PHYSICS

BOOKS - CENGAGE PHYSICS (ENGLISH)

MISCELLANEOUS KINEMATICS

Single Correct Answer Type

1. A particle is moving along the x-axis whose acceleration is given by $a = 3x - 4$, where x is the location of the particle. At t = 0, the particle

is at rest at $x = 4/3m$. The distance travelled by the particles in 5 s is

A. zero

B. 42 m

C. Infinite

D. None of these

Answer: A

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2. A point moves such that its displacement as a function of time is given by $x^3 = t^3 + 1$. Its acceleration as a function of time t will be

A. $\frac{2}{x^5}$

B. $\frac{2t}{x^5}$

C. $\frac{2t}{x^4}$

D. $\frac{2t^2}{x^5}$

Answer: B

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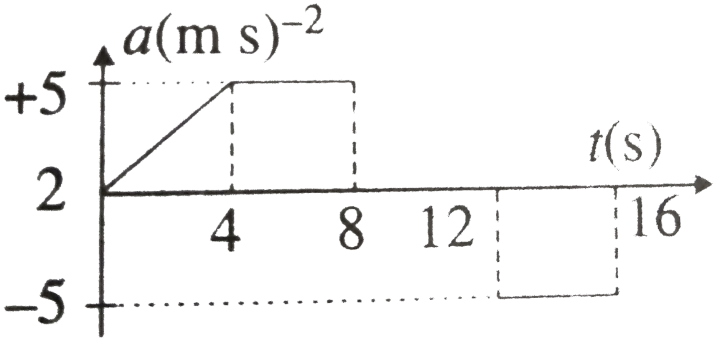
3. The acceleration of a particle starting from rest and travelling along a straight line is shown in figure. The maximum speed of the particle is



A. $20ms^{-1}$

B. $30ms^{-1}$

C. $40ms^{-1}$

D. $60ms^{-1}$

Answer: B

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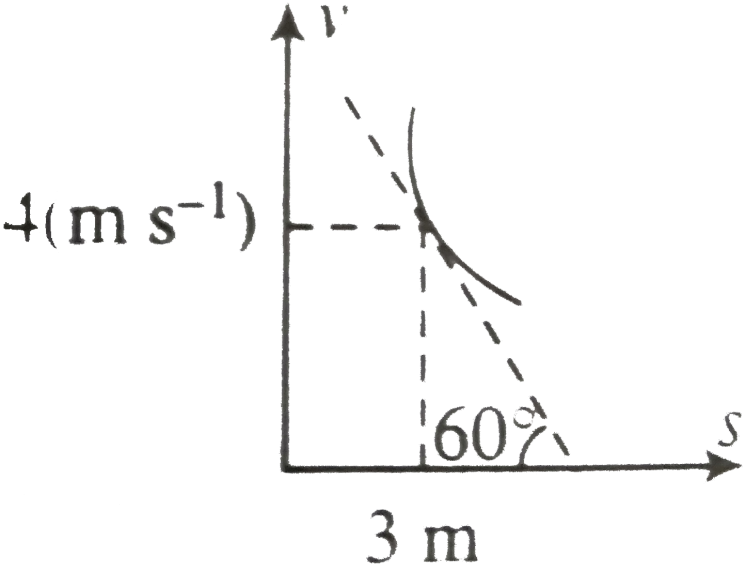
4. A particle is moving along a straight line whose velocity - displacement graph is shown in figure. What is the acceleration when

displacement is 3 m?



A. $-4\sqrt{3}ms^{-2}$

B. $3\sqrt{3}ms^{-2}$

C. $\sqrt{3}ms^{-2}$

D. $4/\sqrt{3}ms^{-2}$

Answer: A

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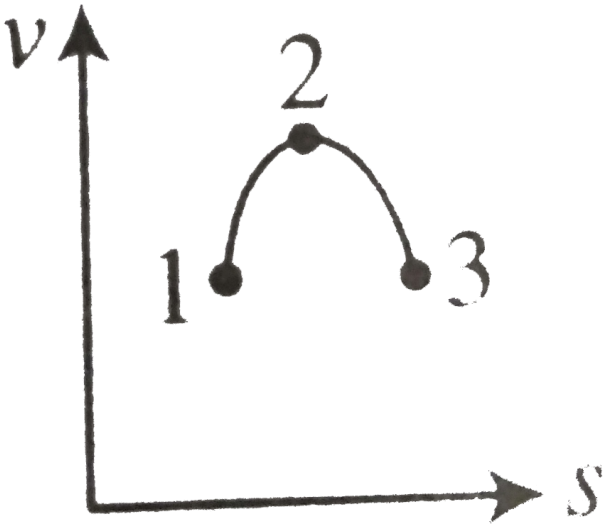
5. Figure shows the velocity-displacement curve for an object moving along a straight line. At which of the points marked is the object

speeding up?



A. 1

B. 2

C. 1 and 3

D. 1,2, and 3

Answer: A

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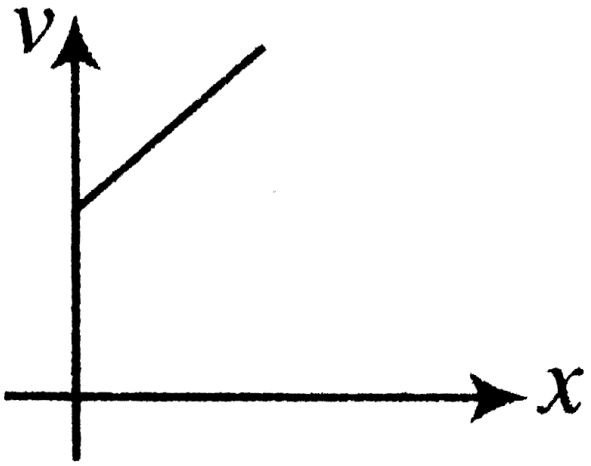
6. Velocity versus displacement graph of a particle moving in a straight line as shown in figure.



The acceleration of the particle.

A. is constant

B. increases linearly with x

C. increases parabolically with x

D. None of these

Answer: B

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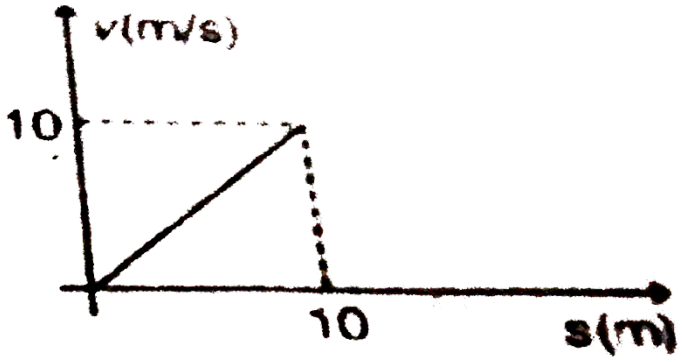
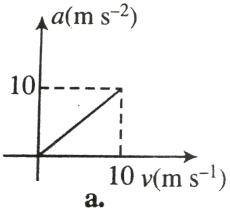
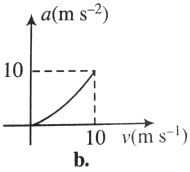
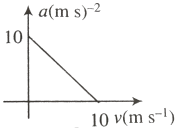
7. Velocity versus displacement graph of a particle moving in a straight line is as shown in figure. Corresponding acceleration verseus velocity graph will be



A. 

