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# **PYQs on MECHANICS (2014-2024)**

A passenger in a moving train tosses a coin upward which falls behind him. It implies that the motion of the train is

- (a) accelerated
- (b) uniform
- (c) retarded
- (d) along the circular tracks





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If the distance  $S$  covered by a moving car in rectilinear motion with a speed  $v$  in time  $t$  is given by  $S = vt$ , then the car undergoes

- (a) a uniform acceleration
- (b) a non-uniform acceleration
- (c) a uniform velocity
- (d) a non-uniform velocity



**Statement I :** A body weighs less on a hill top than on earth's surface even though its mass remains unchanged.

**Statement II :** The acceleration due to gravity of the earth decreases with height.

- (a) Both the statements are individually true and Statement II is the correct explanation of Statement I
- (b) Both the statements are individually true but Statement II is *not* the correct explanation of Statement I
- (c) Statement I is true but Statement II is false
- (d) Statement I is false but Statement II is true



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The displacement-time graph of a particle acted upon by a constant force is

- (a) a straight line
- (b) a circle
- (c) a parabola
- (d) any curve depending upon initial conditions



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When the sun is  $30^\circ$  above the horizon, shadow of one tree is 17.3 m long. What is the height of this tree ?

- (a) 20 m
- (b) 17.30 m
- (c) 10m
- (d) 1.73 m





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The impulse on a particle due to a force acting on it during a given time interval is equal to the change in its

- (a) force
- (b) momentum
- (c) work done
- (d) energy



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A man weighing 70 kg is coming down in a lift. If the cable of the lift breaks suddenly, the weight of the man would become

- (a) 70 kg
- (b) 35 kg
- (c) 140 kg
- (d) Zero



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A racing car accelerates on a straight road from rest to a speed of 50 m/s in 25 s. Assuming uniform acceleration of the car throughout, the distance covered in this time will be

- (a) 625 m
- (b) 1250 m
- (c) 2500 m
- (d) 50 m



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The S.I. unit of acceleration is

- (a)  $\text{ms}^{-1}$
- (b)  $\text{ms}^{-2}$
- (c)  $\text{cms}^{-2}$
- (d)  $\text{kms}^{-2}$



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Two bodies A and B are moving with equal velocities. The mass of B is double that of A. In this context, which one of the following statements is correct ?

- (a) Momentum of B will be double that of A.
- (b) Momentum of A will be double that of B.
- (c) Momentum of B will be four times that of A.
- (d) Momenta of both A and B will be equal.



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A body has a free fall from a height of 20 m. After falling through a distance of 5 m, the body would

- (a) lose one-fourth of its total energy
- (b) lose one-fourth of its potential energy
- (c) gain one-fourth of its potential energy
- (d) gain three-fourth of its total energy



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Suppose the force of gravitation between two bodies of equal masses is  $F$ . If each mass is doubled keeping the distance of separation between them unchanged, the force would become

