative to the elevator.

Q. Find the displacement of the bullet relative to ground during its flight:

A. 50.0 m

B. 40 m

C. 25 m

D. 30 min

Answer: D

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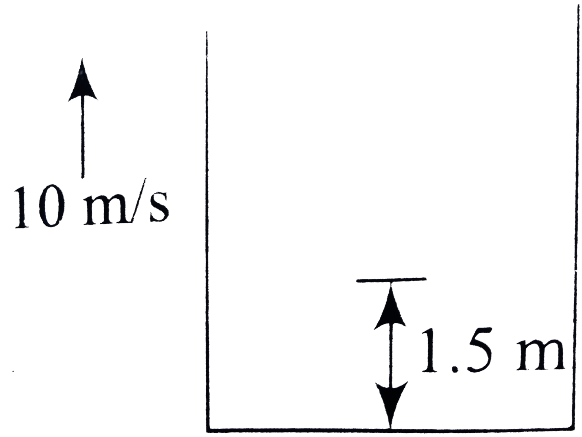

16.

A boy in the elevator shoots a bullet in a vertical upward direction from a height of 1.5 m above the floor of the elevator. There is no roof in the elevator. The floor of the elevator is at 50 m from ground at the instant when velocity of the elevator is 10 m/s in upward direction. The bullet strikes the floor of the elevator in 2 seconds. The initial speed of the bullet is 15 m/s relative to the elevator.

Q. Find the maximum height reached by the bullet relative to the ground :

A. 85 m

B. 82 m

C. 82.75 m

D. 85.25 m

Answer: C

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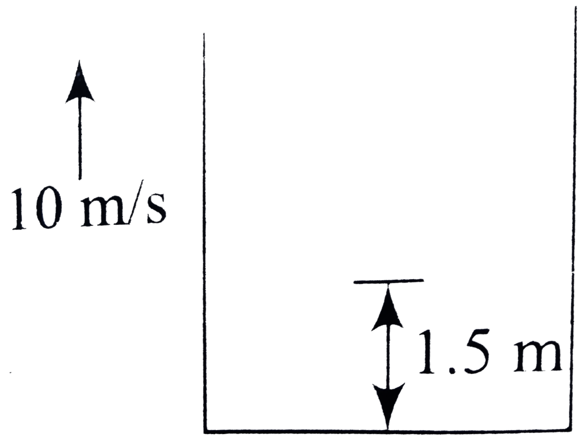

17.

A boy in the elevator shoots a bullet in a vertical upward direction from a height of 1.5 m above the floor of the elevator. There is no roof in the elevator. The floor of the elevator is at 50 m from ground at the instant when velocity of the elevator is 10 m/s in upward direction. The bullet strikes the floor of the elevator in 2 seconds. The initial speed of the bullet is 15 m/s relative to the elevator.

Q. Find the distance travelled by bullet during its flight:

A. 32.0m

B. 30.0m

C. 50.0m

D. 35.0m

Answer: A

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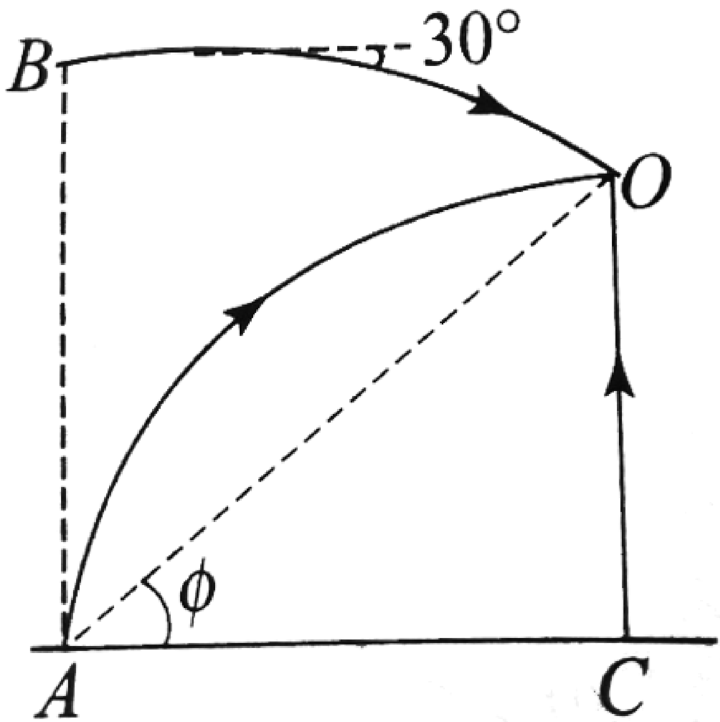
18. Points A and C are on the horizontal ground and A and B are in same vertical plane at a distance of $1500m$

