PHYSICS

BOOKS - NCERT PHYSICS (ENGLISH)

LAWS OF MOTION

Mutiple Choice Questions Mcqs

1. A ball is travelling with uniform translatory motion . This means that

A. it is at rest

B. the path can be straight line or circular and the ball travels with uniform speed

C. all parts of the ball have the same velocity (magnitude and direction) and the velocity is constant

D. the centre of the ball moves with constant velocity and the ball spins about its centre uniformly

Answer: C

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2. A metre scale is moving with uniform velocity . This implies

A. the force acting on the scale is zero , but a torque about the center of mass can act on the scale

B. the force acting on the scale is zero and the torque acting about center of mass of the scale is also zero

C. the total force acting on it need not be zero but the torque on it is zero

D. neither the force nor the torque need to be zero

Answer: B

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3. A cricket ball of mass 150 g has an intial velocity u = $\left(3\hat{i}+4\hat{j}\right)ms^{-1}$ and a final velocity $v = -\left(3\hat{i}+4\hat{j}\right)ms^{-1}$, after being

hit. The change in momentum (final momentum - initial momentum) is (in $Kgms^1$)

A. zero

B. $-\left(0.45\hat{i}+0.6\hat{j}\right)$

C. $-\left(0.9\hat{j}+1.2\hat{j}\right)$

D. $-5\left(\hat{i}+\hat{j}\right)\hat{i}$

Answer: C

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4. In the previous problem 3 the magnitude of the momentum transferred during the hit is .

A. zero

B. $0.75Kg - ms^{-1}$

C. $1.5kg - ms^{-1}$

D. $14kgms^{-1}$

Answer: C

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5. Conservation of momentum in a collision between particles can be understood from

A. conservation of energy

B. Newton's first law only

C. Newton's second law only

D. Both Newton's second and third law

Answer: D

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6. A hockey player is moving northward and suddenly turns westward with the same speed to avoid an opponet. The force that acts on the player is.

A. frictional force along westward

B. muscle force along southward

C. frictional force along south - West

D. muscle force along south-West

Answer: C

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7. A body of mass 2kg travels according to the law x(t) = $pt + qt^2 + rt^3$ where , q = $4ms^{-2}$, p = $3ms^{-1}$ and $r = 5ms^{-3}$. The force acting on the body at t = 2s is

A. 136 N

B. 134 N

C. 158 N

D. 68 N

Answer: A

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8. A body with mass 5 kg is acted upon by a force $\vec{F} = \left(-3\hat{i} + 4\hat{j}\right)N$. If its initial velocity at t =0 is $\vec{v} = \left(6\hat{i} - 12\hat{j}\right)ms^{-1}$, the time at which it will just have a velocity along the y-axis is :

A. never

B. 10 s

C. 2 s

D. 15 s

Answer: B

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9. A car of mass m starts from rest and acquires a velocity along east $v = v\hat{i}(v > 0)$ in two seconds Assuming the car moves with uniform acceleration the force exerted on the car is .

A. $\frac{mv}{2}$ eastward and is exerted by the car engine

B. $\frac{mv}{2}$ eastward and is due to the friction on the tyres exerted by the road

C. more than $\frac{mv}{2}$ eastward exerted due to the engine and overcomes the friction of the road

D. $\frac{mv}{2}$ exerted by the engine

Answer: B

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Mutiple Choice Questions More Than One Options

1. The equation of a tangent to the parabola $y^2 = 8xisy = x + 2$. The point on this line from which the other tangent to the parabola is perpendicular to the given tangent is (1) $(-1, 1)$ (2) $(0, 2)$ (3) $(2, 4)$ (4) $(-2, 0)$