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



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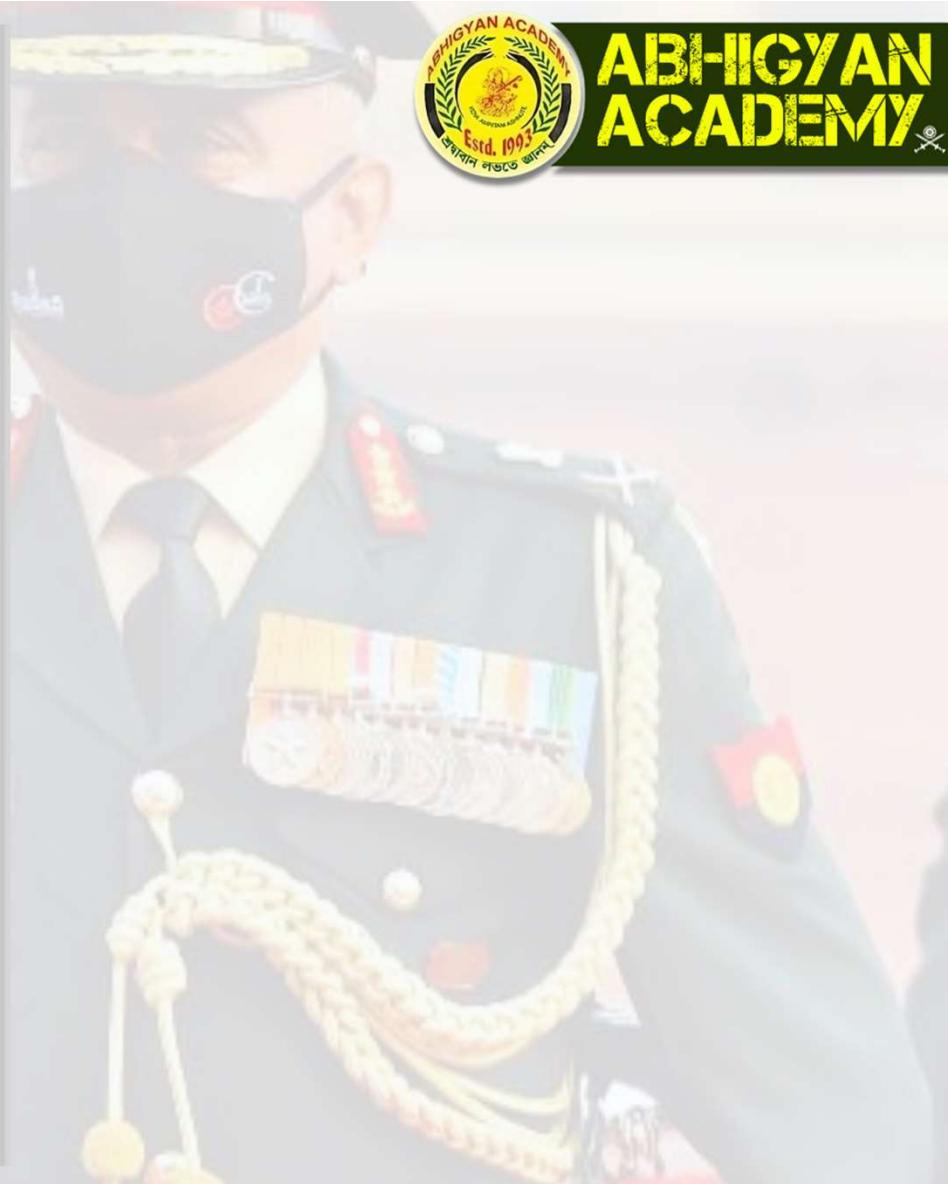
Which one of the following is an example of the force of gravity of the earth acting on a vibrating pendulum bob ?

- (a) Applied force
- (b) Frictional force
- (c) Restoring force
- (d) Virtual force



i. An object is moving with uniform acceleration  $a$ . Its initial velocity is  $u$  and after time  $t$  its velocity is  $v$ . The equation of its motion is  $v = u + at$ . The velocity (along y-axis) time (along x-axis) graph shall be a straight line

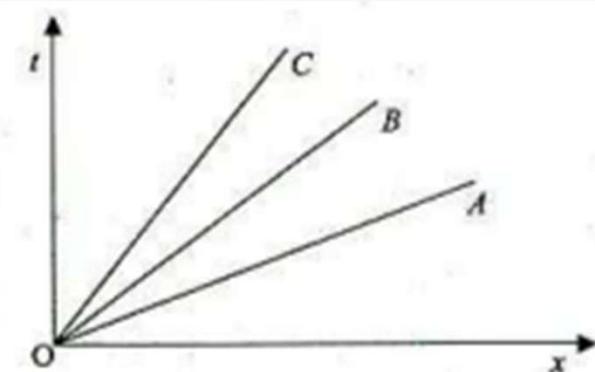
- (a) passing through origin
- (b) with x-intercept  $u$
- (c) with y-intercept  $u$
- (d) with slope  $u$



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The figure shown above gives the time ( $t$ ) versus position ( $x$ ) graphs of three objects  $A$ ,  $B$  and  $C$ . Which one of the following is the correct relation between their speeds  $V_A$ ,  $V_B$  and  $V_C$ , respectively at any instant ( $t > 0$ )?