B. 

C.

D. 

Answer: A

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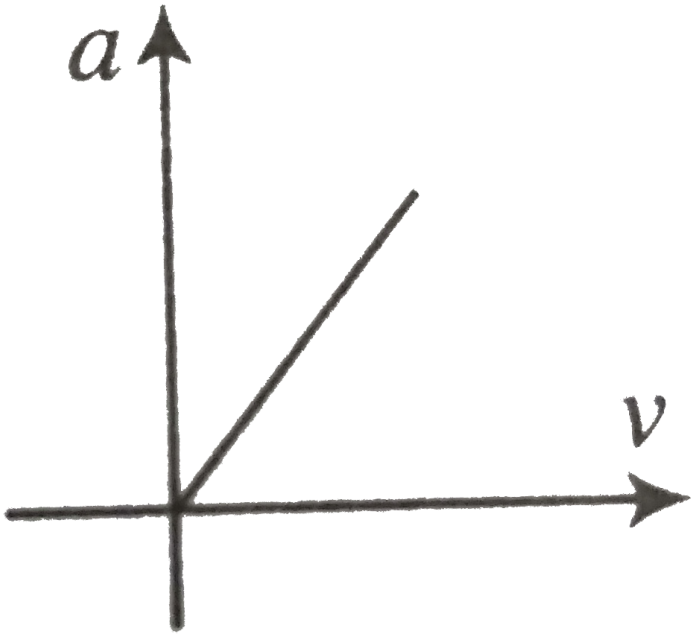
8. The acceleration - velocity graph of a particle moving in a straight line is shown in figure. Then the slope of the velocity- displacement graph



A. increases linearly

B. decreases linearly

C. is constant

D. increases parabolically

Answer: C

9. A particle starts moving rectilinearly at time $t = 0$ such that its velocity v changes with time t according to the equation $v = t^2 - t$, where t is in seconds and v in ms^{-1}. Find the time interval for which the particle retards.

A. $t < 1/2$

B. $1/2 < t < 1$

C. $t > 1$

D. $t < 1/2$ and $t > 1$

Answer: B

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10. An object is moving in the x-y plane with the position as a function of time given by

$\overrightarrow{r} = x(t)\hat{i} + y(t)\hat{j}$. Point O is at $x = 0, y = 0$.

The object is definitely moving towards O when

A. $v_x > 0, v_y > 0$

B. $v_x < 0, v_y < 0$

C. $xv_x + yv_y < 0$

D. $xv_x + yv_y > 0$

Answer: C

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11. An object has velocity $\overrightarrow{v}_1$ w.r.t. ground. An observer moving with constant velocity $\overrightarrow{v}_0$ w.r.t. ground measures the velocity of the object as $\overrightarrow{v}_2$. The magnitudes of three velocities are related by

A. $v_0 \geq v_1 + v_2$

B. $v_1 \leq v_2 + v_0$

C. $v_2 \geq v_1 + v_0$

D. All of the above

Answer: B

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12. A man swimming downstream overcomes a float at a point M. After travelling distance D,he turned back and passed the float at a distance of $D/2$ from the point M. Then the ratio of speed of swimmer with respect to still water to the speed of the river will be

A. 1

B. 2

C. 4

D. 3

Answer: D

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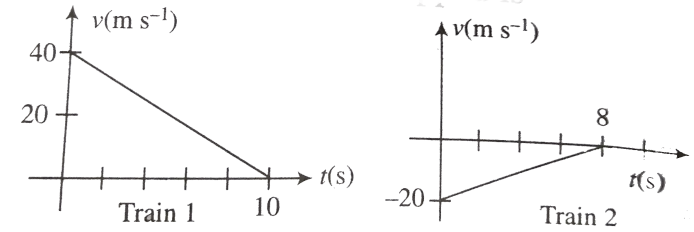
13. Two trains, which are moving along different tracks in opposite directions, are put on the same track due to a mistake. Their drivers, on noticing the mistake, start slowing down the trains when the trains are 300 m apart. Graphs given in figure show their velocities as function of time as the trains slow down. The separation

between the trains when both have stopped is



A. $120m$

B. 280 m

C. 60 m

D. 20 m

Answer: D

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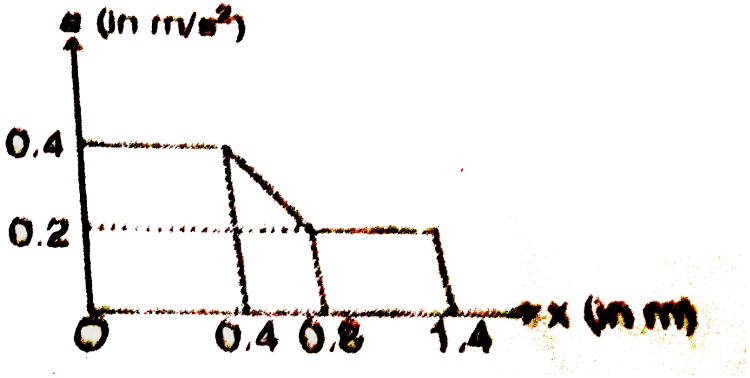
14. The acceleration of a particle which moves along the positive x- axis varies with its position as shown. If the velocity of the particle is $0.8m/s$ at $x = 0$, the velocity of the particle at $x = 14$ is (in m/s)



A. 1.6

B. 1.2

C. 1.4

D. None of these

Answer: B

15. Six particles situated at the corners of a regular hexagon of side a move at a constant speed v. Each particle maintains a direction towards the particle at the next corner. Calculate the time the particles will take to meet each other.