. Simultaneously bullets are fired from A, Bll and C and they collide at O. The bullets at B is fired at an angle of $30\,^{\circ}$ with horizontal towards the ground iat velocity $100m/s$. the bullet at C is projected vertically upwards at velocity of $100m/s$. the bullet projected from A reaches its maximum height at O.



Find the time in which bullets will collide (seconds):

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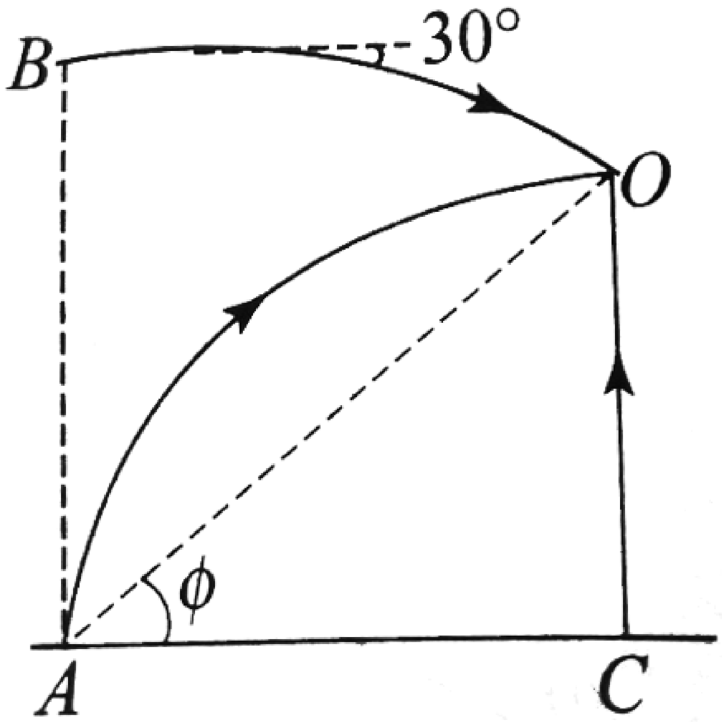
19. Points A and C are on the horizontal ground and A and B are in same vertical plane at a distance of $1500m$. Simultaneously bullets are fired from A, Bll and C and they collide at O. The bullets at B is fired at an angle of 30° with horizontal towards the ground iat velocity $100m/s$. the bullet at C is projected vertically upwards at velocity of $100m/s$. the bullet projected from A reaches its maximum height at O.



Find the elevation angle $\angle\theta = \angle OAC$:

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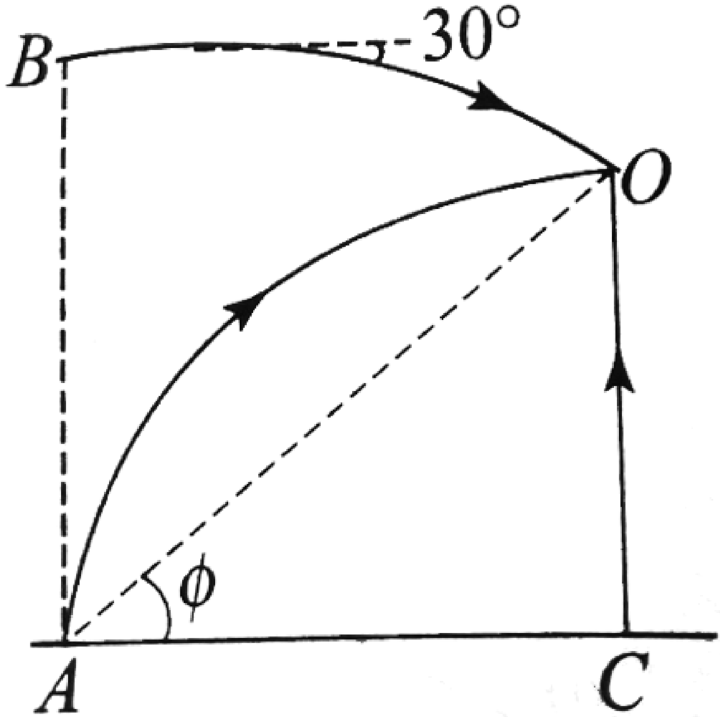
20. Points A and C are on the horizontal ground and A and B are in same vertical plane at a distance of $1500m$. Simultaneously bullets are fired from A, Bll and C and they collide at O. The bullets at B is fired at an angle of $30\,^{\circ}$ with horizontal towards the ground iat velocity $100m/s$. the bullet at C is projected vertically upwards at velocity of $100m/s$. the bullet projected from A reaches its maximum height at O.