- (a)  $V_A < V_B < V_C$
- (b)  $V_A > V_B > V_C$
- (c)  $V_A = V_B = V_C \neq 0$
- (d)  $V_A = V_B = V_C = 0$



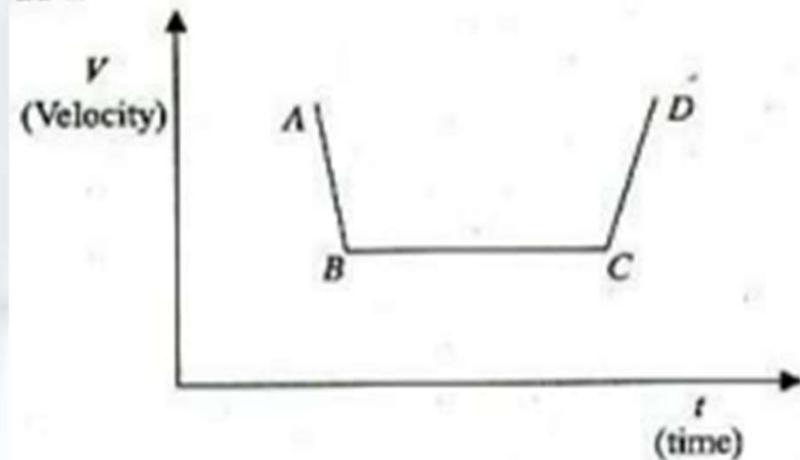


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1 dyne (a unit of force in CGS system)  
equals to

- (a)  $10^3 \text{ g cm/s}^2$
- (b)  $10^{-3} \text{ g cm/s}^2$
- (c)  $10^5 \text{ kg m/s}^2$
- (d)  $10^{-5} \text{ kg m/s}^2$

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In the given velocity ( $V$ ) versus time ( $t$ ) graph, accelerated and decelerated motions are respectively represented by line segments

- (a)  $CD$  and  $BC$
- (b)  $BC$  and  $AB$
- (c)  $CD$  and  $AB$
- (d)  $AB$  and  $CD$



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Two forces of 5·0 N each are acting on a point mass. If the angle between the forces is  $60^\circ$ , then the net force acting on the point mass has magnitude close to :

- (a) 8·6 N
- (b) 4·3 N
- (c) 5·0 N
- (d) 6·7 N



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A particle is moving with uniform acceleration along a straight line  $ABC$ , where  $AB = BC$ . The average velocity of the particle from  $A$  to  $B$  is  $10 \text{ m/s}$  and from  $B$  to  $C$  is  $15 \text{ m/s}$ . The average velocity for the whole journey from  $A$  to  $C$  in  $\text{m/s}$  is

- (a) 12
- (b) 12.5
- (c) 13
- (d) 13.5



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A bullet is fired vertically up from a 400 m tall tower with a speed 80 m/s. If  $g$  is taken as  $10 \text{ m/s}^2$ , the time taken by the bullet to reach the ground will be

- (a) 8 s
- (b) 16 s
- (c) 20 s
- (d) 24 s



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A cyclotron accelerates particles of mass  $m$  and charge  $q$ . The energy of particles emerging is proportional to

- (a)  $q^2 / m$
- (b)  $q / m^2$
- (c)  $q^2 / m^2$
- (d)  $q$



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If the length of the Equator is about 40000 km and the velocity of rotation is about 1700 km per hour, what would be the velocity of rotation at the Pole?

- (a) Zero
- (b) 850 km/hr
- (c) 1700 km/hr
- (d) 3400 km/hr





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Two cars  $A$  and  $B$  have masses  $m_A$  and  $m_B$  respectively, with  $m_A > m_B$ . Both the cars are moving in the same direction with equal kinetic energy. If equal braking force is applied on both, then before coming to rest

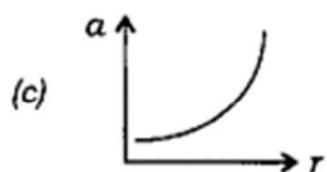
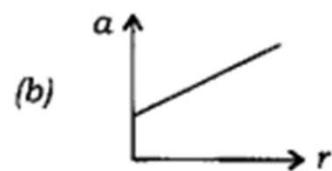
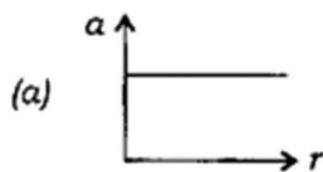
- (a)  $A$  will cover a greater distance
- (b)  $B$  will cover a greater distance
- (c) both will cover the same distance
- (d) distance covered by them will depend on their respective velocities





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99. A particle is moving in a circular path of radius  $r$  at a constant speed  $v$ . Which one of the following graphs correctly represents its acceleration  $a$ ?