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

B. $\frac{2a}{v}$

C. $\frac{2a}{v\left(2+\sqrt{3}\right)}$

D. $\frac{2a}{v\left(2-\sqrt{3}\right)}$

Answer: D

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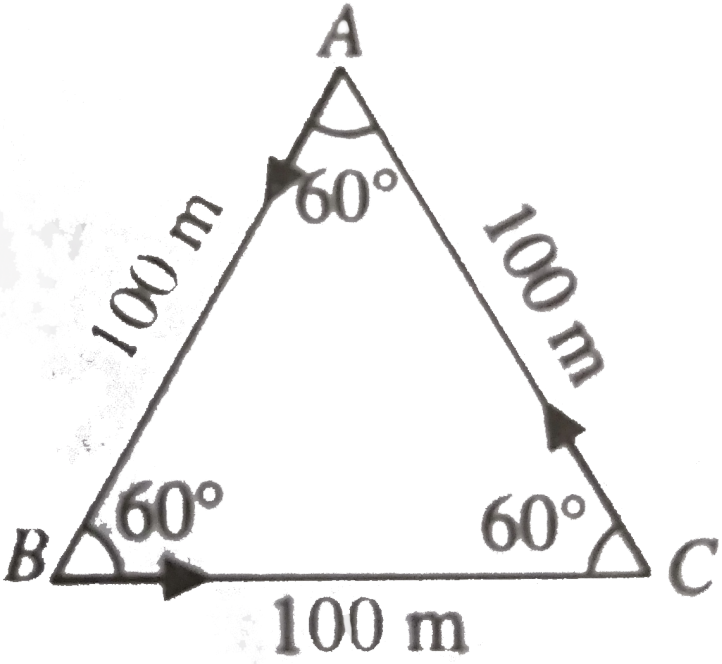
16. Three boys are running on a equitriangular track with the same speed $5ms^{-1}$. At start, they

were at the three corners with velocity along indicated directions. The velocity of approach of any one of them towards another at $t = 10s$ equals



A. $7.5ms^{-1}$

B. $10ms^{-1}$

C. $5ms^{-1}$

D. $0ms^{-1}$

Answer: D

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17. Two boys P and Q are playing on a river bank. P plans to swim across the river directly and come back. Q plans to swim downstream by a length equal to the width of the river and then come back. Both of them bet each other, claiming that the boy succeeding in less time

will win. Assuming the swimming rate of both P and Q to the same, it can be concluded that

A. P wins

B. Q wins

C. A draw takes place

D. Nothing certain can be stated.

Answer: A

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18. A man holds an umbrella at 30° with the vertical to keep himself dry. He, then, runs at a speed of $10ms^{-1}$, and find the rain drops to be hitting vertically. Study the following statement and find the correct options.

i. Velocity of rain w.r.t. Earth is $20ms^{-1}$

ii. Velocity of rain w.r.t. man is $10\sqrt{3}ms^{-1}$.

iii. Velocity of rain w.r.t. Earth is $30ms^{-1}$

iv. Velocity of rain w.r. t. man is $10\sqrt{2}ms^{-1}$.

A. Statements (i) and (ii) are correct.

B. Statements (i) and (iii) are correct.

C. Statements (iii) and (iv) are correct.

D. Statements (ii) and (iv) are correct.

Answer: A

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19. Rain appears to fall vertically to a man walking at $3kmh^{-1}$, but when he changes his speed to double, the rain appears to fall at 45° with vertical. Study the following statements and find which of them are correct.

i. Velocity of rain is $2\left(\sqrt{3}\right)kmh^{-1}$.

ii. The angle of fall of rain (with vertical) is $\theta = \tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$.

iii. The angle of fall of rain (with vertical) is $\theta = \sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$.

iv. Velocity of rain is $3\left(\sqrt{2}\right) kmh^{-1}$.

A. Statements (i) and (ii) are correct.

B. Statements (i) and (iii) are correct.

C. Statements (iii) and (iv) are correct.

D. Statements (ii) and (iv) are correct.

Answer: C

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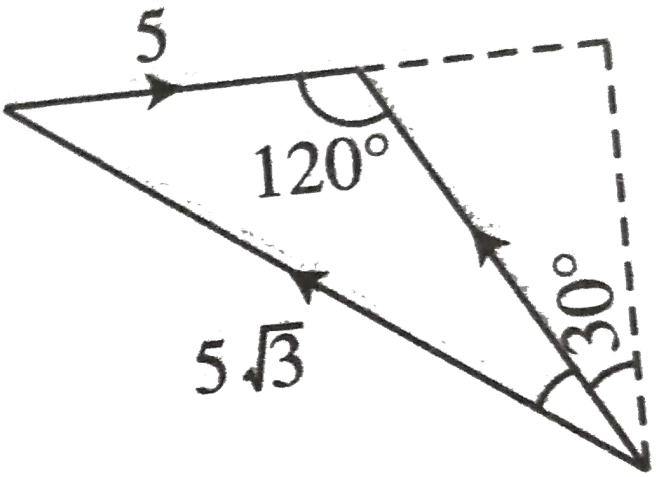
20. A motor boat is to reach at a point 30° upstream on the outer side of a river flowing with velocity $5ms^{-1}$. The velocity of motor boat with respect to water is $5\left(\sqrt{3}\right)ms^{-1}$. The driver should steer the boat at an angle.



A. 30° w.r.t. the line of destination from the starting point.

B. 60° w.r.t. normal to the bank.

C. 120° w.r.t. stream direction

D. None of these

Answer: C

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21. The raindrops are hitting the back of a man walking at a speed of $5km/hr$. If he now starts

running in the same direction with a constant acceleration, the magnitude of the velocity of the rain with respect to him will

A. gradually increase

B. gradually decrease

C. first decrease then increase

D. first increase then decrease

Answer: C

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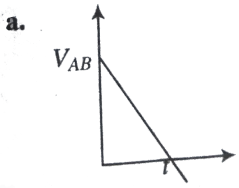
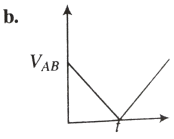
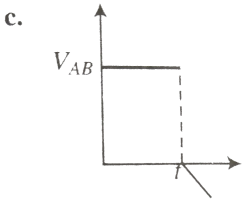
22. A body A is thrown vertically upwards with such a velocity that it reaches a maximum height of h. Simultaneously, another body B is dropped from height h. It strikes the ground and does not rebound. The velocity of A relative to B versus time graph is best represented by (upward direction is positive).

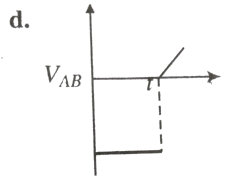
A. 

B. 

C.



D.



Answer: C

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23. A particle is projected from the ground at an angle 30° with the horizontal with an initial speed $20ms^{-1}$. After how much time will the

velocity vector of projectile be perpendicular to the initial velocity ? [in second].

A. 4s

B. 2s

C. 3s

D. Not possible in this case.

Answer: D

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24. Two particles are projected simultaneously from the same point, with the same speed, in the same vertical plane, and at different angles with the horizontal in a uniform gravitational field acting vertically downwards. A frame of reference is fixed to one particle. The position vector of the other particle , as observed from this frame, is $\overrightarrow{r}$. Which of the following statement is correct?

A. $\overrightarrow{r}$ is a constant vector.

B. $\vec{r}$ changes in magnitude as well as direction with time.

C. The magnitude of $\vec{r}$ increases linearly with time, its direction does not change.

D. The direction of $\vec{r}$ changes with time, its magnitude may or may not change, depending on the angles of projection.