A. The force at t = (1/8) s on the particle is

$$-16\pi^2 A - m$$

B. The particle is acted upon by on impulse of magnitude $4\pi^2 A - m$ at t = 0 s and t (1/4) 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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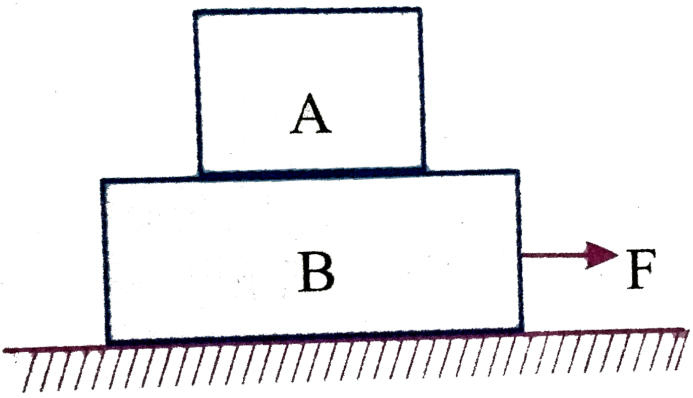
2. In the co-efficinet of friction between the floor and the body B is 0.1. The co-efficient of friction beteen the bodies B and A is 0.2 A fore F is applied as shown B The mass of A is $m/2$ and of B is m Which of the following statements are ture ?



A. The bodies will move together if F = 0.25 mg

B. The body A will slip with respect to B if F = 0.5 mg

C. The bodies will be rest if F = 0.1 mg

D. The maximum value of F for which the two bodies will move together is 0.45 mg

Answer: A::B::D

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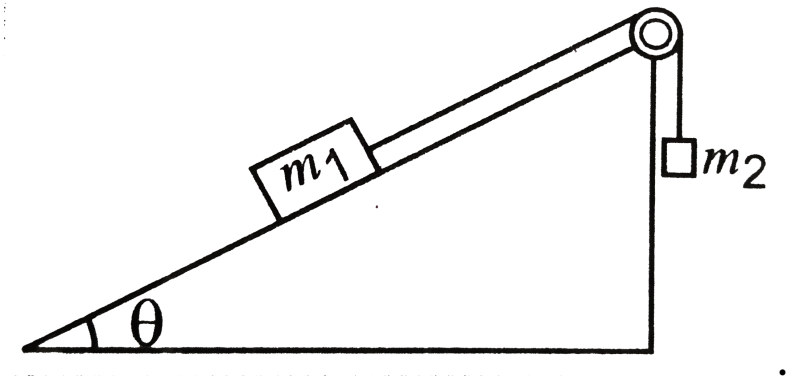
3. Mass m_1 moves on a slope making an angle θ with the horizontal and is attached to mass m_2 by a string passing over a frictionless pulley as shown in The co-efficient of friction between m_1 and the slopping surface is μ Which of the following statements are true ?



A. If $m_2 > m_1 \sin\theta$, the body will move up the plane

B. If $m_2 > m_1(\sin\theta + \mu\cos\theta)$, the body will move up the plane

C. If $m_2 < m_1(\sin\theta + \mu\cos\theta)$, the body will move up the plane

D. If $m_2 < m_1(\sin\theta - \mu\cos\theta)$, the body will move down the plane

Answer: B::D

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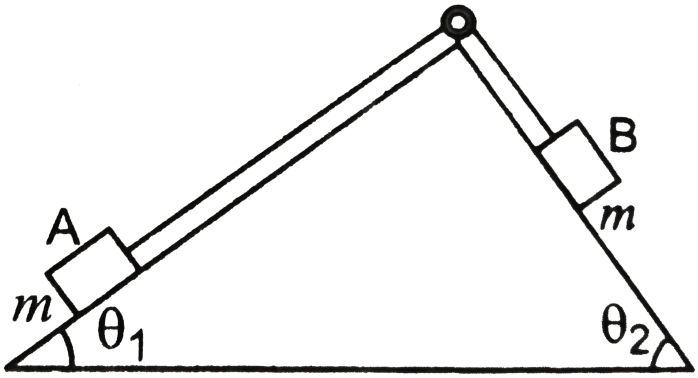
4. A body A of mass m slides on plane inclined at angle θ_0 to the horizontal and μ_1 is the coefficient of friction between A and the plane A is connected by a light string passing over a frictionless pulley to another body B also of mass m slidding on a frictionless plane inclined at angle θ_2 to the horizontal Which of

the following statements are ture ?