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- A force applied on a body is represented as

$$\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$$

and accelerates it at  $1 \text{ m/s}^2$ . The mass of the body is

- (a)  $10 \text{ kg}$
- (b)  $10\sqrt{2} \text{ kg}$
- (c)  $2\sqrt{10} \text{ kg}$
- (d)  $8 \text{ kg}$





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Two bodies  $A$  and  $B$  having masses  $m$  and  $4m$  respectively are moving with equal linear momentum. The ratio of kinetic energies between  $A$  and  $B$  is

- (a) 1 : 4
- (b) 4 : 1
- (c) 1 : 1
- (d) 1 : 2



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- If the motion of an object is represented by a straight line parallel to the time axis in a distance-time graph, then the object undergoes
- (a) an accelerated motion
  - (b) a decelerated motion
  - (c) a uniform non-zero velocity motion
  - (d) a zero velocity motion





**Statement I :**

A body moving in a circular path is acted upon by the centripetal force.

**Statement II :**

Centripetal force acting on the body is doing work to keep it rotating in the circular path.

*Code :*

- (a) Both the statements are individually true and Statement II is the correct explanation of Statement I
- (b) Both the statements are individually true but Statement II is **not** the correct explanation of Statement I
- (c) Statement I is true but Statement II is false
- (d) Statement I is false but Statement II is true

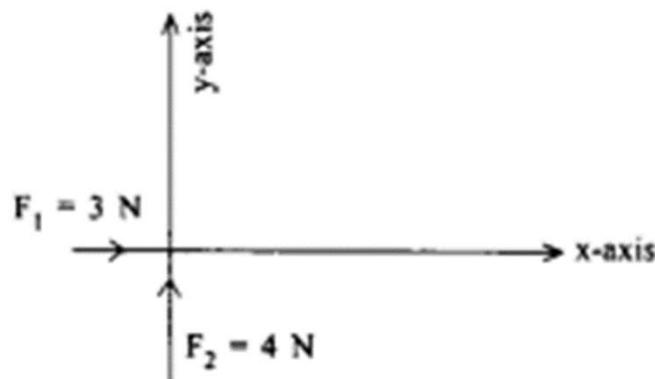


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4. In SI unit of force 'Newton' (N) is given by (where m stands for metre and s stands for second):

- (a)  $1 \text{ N} = 1 \text{ kg/ms}^2$
- (b)  $1 \text{ N} = 1 \text{ kgm/s}^2$
- (c)  $1 \text{ N} = 1 \text{ kg s}^2/\text{m}$
- (d)  $1 \text{ N} = 1 \text{ kg m s}^2$

1. Two forces, one of 3 newton and another of 4 newton are applied on a standard 1 kg body, placed on a horizontal and frictionless surface, simultaneously along the x-axis and the y-axis, respectively, as shown below:



The magnitude of the resultant acceleration is:

- (a)  $7 \text{ m/s}^2$
- (b)  $1 \text{ m/s}^2$
- (c)  $5 \text{ m/s}^2$
- (d)  $\sqrt{7} \text{ m/s}^2$





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Conservation of momentum in a collision between particles can be understood on the basis of:

- (a) Newton's first law of motion
- (b) Newton's second law of motion only
- (c) Both Newton's second law of motion and Newton's third law of motion
- (d) Conservation of energy



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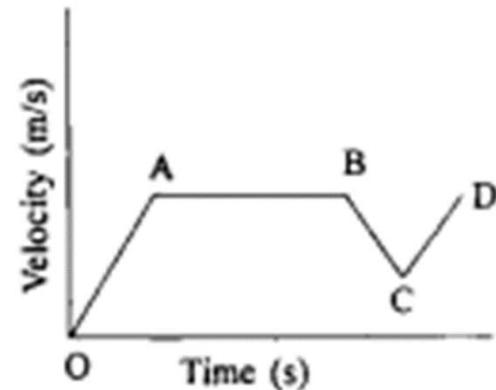
A man is sitting in a train which is moving with a velocity of 60 km/hour. His speed with respect to the train is:

- (a)  $10/3$  m/s
- (b) 60 m/s
- (c) infinite
- (d) zero



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- The following figure represents the velocity-time graph of a moving car on a road:



Which segment of the graph represents the retardation?