Answer: C

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25. Two particles are thrown horizontally in opposite directions with velocities u and 2u from the top of a high tower. The time after which their radius of curvature will be mutually perpendicular is

A. $\left(\sqrt{2}\right)\frac{u}{g}$

B. $2\frac{u}{g}$

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

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

Answer: A

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26. In figure, the angle of inclination of the inclined plane is 30°. Find the horizontal velocity V_0 so that the particle hits the inclined plane perpendicularly.

A. $V_0 = \sqrt{\frac{2gH}{5}}$

B. $V_0 = \sqrt{\frac{2gH}{7}}$

C. $V_0 = \sqrt{\frac{gH}{5}}$

D. $V_0 = \sqrt{\frac{gH}{7}}$

Answer: A

27. A particle reaches its highest point when it has covered exactly one half of its horizontal range. The corresponding point on the displacement -time graph is charecterized by :

A. Zero slope and zero curvature

B. Zero slope and non-zero curvature

C. Positive slope and zero curvature

D. None of these

Answer: B

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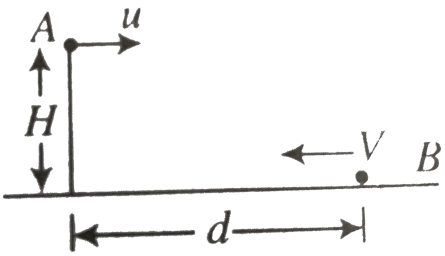
28. Two particles A and B are placed as shown in figure. The particle A, on the top of tower, is projected horizontally with a velocity u and particle B is projected along the surface towards the tower, simultaneously. If both particles meet each other, then the speed of projection of

particles B is [ignore any friction]



A. a. $d\sqrt{\frac{g}{2H}} - u$

B. b. $d\sqrt{\frac{g}{2H}}$

C. c. $d\sqrt{\frac{g}{2H}} + u$

D. d. u

Answer: A

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29. A projectile is fired with a velocity v at right angle to the slope inclined at an angle θ with the horizontal. The range of the projectile along the inclined plane is

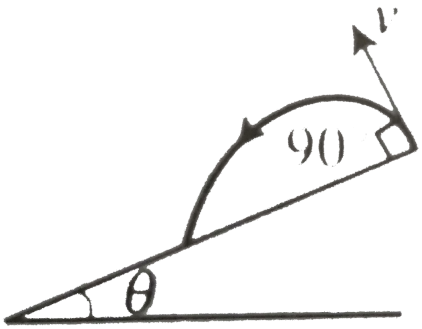

Fig. A.13

A. $\frac{2v^2 \tan\theta}{g}$

B. $\frac{v^2 \sec\theta}{g}$

C. $\frac{2v^2 \tan\theta \sec\theta}{g}$

D. $\frac{v^2 \sin\theta}{g}$

Answer: C

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30. A ball rolls off the top of a staircase with a horizontal velocity ums^{-1}. If the steps are h

metre high and b metre wide, the ball will hit the edge of the nth step, if.

A. 9

B. 10

C. 11

D. 12

Answer: A

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31. The maximum range of a projectile is 500m. If the particle is thrown up a plane is inclined at an angle of 30° with the same speed, the distance covered by it along the inclined plane will be:

A. 250 m

B. 500 m

C. 750m

D. 1000 m

Answer: B

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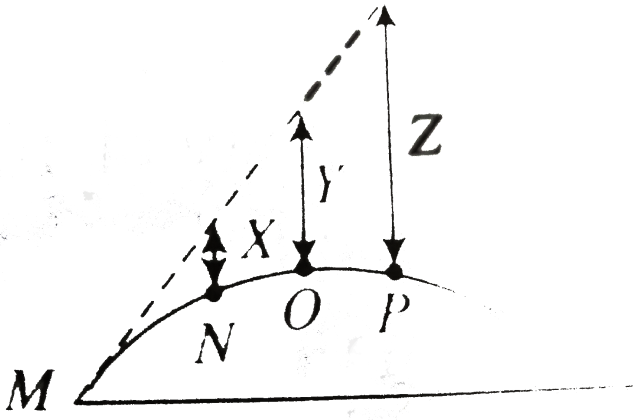
32. A cannon fires a projectile as shown in figure. The dashed line shows the trajectory in the absence of gravity. The points M,N, O, and P correspond to time at $t = 0, 1s, 2s,$ and 3 s, respectively. The length of X,Y, and Z are , respectively.



A. 5m, 10m, 15m

B. 10m, 40m, 90m

C. 5m, 20m, 45m

D. 10m, 20m, 30m.

Answer: C

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33. The speed of a projectile when it is at its greatest height is $\sqrt{2/5}$ times its speed at half

the maximum height. What is its angle of projection?

A. 45°

B. 30°

C. 37°

D. 60°

Answer: D

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34. A particle is projected at an angle of elevation α and after t second it appears to have an elevation of β as seen from the point of projection. Find the initial velocity of projection.

A. $\frac{gt}{2\sin(\alpha-\beta)}$

B. $\frac{gt\cos\beta}{2\sin(\alpha-\beta)}$

C. $\frac{\sin(\alpha-\beta)}{2gt}$

D. $\frac{2\sin(\alpha-\beta)}{gt\cos\beta}$

Answer: B

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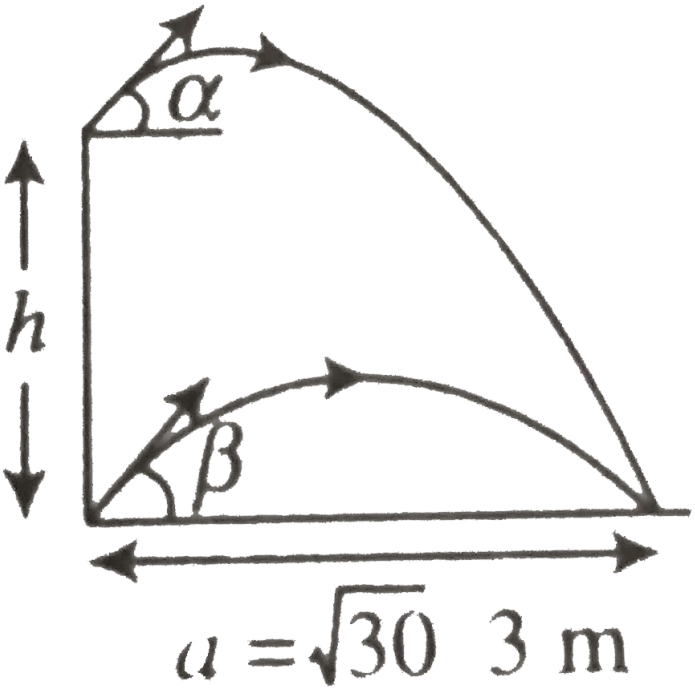
35. Shots are fired simultaneously from the top and bottom of a vertical cliff with the elevation $\alpha = 30^\circ$, beta $= 60^\circ$, respectively. The shots strike an object simultaneously at the same point. If $a = 10\left(\sqrt{3}\right)$ m is the horizontal distance of the object from the cliff, then the