A. A will never move up the plane

B. A will just start moving up the plane when $\mu = \dfrac{\sin\theta_2 - \sin\theta_1}{\cos\theta_1}$

C. For A to move up the plane θ_2 , must always be greater than θ_1

D. B will always slide down with constant speed

Answer: B::C

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5. Two billiard balls A and B each of mass 50 g and moving in opposite directions with speed of $5m/s$ each, collide and rebound with the same speed if the collision lasts for 10^{-3} s

which of the following statement(s) is (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 $0.25kg - ms^{-1}$ and the force exerted on each ball is 25×10^{-5}N

C. The impulse imparted to each ball is 0.5 N-s

D. The impulse and the force on each ball are equal in magnitude and opposite directions

Answer: C::D

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6. A body of mass 10 kg is acted upon by two perpendicular forces , 6 N and 8 N . The resultant acceleration of the body is

A. $1ms^{-2}$ at an angle of $\tan^{-1}\left(\frac{3}{4}\right)$ w.r.t. 6 N force

B. $0.2ms^{-2}$ at an angle of $\tan^{-1}\left(\frac{4}{3}\right)$ w.r.t. 6 N force

C. $1ms^{-2}$ at an angle of $\tan^{-1}\left(\frac{3}{4}\right)$ w.r.t. 8 N force

D. 0.2 ms^{-2} at an angle of $\tan^{-1}\left(\frac{3}{4}\right)$ w.r.t. 8 N force

Answer: A::C

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Very Short Answer Type Questions

1. A girl ridding a bicycle along a straight road with a speed of $5ms^{-1}$ throws a stone of mass 0.5 kg which has a speed of $15ms^{-1}$ with respect to the ground along her direction of motion. The mass of the girl and bicycle is $50kg$. Does the speed of the bicycle change after the stone is thrown ? What is the change in speed, if so ?

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2. A person of mass 50 kg stands on a weighing scale on a lift . If the lift is descending with a downward acceleration of $9ms^{-2}$ what would be the reading of the weighing scale? $\left(g = 10ms^{-2}\right)$.

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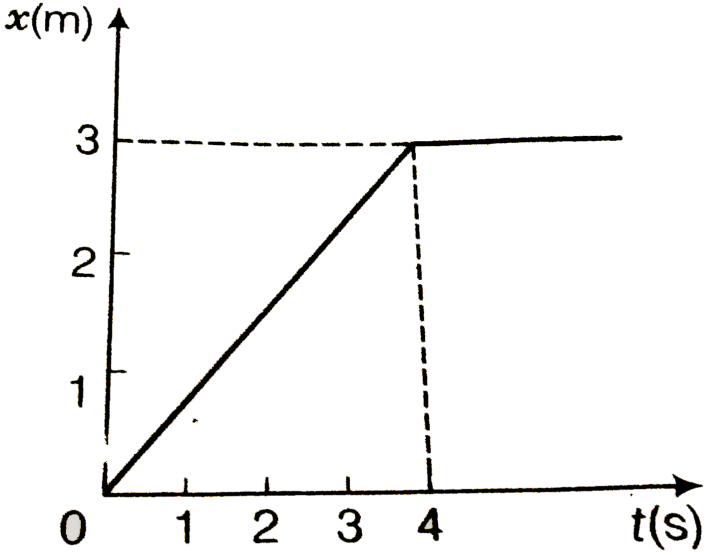
3. The position-time graph of a body of mass 2 kg is as given in figure . What is the impulse on

the body at t = 0 s and t = 4 s .



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4. A person driving a car suddenly applies the brakes on seeing a child on the road ahead . If he is not wearing seat belt, he falls forward

and hits his head against the steering weel. Why ?

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5. The velocity of a body of mass $2kg$ as a function of t is given by $v(t) = 2t\hat{i} + t^2\hat{j}$ Find the momentum and force acting on it at time $t = 2s.$

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6. A block placed on a rough horizontal surface is pulled by a horizontal force F Let f be the force applied by the rough surface on the block . Plot a graph of f versus F .

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7. Why are porcelain objects wrapped in paper or straw before packing for transportation ?