- (a) AB
- (b) BC
- (c) CD
- (d) None



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Which one of the following statements is *not* correct?

- (a) If the velocity and acceleration have opposite sign, the object is slowing down
- (b) If the velocity is zero at an instant, the acceleration should also be zero at that instant
- (c) If the velocity is zero for a time interval; the acceleration is zero at any instant within the time interval
- (d) If the position and velocity have opposite sign, the object is moving towards the origin

A brass ball is tied to a thin wire and swung so as to move uniformly in a horizontal circle. Which of the following statements in this regard is / are true?

1. The ball moves with constant velocity
2. The ball moves with constant speed
3. The ball moves with constant acceleration
4. The magnitude of the acceleration of the ball is constant

Select the correct answer using the code given below:

- (a) 1 only
- (b) 1 and 3
- (c) 1, 2 and 4
- (d) 2 and 4 only



- . Two balls,  $A$  and  $B$ , are thrown simultaneously,  $A$  vertically upward with a speed of  $20 \text{ m/s}$  from the ground and  $B$  vertically downward from a height of  $40 \text{ m}$  with the same speed and along the same line of motion. At what points do the two balls collide by taking acceleration due to gravity as  $9.8 \text{ m/s}^2$ ?
- (a) The balls will collide after  $3\text{s}$  at a height of  $30.2 \text{ m}$  from the ground
  - (b) The balls will collide after  $2\text{s}$  at a height of  $20.1 \text{ m}$  from the ground
  - (c) The balls will collide after  $1\text{s}$  at a height of  $15.1 \text{ m}$  from the ground
  - (d) The balls will collide after  $5\text{s}$  at a height of  $20 \text{ m}$  from the ground



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- i. Which one of the following four particles, whose displacement  $x$  and acceleration  $a_x$  are related as follows, is executing simple harmonic motion ?
- (a)  $a_x = + 3x$
  - (b)  $a_x = + 3x^2$
  - (c)  $a_x = - 3x^2$
  - (d)  $a_x = - 3x$



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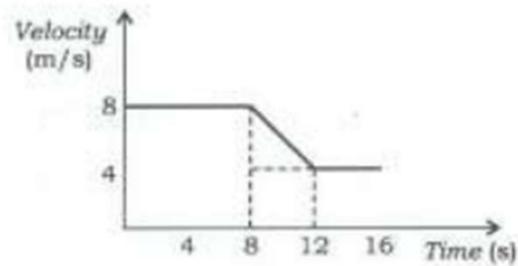
1. When a force of 1 newton acts on a mass of 1 kg which is able to move freely, the object moves in the direction of force with a/an
- (a) speed of 1 km/s
  - (b) acceleration of  $1 \text{ m/s}^2$
  - (c) speed of 1 m/s
  - (d) acceleration of  $1 \text{ km/s}^2$



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3. A ball is thrown vertically upward from the ground with a speed of  $25.2 \text{ m/s}$ . The ball will reach the highest point of its journey in
- (a)  $5.14 \text{ s}$
  - (b)  $3.57 \text{ s}$
  - (c)  $2.57 \text{ s}$
  - (d)  $1.29 \text{ s}$

- Consider the following velocity and time graph :



Which one of the following is the value of average acceleration from 8 s to 12 s?

(a)  $8 \text{ m/s}^2$

(b)  $12 \text{ m/s}^2$

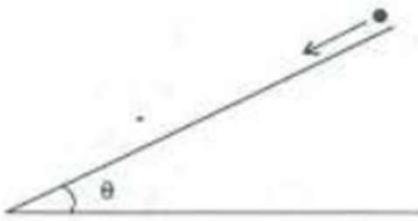
(c)  $2 \text{ m/s}^2$

(d)  $-1 \text{ m/s}^2$



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1. A ball is released from rest and rolls down an inclined plane, as shown in the following figure, requiring 4 s to cover a distance of 100 cm along the plane :



Which one of the following is the correct value of angle  $\theta$  that the plane makes with the horizontal? ( $g = 1000 \text{ cm/s}^2$ )