Find the velocity of bullet at A:

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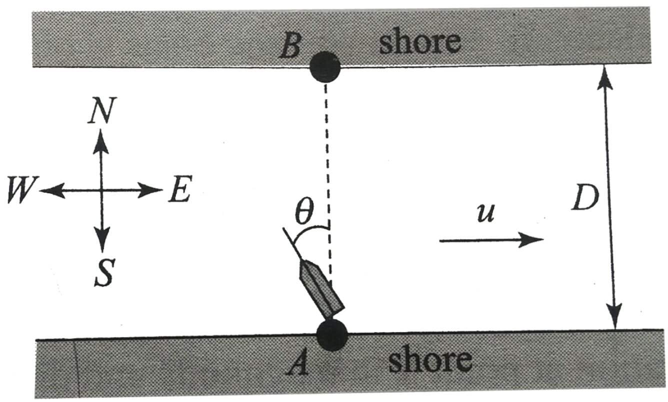
21.



Two ports, A and B, on a north-south line ar separated by a river of width D. The river flows east with speed u. A boat crosses the river starting from port A. The speed of the boat relative to the river is v. Assume

$v = 2u$

Q. What is the direction of the velocity of boat relative to river θ, sothat it crosses directly on a line from A to B?

A. 30° west of north

B. 30° east of north

C. 60° west of north

D. 60° east of north

Answer: B

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22.

Two ports, A and B, on a north-south line ar separated by a river of width D. The river flows east with speed u. A boat crosses the river starting from port A. The speed of the boat relative to the river is v. Assume

$v = 2u$

Q. Suppose the boat wants to cross the river from A to the other side in the shortest possible time. Then what should be the direction of the velocity of boat relative to river?

A. 30° west of north

B. 30° east of north

C. 60° west of north

D. along north

Answer: B

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23.

Two ports, A and B, on a north-south line ar separated by a river of width D. The river flows east with speed u. A boat crosses the river starting from port A. The speed of the boat relative to the river is v. Assume

$v = 2u$

Q. The boat crosses the river from A to the other side in shortest possible time, then how far is the boat from the port B after crossing the river

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

B. $\sqrt{2}D$

C. $2D$

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

Answer: D

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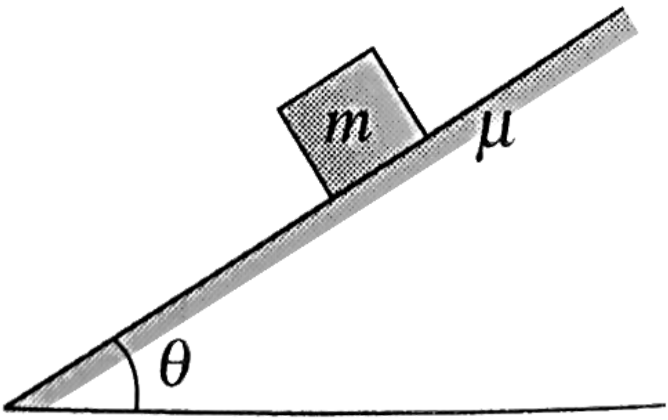
24. 

A block of mass m is placed on a rough inclined plane. The corfficient of friction between the block and the plane is μ and the inclination of the plane is θ.Initially $\theta = 0$ and the block will remain stationary on the plane. Now the inclination θ is gradually increased .