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8. Why does a child feel more pain when she falls down on a hard cement floor, than when she falls on the soft muddy ground in the garden ?

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9. A woman throws an object of mass 500 g with a speed of $25ms^{-1}$.

(a) What is the impulse imparted to the object ?

(b) If the object hitts a wall and rebounds with

the half the original speed , what is the change in momentum of the object ?

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10. Why are mountain roads generally made winding upwards rather than going straight up ?

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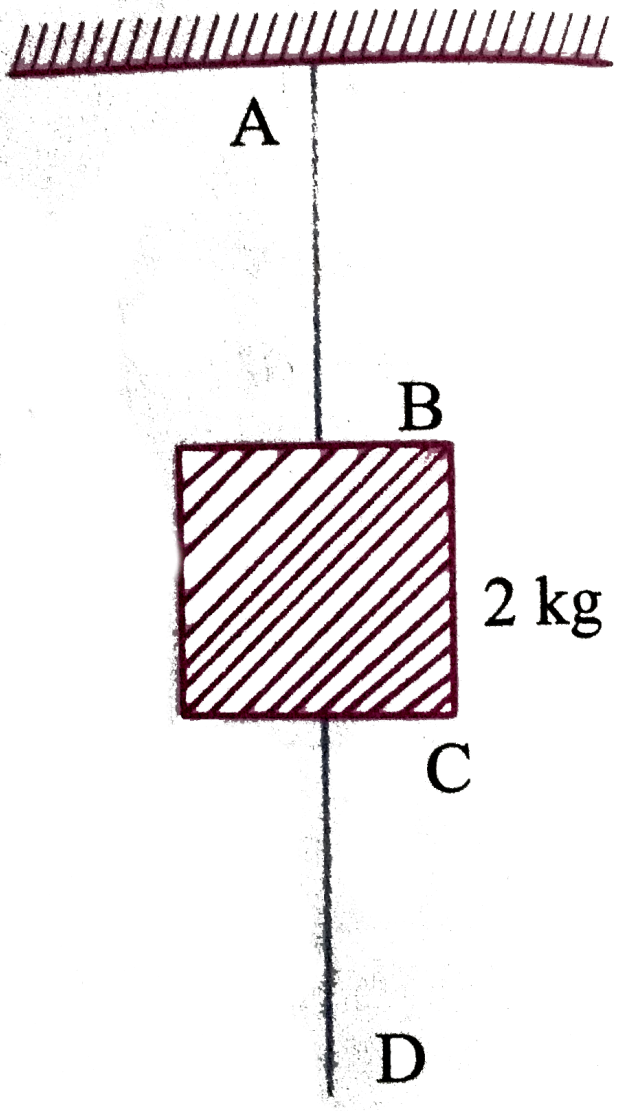
11. A mass of $2kg$ is suspended with thread AB (figure) Thread CD of the same type is attached to the other end of $2kg$ mass. Lower thread is pulled gradually, harder and harder in the downward gradually, harder and harder in the downward direction so as to apply force on AB. which of the threads will break and

why?



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12. In the above given problem if the lower thread is pulled with a jerk , what happens ?

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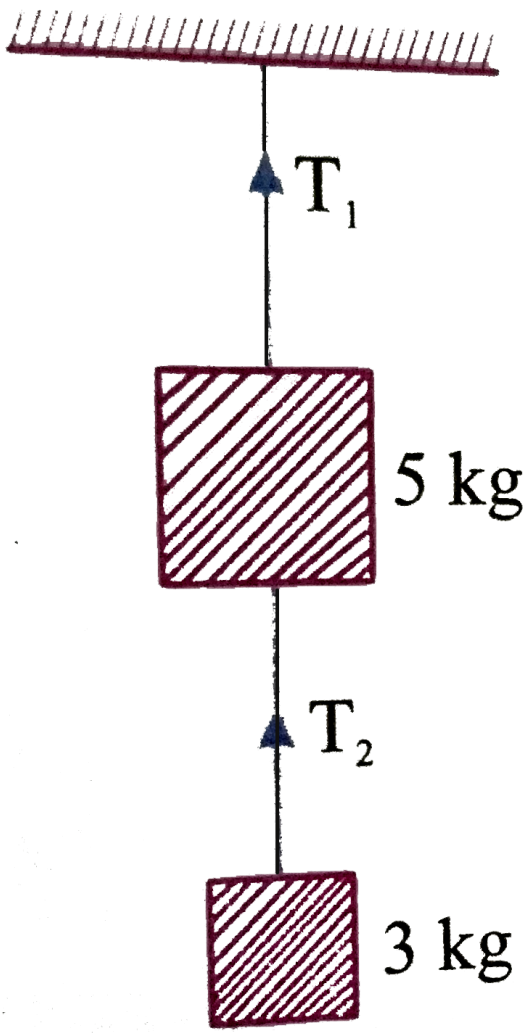
Short Answer Type Questions