(a)  $\theta = \sin^{-1}(1/9.8)$

(b)  $\theta = \sin^{-1}(1/20)$

(c)  $\theta = \sin^{-1}(1/80)$

(d)  $\theta = \sin^{-1}(1/100)$



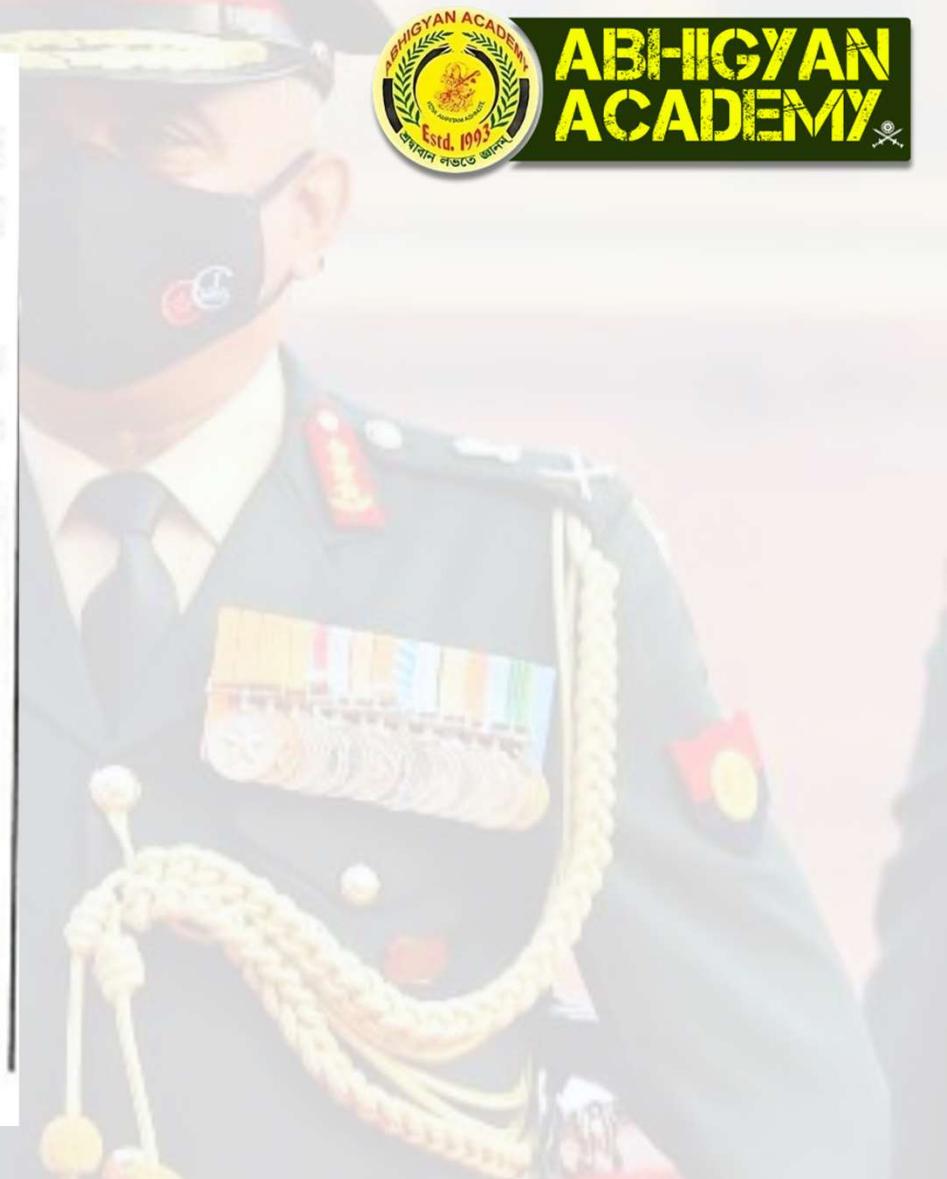
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An object moves in a circular path with a constant speed. Which one of the following statements is correct ?

- (a) The centripetal acceleration of the object is smaller for a gentle curve (i.e., curve of larger radius) than that for a sharp curve (i.e., curve of smaller radius).
- (b) The centripetal acceleration is greater for a gentle curve than that for a sharp curve.
- (c) The centripetal acceleration is the same for both, the gentle and sharp curves.
- (d) The centripetal acceleration causes the object to slow down.





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A tennis ball is thrown in the vertically upward direction and the ball attains a maximum height of 20 m. The ball was thrown approximately with an upward velocity of

- (a) 8 m/s
- (b) 12 m/s
- (c) 16 m/s
- (d) 20 m/s



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