height h of the cliff is



A. 30 m

B. 45 m

C. 60 m

D. 90 m

Answer: C

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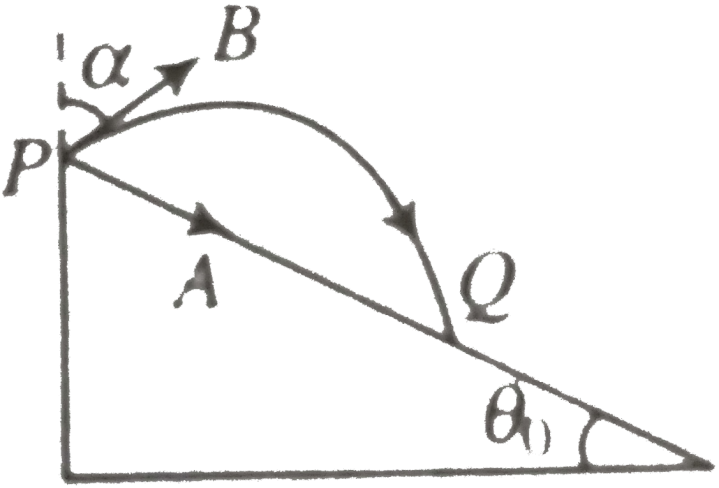
36. Figure shows that particle A is projected from point P with velocity u along the plane and simultaneously another particle B with velocity v at an angle α with vertical. The particles collide

at point Q on the plane. Then



A. $v\sin(\alpha-\theta_0)=u$

B. $v\cos(\alpha-\theta_0)=u$

C. $v=u$

D. None of these

Answer: A

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37. A platform is moving upwards with an accelerations of $5ms^{-2}$. At the moment when its velocity is $u = 3ms^{-1}$, a ball is thrown from it with a speed of $30ms^{-1}$ w.r.t. platform at an angle of $\theta = 30^{\circ}$ with horizontal. The time taken by the ball to return to the platform is

A. 2 s

B. 3 s

C. 1 s

D. $2.5s$

Answer: A

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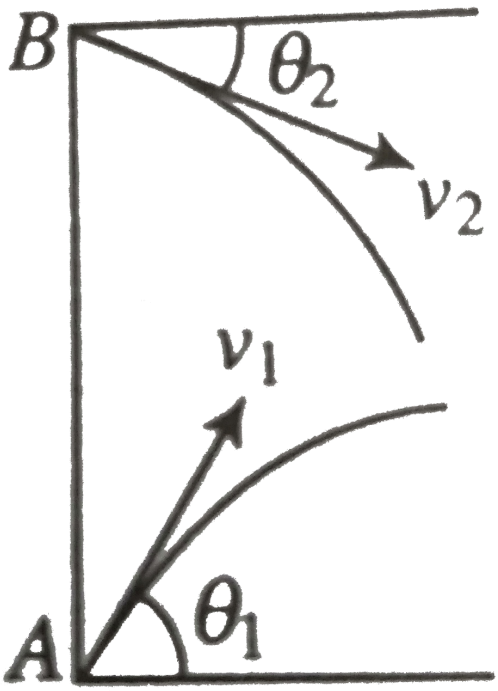
38. Two balls are projected from points A and B in vertical plane as shown in figure. AB is a straight vertical line. The balls can collide in mid

air if v_1 / v_2 is equal to



A. a. $\frac{\sin \theta_1}{\sin \theta_2}$

B. b. $\frac{\sin \theta_2}{\sin \theta_1}$

C. c. $\frac{\cos \theta_1}{\cos \theta_2}$

D. d. $\frac{\cos\theta_2}{\cos\theta_1}$

Answer: D

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39. A particle is thrown at time t = 0 with a velocity of $10ms^{-1}$ at an angle 60° with the horizontal from a point on an inclined plane, making an angle of 30° with the horizontal. The time when the velocity of the projectile becomes

parallel to the incline is

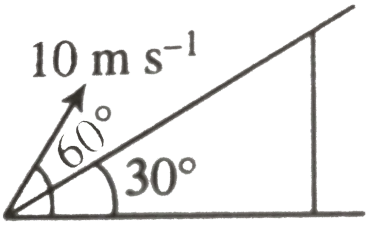

Fig. A.18

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

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

C. $\sqrt{3}s$

D. $\frac{1}{2\left(\sqrt{3}\right)}s$

Answer: B

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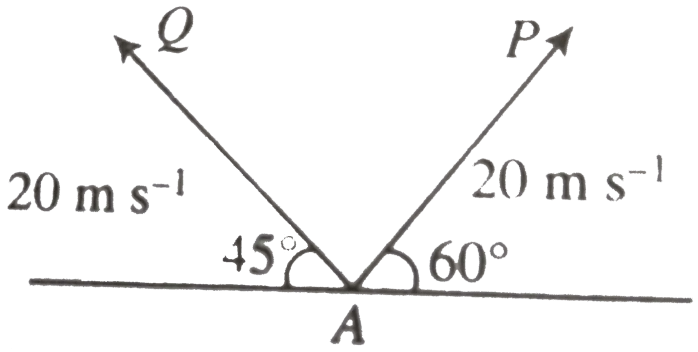
40. Two particles P and Q are projected simultaneously away from each other from a point A as shown in figure. The velocity of P relative to Q in ms^{-1} at the instant when the motion of P is horizontal is



A. $10\sqrt{4-\sqrt{3}}$

B. $20\sqrt{4-\sqrt{3}}$

C. $10\sqrt{4+\sqrt{3}}$

D. $20\sqrt{4+\sqrt{3}}$

Answer: B

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41. Figure shows the velocity and acceleration of a point line body at the initial moment of its motion. The acceleration vector of the body remains constant. The minimum radius of

curvature of trajectory of the body is

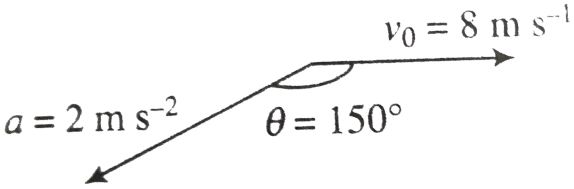

Fig. A.20

A. 2 m

B. 3 m

C. 8 m

D. 16 m

Answer: C

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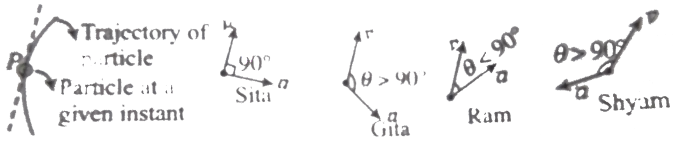
42. Figure shows path followed by a particle and position of a particle at any instant. Four different students have represented the velocity vectors and acceleration vectors at the given instant. Which vector diagram can not be true in any situation? (In each figure velocity is tangential to the trajectory).