The block presses theinclined plane with a force $mg\cos\theta$. So welding strength between the block and inclined is $\mu mg\cos\theta$, and the pulling forces is $mg\sin\theta$. As soon as the pulling force is greater than the welding strength, the welding breaks and the blocks starts sliding, the angle θ for which the block start sliding is called angle of repose (λ). During the contact, two contact forces are acting between the block and the inclined plane. The pressing reaction (Normal reaction) and the shear reaction (frictional force). The net contact force will be resultant of both.

Answer the following questions based on above comprehension:

Q. If the entire system, were accelerated upward with acceleration a the angle of repose, would:

A. increase

B. decrease

C. remain same

D. increase if $a > g$

Answer: C

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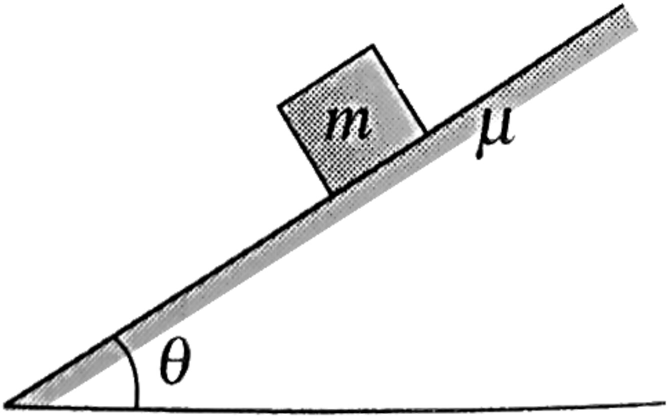
25. 

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Answer the following questions based on above comprehension:

Q. For what value of θ will the block slide on the inclined plane:

A. $\theta > \tan^{-1}\mu$

B. $\theta < \tan^{-1}\mu$

C. $\theta > \cot^{-1}\mu$

D. $\theta < \cot^{-1}\mu$

Answer: A

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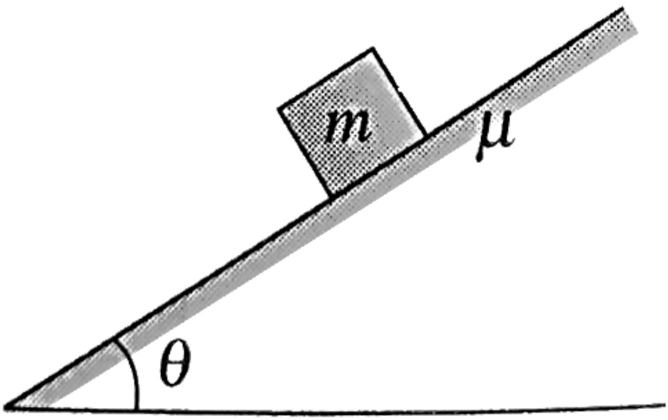
26. 

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Answer the following questions based on above comprehension:

Q. If $\mu = \frac{3}{4}$ then what will be frictional force (shear force) acting between the block and inclined plane when $\theta = 30^\circ$:

A. $\frac{3\sqrt{3}}{8}mg$

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

C. $\frac{\sqrt{3}}{2}mg$

D. zero

Answer: B

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27.

A block B is placed over a cart which in turn lies over a smooth horizontal floor. Block A and Block C are connected to block B with light inextensible strings passing over light frictionless pulleys fixed to the cart as shown. Initially the blocks and the cart are at rest. All the three blocks have mass m and the cart has mass $M(M = 3m)$. Now a constant horizontal force of magnitude F is applied to block A towards right.

Assuming friction to be absent everywhere, the magnitude of acceleration of cart at the shoen instant is

A. $\frac{F}{6m}$

B. (F)/(4m)`

C. $\dfrac{F}{3m}$

D. 0

Answer: D

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28.

A block B is placed over a cart which in turn lies over a smooth horizontal floor. Block A and Block C are connected to block B with light inextensible strings passing over light frictionless pulleys fixed to the cart as shown. Initially the blocks and the cart are at rest.