1. Two masses of $5kg$ and $3kg$ are suspended with help of massless inextensible strings as shown in figure. Calculate T_1 and T_2 when whole system is going upwards with

acceleration $= 2m/s^2 \left(useg = 9.8ms^{-2}\right).$



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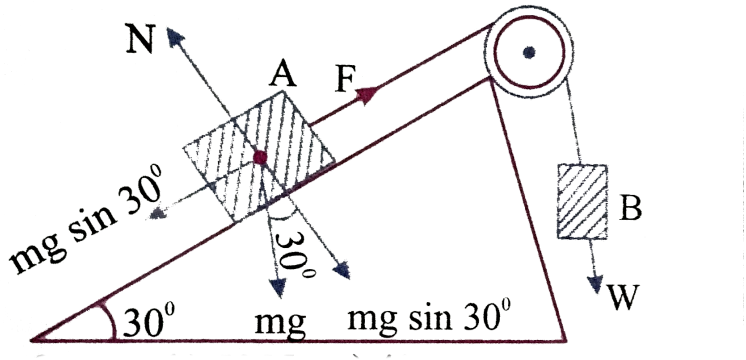
2. Block A of weight $100N$ rests on a frictionless inclined plane of slope angle 30° (Fig. 5.7). A flexible cord attached to A passes over a frictonless pulled and is connected to block B of weight W. Find the weight W for which the system in equilibrium.



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3. A block of mass M is held against a rough vertical wall by pressing it with a finger . If the coefficient of friction between the block and the wall is μ and the acceleration due to gravity is g , calculate the minimum force required to be applied by the finger to hold the block against the wall.

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4. a 100kg gun fires a ball of 1kg horizontally from a cliff of height 500m. If falls on the

ground at a distance of 400m from the bottom of the cliff. The recoil velocity of the gun is (Take g: $10ms^{-2}$

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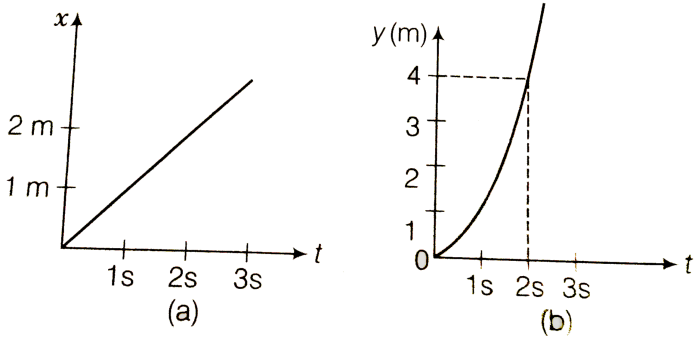
5. Figure shows (x,t) (y,t) diagram of a particle moving in 2-dimensions.



If the particle has a mass of 500 g , find the

force (direction and magnitude) acting on the particle .

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6. A person in an elevator accelerating upwards with an acceleration of $2ms^{-2}$, tosses a coin vertically upwards with a speed of $20ms^{-1}$. After how much time will the coin fall back into his hand ? (g = 10 ms^{-2})

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Long Answer Type Questions

1. There are three forces F_1, F_2 and F_3 acting on a body , all acting on a point P on the body . The body is found to move with uniform speed.