A. a.Sita

B. b. Gita

C. c. Ram

D. d. Shyam

Answer: D

Watch Video Solution

43. A car is moving in east direction. It takes a right turn and moves along south direction without change in its speed. What is the direction of average acceleration of the car?

A. North east

B. South east

C. North west

D. South west

Answer: D

Watch Video Solution

44. Two guns on a battleship simultaneously fire two shells with same speed at enemy ships. If the shells follow the parabolic trajectories as

shown in figure. Which ship will get hit first?

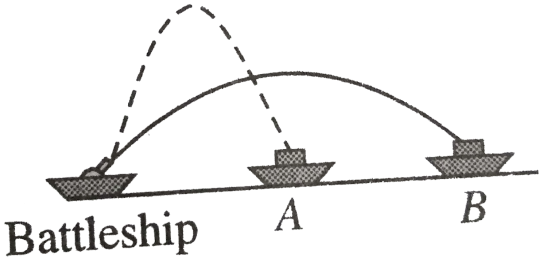


Fig. A.22

A. a. A

B. b. B

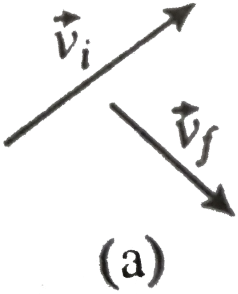
C. c. both at same time

D. d. need more information

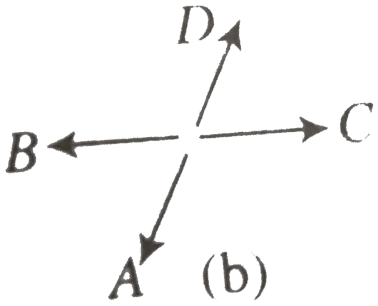
Answer: B

Watch Video Solution

45. The initial and final velocities of an object are as shown in figure(a). Which arrows shown in figure(b) can be represent average acceleration vector?



(a)



(b)

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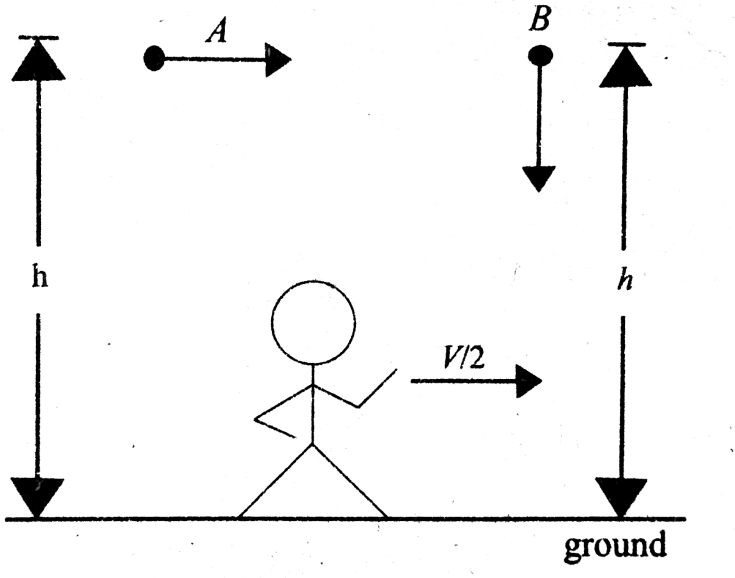
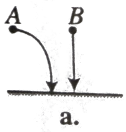
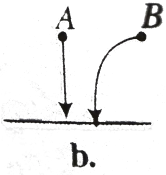
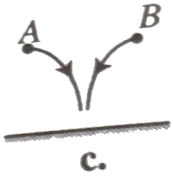
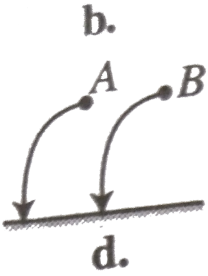
46. Two identical balls are set into motion simultaneously from an equal height h. While ball A is thrown horizontally with velocity v, ball B is just released to fall by itself. Choose the alternative that best represents the motion of A and B with respect to an observer who moves with velocity $v/2$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



A. 

B. 

C. 

D. 

Answer: C

Watch Video Solution

47. An aeroplane is flying vertically upwards. When it is at a height of $1000m$ above the ground and moving at a speed of $367m/s.$, a shot is fired at it with a speed of 567 ms^{-1} from a point directly below it. What should be the acceleration of aeroplane so that it may escape from being hit?

A. $> 5ms^{-2}$

B. $> 10ms^{-2}$

C. $< 10ms^{-2}$

D. Not possible

Answer: B

Watch Video Solution

48. Jai is standing on the top of a building of height 25 m he wants to throw his gun to Veeru who stands on top of another building of height 20 m at distance 15 m from first building. For which horizontal speed of projectile, it is possible?

A. $5ms^{-1}$

B. $10ms^{-1}$

C. $15ms^{-1}$

D. $20ms^{-1}$

Answer: C

 Watch Video Solution

49. A shot is fired at an angle θ to the horizontal such that it strikes the hill while moving horizontally. Find the initial angle of projection θ

.

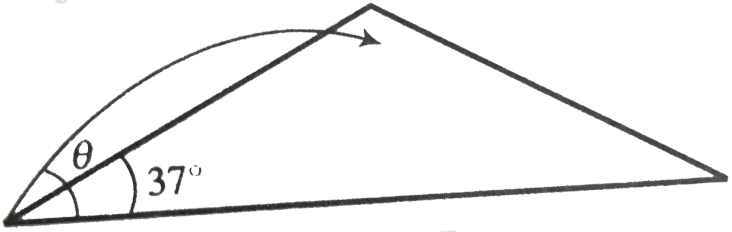


Fig. 6.25

A. a. $\tan\theta = \frac{2}{5}$

B. b. $\tan\theta = \frac{3}{8}$

C. c. $\tan\theta = \frac{3}{2}$

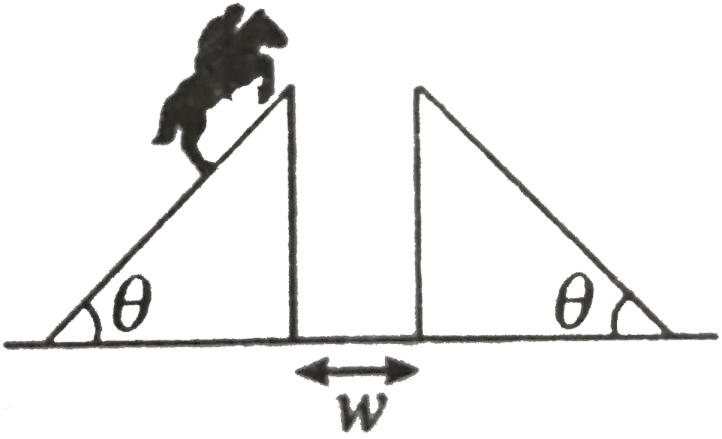
D. d. None of these

Answer: C

Watch Video Solution

50. A man is riding on a horse. He is trying to jump the gap between two symmetrical ramps of snow separated by a distance W as shown in figure. He launches off the first ramp with a speed v_L. The man and the horse have a total mass m. and their size is small as compared to W. The value of initial launch speed V_L which will put the horse exactly at the peak of the second