All the three blocks have mass m and the cart has mass $M(M = 3m)$. Now a constant horizontal force of magnitude F is applied to block A towards right.

Q. Taking friction to be absent every where the magnitude of tension in the string connecting block B and block C is

A. $\frac{F}{9}$

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

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

D. $\frac{2F}{3}$

Answer: C

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29.

A block B is placed over a cart which in turn lies over a smooth horizontal floor. Block A and Block C are connected to block B with light inextensible strings passing over light frictionless pulleys fixed to the cart as shown. Initially the blocks and the cart are at rest. All the three blocks have mass m and the cart has mass $M(M = 3m)$. Now a constant horizontal force of magnitude F is applied to block A towards right.

Q. Let the coefficient of friction between block B and cart is $\mu(\mu > 0)$ and friction is absent everywhere else. Then the maximum value of force F applied to block A such that there is no relative acceleration between block B and cart is

A. μmg

B. $2\mu mg$

C. $3\mu mg$

D. $4\mu mg$

Answer: B

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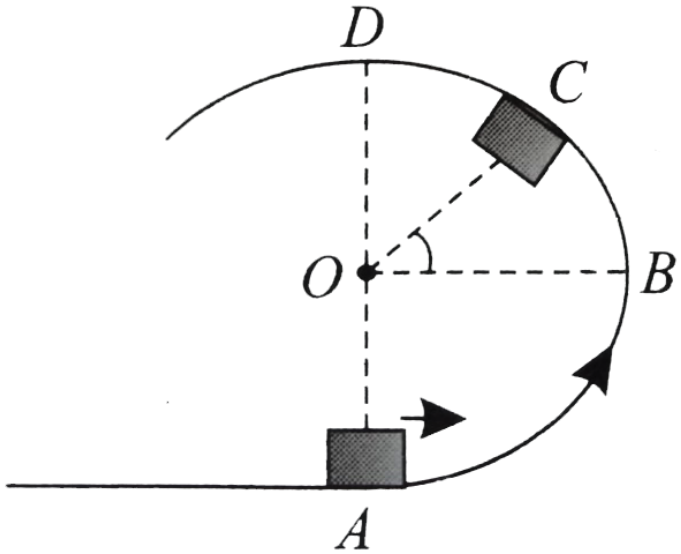
30.



A small block of mass m is pushed on a smooth track from position A with a velocity $\frac{2}{\sqrt{5}}$ times the minimum velocity required to reach point D. The block will leave the contact with track at the point where normal force between them becomes zero.

Q. When the block reaches the point B, what is the direction (in terms of angle with horizontal) of acceleration of the block?

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

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

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

D. The block never reaches point B.

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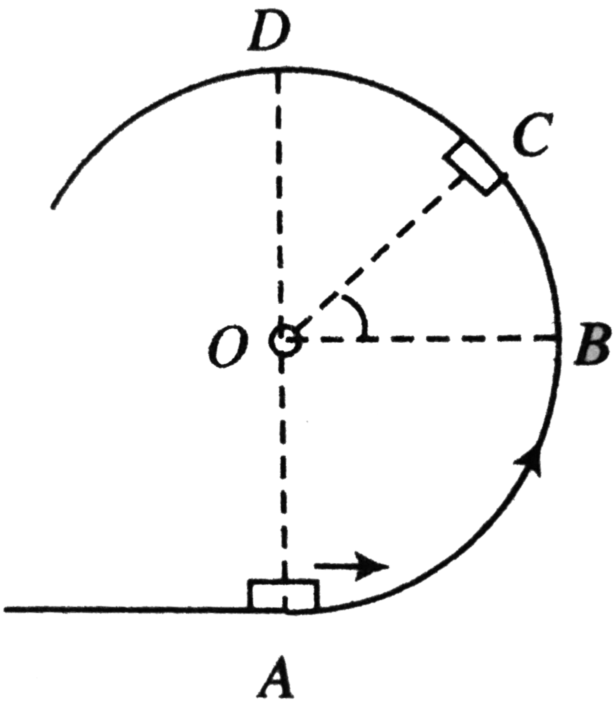
31. A small block of mass m is pushed on a smooth track from position A with a velocity $2\sqrt{5}$ times the minimum velocity required to reach point D. The block will leave the contact with track at the point where normal force between them becomes zero.