(a) Show that the forces are coplanar.

(b) Show that the torque acting on the body about any point due to these three forces is zero.

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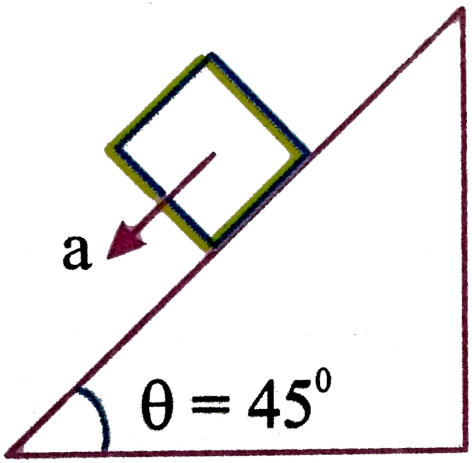
2. When body slides down from rest along smooth inclined plane making angle of 45° with the horizontal, it takes time T When the same body slides down from rest along a rough inclined plane making the same angle and through the same distance it is seen to take time pT, where p is some number greater that 1. Calculate late the coefficient of friction

beween the body and the rough plane.



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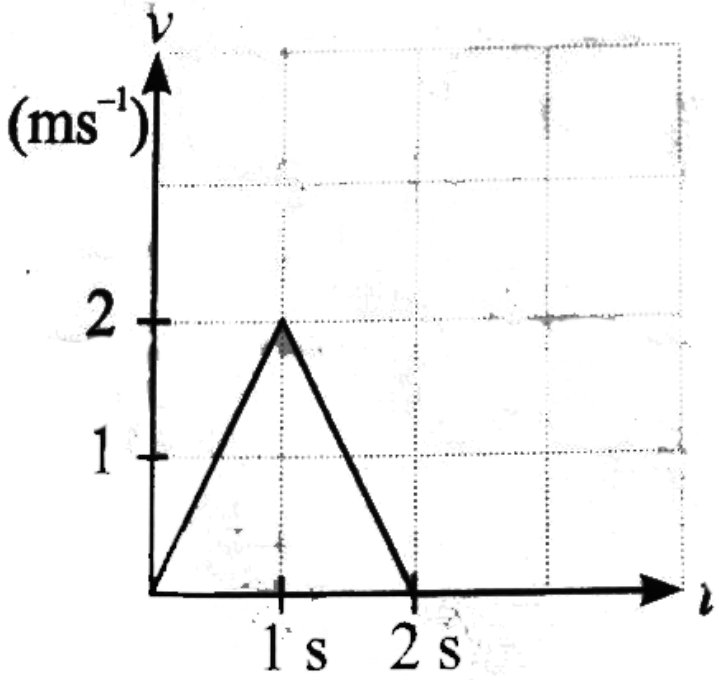
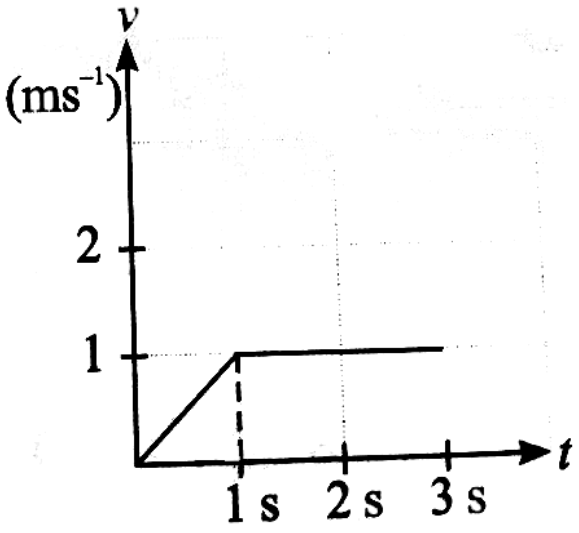
3.



(a)



(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.