ramp is



A. $\sqrt{\frac{Wg}{\sin\theta \times \cos\theta}}$

B. $\sqrt{\frac{Wg}{\sin(\theta/2) \times \cos(\theta/2)}}$

C. $\sqrt{\frac{Wg}{2\sin\theta\cos\theta}}$

D. $\sqrt{\frac{2Wg}{\sin\theta\cos\theta}}$

Answer: C

Watch Video Solution

51. A particle is moving eastwards with a velocity of $5ms_{-1}$. In $10\,\text{sec}\,onds$ the velocity changes to $5ms^{-1}$ northwards. The average acceleration in this time is

A. Zero

B. $1/\sqrt{2}ms^{-2}$ towards north-west

C. $1/2ms^{-2}$ towards north-west

D. $1/2ms^{-2}$ towards north.

Answer: B

Watch Video Solution

52. A river is flowing from west to east at a speed of $5 metres per \min ute$. A man on the south bank of the river , capable of swimming at $10 metres per \min ute$, in still water , wants to swim across the river in the shortest time . He should swim in a direction

A. Due north

B. 30° east of north.

C. 30° west of north

D. 60° east of north.

Answer: A

Watch Video Solution

53. A boat which has a speed of $5km/hr$ in steel water crosses a river of width $1km$ along the shortest possible path in $15\ \min utes$. The velocity of the river water in km/hr is

A. 1

B. 3

C. 4

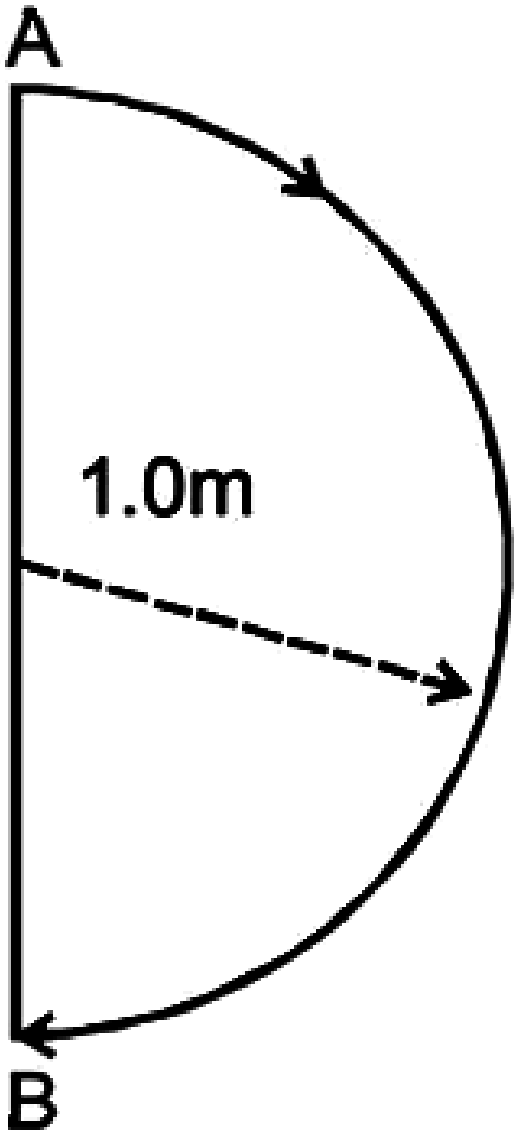
D. $\sqrt{41}$

Answer: B

Watch Video Solution

54. In $1.0s$, a particle goes from point A to point B , moving in a semicircle of radius $1.0m$ (see

figure). The magnitude of the average velocity



A. $3.14ms^{-1}$

B. $2.0ms^{-1}$

C. $1.0ms^{-1}$

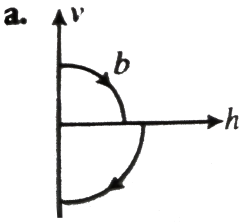
D. Zero

Answer: B

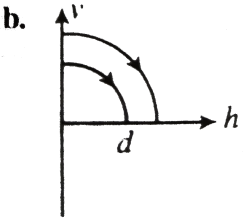
55. A ball is dropped vertically from a height d above the ground. It hits the ground and bounces up vertically to a height d/2. Neglecting subsequent motion and air resistance, its

velocity v varies with the heiht h above the ground as

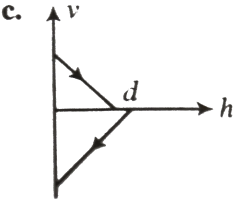
A.



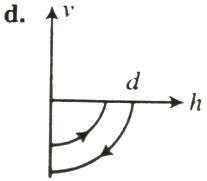
B.



C.



D.



Answer: A

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56. A particle starts sliding down a frictionless inclined plane. If S_n is the distance travelled by it from time $t = n - 1\,\text{sec}$, to $t = n\,\text{sec}$, the ratio $\frac{S_n}{s_{n+1}}$ is

A. $\frac{2n-1}{2n+1}$

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

C. $\frac{2n}{2n+1}$

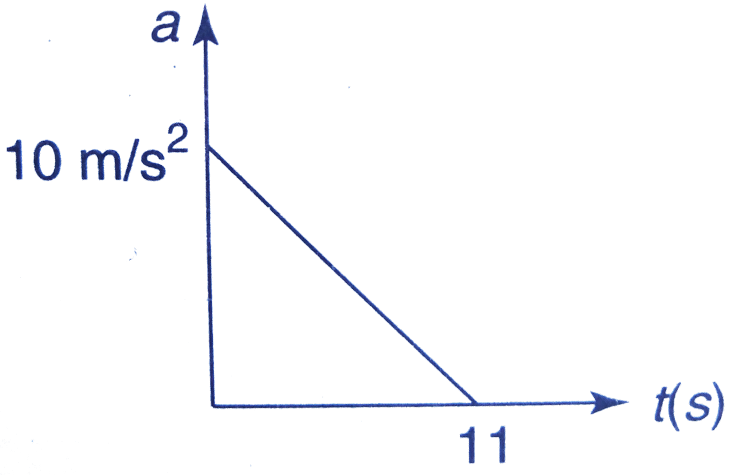
D. $\frac{2n+1}{2n-1}$

Answer: A

Watch Video Solution

57. A particle starting from rest. Its acceleration (a) versus time (t) is as shown in the figure.

The maximum speed of the particle will be.