Find where the maximum contact force occurs between the block and the track.

A. at B

B. at C

C. somewhere between A and B

D. at A

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single correct type

1. $\frac{d}{dx}\left(\sqrt{x}+\frac{1}{\sqrt{x}}\right)^2=$

A. $1-\frac{1}{x^2}$

B. $1+\frac{1}{x^2}$

C. $1-\frac{1}{2x}$

D. none of these

Answer: A

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2. If $y = \frac{1}{a - z}$, show that $\frac{dz}{dy} = (z - a)^2$

A. $(z - a)^2$

B. $-(z - a)^2$

C. $(z + a)^2$

D. $-(z + a)^2$

Answer: A

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3. If $y = x\sin x$, then

A. $\frac{1}{y}\frac{dy}{dx} = \frac{1}{x} + \cot x$

B. $\frac{dy}{dx} = \frac{1}{x} + \cot x$

C. $\frac{1}{y}\frac{dy}{dx} = \frac{1}{x}$ - $\cot x$

D. none of these

Answer: A

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4. If $y = \cos\left(\sin x^2\right)$, then at $x = \sqrt{\frac{\pi}{2}}, \frac{dy}{dx} =$

A. -2

B. 2

C. $-2\sqrt{\frac{\pi}{2}}$

D. 0

Answer: D

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5. $f(x) = x^2 - 3x$,then the points at which $f(x) = f$ (x)` are

A. $1, 3$

B. $1, -3$

C. $-1, 3$

D. none of these

Answer: D

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6. If $f(x) = mx + c, f(0) = f'$ (0)=1$then$f(2)=`

A. 1

B. 2

C. 3

D. -3

Answer: C

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7. If $x = \sqrt{1 - y^2}$, then $\frac{dy}{dx} =$

A. 0

B. x

C. $\frac{\sqrt{1 - y^2}}{1 - 2y^2}$

D. $\frac{\sqrt{1 - y^2}}{1 + 2y^2}$

Answer: C

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8. If $f(x) = \sqrt{ax} + \frac{a^2}{\sqrt{ax}}$, then f (a)=`

A. -1

B. 1

C. 0

D. a

Answer: C

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9. If $x = \frac{1 - t^2}{1 + t^2}$ and $y = \frac{2at}{1 + t^2}$, then $\frac{dy}{dx} =$

A. $\dfrac{a\left(1-t^2\right)}{2t}$

B. $\dfrac{a\left(t^2-1\right)}{2t}$

C. $\dfrac{a\left(t^2+1\right)}{2t}$

D. $\dfrac{a\left(t^2-1\right)}{t}$

Answer: B

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10. If $x = \dfrac{1-t^2}{1+t^2}$ and $y = \dfrac{2t}{1+t^2}$,then $\dfrac{dy}{dx} =$

A. $\dfrac{-y}{x}$

B. $\frac{y}{x}$

C. $\frac{-x}{y}$

D. $\frac{x}{y}$

Answer: C

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11. If $x = at^2, y = at$, then $\frac{d^2y}{dx^2} =$

A. $-\frac{1}{t^2}$

B. $\frac{1}{2at^3}$

C. $-\frac{1}{t^3}$

D. $-\frac{1}{4at^3}$

Answer: D

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12.

If $x\sqrt{1+y}+y\sqrt{1+x}=0$, prove that $\frac{dy}{dx} = -\frac{1}{(x+1)^2}$.

A. $1+x$

B. $(1+x)^{-2}$

C. $-(1+x)^{-1}$

D. $-(1+x)^{-2}$

Answer: D

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13. If $x = 2\cos t - \cos 2t, y = 2\sin t - \sin 2t$, then at $t = \frac{\pi}{4}$, $\frac{dy}{dx} =$

A. $\sqrt{2} + 1$

B. $\sqrt{2 + 1}$

C. $\frac{\sqrt{2 + 1}}{2}$

D. none of these

Answer: A

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14. If $y = a\sin x + b\cos x, then y^2 + \left(\frac{dy}{dx}\right)^2$ is a function of x (b) function of y function of $x and y$ (d) constant

A. function of x

B. function of y

C. function x and y

D. constant

Answer: D

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