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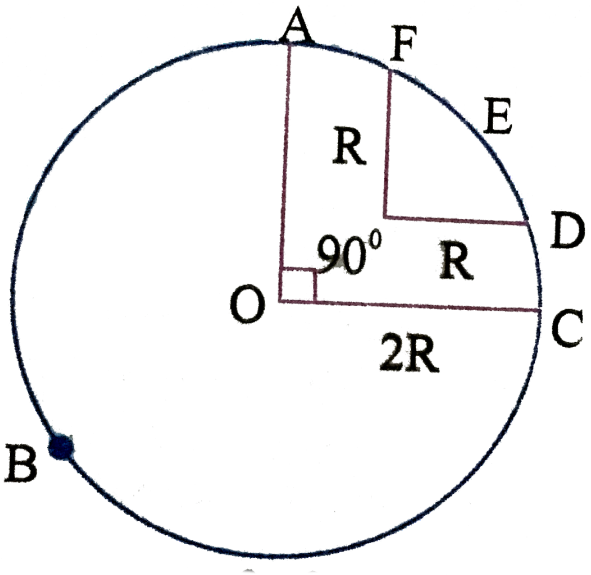
4. A racing car travels on a track (without banking) $ABCDEFA.ABC$ is a circular arc of radius $2R$. CD and FA are straight paths of length R and DEF is a circular arc of radius $R = 100m$. The co-efficient of friction on the road is ¼ $= 0.1$. the maximum speed of the

car is $50ms - 1$. Find the minimum time for completing one round.



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5. The displacement vector of a particle of mass m is given by r (t) =

$\hat{i}A\cos\omega t + \hat{j}B\sin\omega t.$

(a) Show that the trajectory is an ellipse.

(b) Show that F = $-m\omega^2 r.$

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6. A cricket bowler releases the ball in two different ways

(a) giving it only horizontal velocity and

(b) giving it horizontal velocity and a small downward velocity.

The speed v_s at the time of release is the same

. Both are released at a height H from the ground . which one will have greater speed when the ball hits the ground ? Neglect air resistance .

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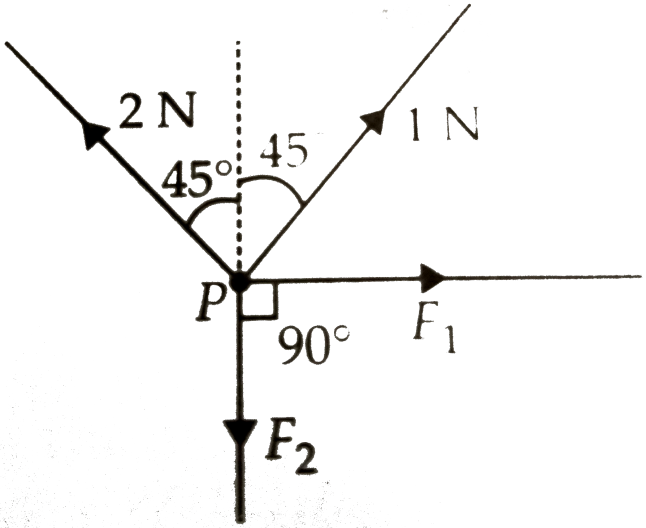
7. There are four forces ,acting at a point P produced by strings as shown in figure. which

is at rest. The forces F_1 and F_2 are



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8. A rectangular box lies on a rough inclined surface . The coefficient of friction between the surface and the box is μ. Let the mass of

the box be m .

(a) At what angle of inclination θ of the plane to the horizontal will the box just start to slide down the plane ?

(b) What is the force acting on the box down the plane , if the angle of inclination of the plane is increased to $\alpha > \theta$?

(c) What is the force needed to be applied upwards along the plane to make the box either remain stationary or just move up with uniform speed ?

(d) What is the force needed to be applied

upwards along the plane to make the box move up the plane with acceleration a ?

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9. A helicopter of mass 2000 kg rises with a vertical acceleration of $15ms^{-2}$. The total mass of the crew and passengers is 500 kg. Give the magnitude and direction of the (g $= 10ms^{-2}$)

(a) Force on the floor of the helicopter by the crew and passengers.

(b) action of the rotor of the helicopter on the surrounding air.

(c) force on the helicopter dur to the surrounding air.

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