A. $110ms^{-1}$

B. $55ms^{-1}$

C. $550ms^{-1}$

D. $660ms^{-1}$

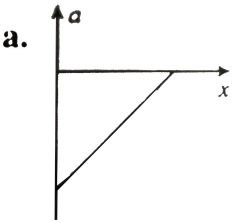
Answer: B

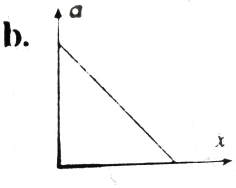
Watch Video Solution

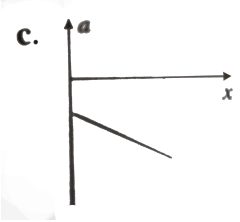
58. The velocity - displacement graph of a particle moving along a straight line is shown

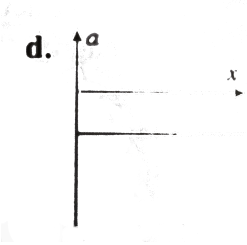
The most suitable acceleration - displacement

graph will be

A. 

B. 

C. 

D. 

Answer: A

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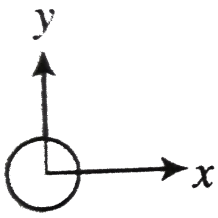
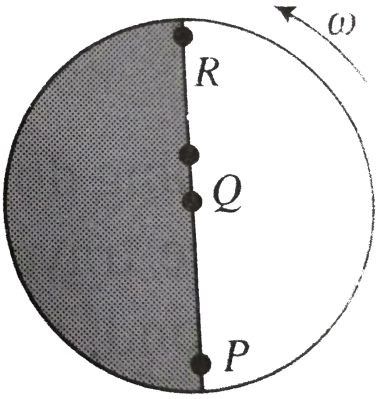
59. Consider a disc rotating in the horizontal plane with a constant angular speed ω about its center O. The disc has a shaded region on one side of the diameter and an unshaded region on the other side as shown in figure. When the disc is in the orientation as shown, two pebbles P and Q are simultaneously projected at an angle towards R. The velocity of projection in the y-z

plane and is same for both pebbles with respect to the disc. Assume that (i) they land back on the disc before the disc has completed $1/8$ rotation, (ii) their range is less than half the disc radius, and (iii) ω remains constant throughout. Then





A. P lands in the shaded region and Q in the unshaded region.

B. P lands in the unshaded region and Q in the shaded region.

C. Both P and Q land in the unshaded region.

D. Both P and Q land in the shaded region.

Answer: C

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Multiple Correct Answer Type

1. For a particle moving along the x-axis, mark the correct statement(s).

A. if x is positive and is increasing with the time, then average velocity of the particle is positive.

B. if x is negative and becoming positive after some time, then the velocity of the particle is always positive.

C. If x is negative and becoming less negative as time passes, then the average velocity

of the particle is positive.

D. If x is positive and is increasing with time, then the velocity of the particle is always positive.

Answer: A::C::D

Watch Video Solution

2. For a particle moving along the x-axis, x-t graph is as given as graph in figure. Mar the correct statement (s).

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width="80%">

A. a. Initial velocity of the particle is zero.

B. b. For BC, acceleration is positive and for DE, acceleration is negative.

C. c. For EF, the acceleration is positive.

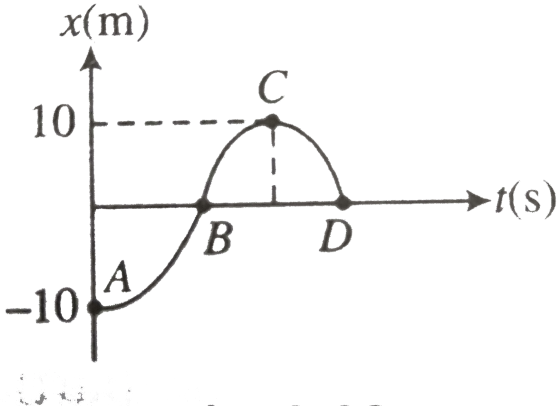
D. Velocity becomes zero three times in the motion.

Answer: A::C::D

Watch Video Solution

3. For a particle moving along x-axis, a scaled x-6 graph is shown in figure. Mark the correct statement (s).

Fig. A.28. Mark the correct



A. Speed of the particle is greatest at C.

B. Speed of the particle is greatest at B.

C. Particle is speeding up in region marked CD.

D. Particle is speeding up in region marked AB.

Answer: B::C::D

Watch Video Solution

4. Mark the correct statement (s).

A. A particle can have zero displacement and non-zero average velocity.

B. A particle can have zero displacement and non-zero velocity.

C. A particle can have zero acceleration and non-zero velocity.

D. A particle can have zero velocity and non-zero acceleration.

Answer: B::C::D

 Watch Video Solution

5. At time $t = 0,$ a car moving along a straight line has a velocity of $16ms^{-1}$. It slows down with an acceleration of $-0.5tms^{-2},$ where t is in second. Mark the correct statement (s).

A. a. The direction of velocity changes at t = 8s.

B. b. The distance travelled in 4 s is approximately 59 m.

C. c. The distance travelled by the particle in 10 s is 94 m.

D. d. The velocity at $t = 10sis9ms^{-1}$.

Answer: A::B::C

Watch Video Solution

6. A ball is thrown upwards into air with a speed greater than its terminal speed. It lands at the same place from where it was thrown. Mark the correct statement (s).

A. a. It acquires terminal speed before it gets to the highest point of the trajectory.

B. b. Before reaching the highest point of trajectory, its speed is continuously decreasing.

C. c. During the entire flight, the force of air resistance is greatest just after it is down

D. d. The magnitude of net force experienced by the ball is maximum just after it is thrown.

Answer: B::C::D

7. A particle is moving along the x-axis whose position is given by $x = 4 - 9t + \frac{t^3}{3}$. Mark the correct statement(s) in relation to its motion.

A. a. The direction of motion is not changing at any of the instants.

B. b. The direction of the motion is changing at $t = 3s$.

C. c. For $0 < t < 3s$, the particle is slowing down.

D. d. For $0 < t < 3s$, the particle is speeding up.

Answer: B::C

Watch Video Solution

8. A particle is thrown in vertically in upward direction and passes three equally spaced windows of equal heights. Then

A. a. The average speed of the particle while passing the windows satisfy the relation $v_{av1} > v_{av2} > v_{av3}$.

B. b. The time taken by the particle to cross the windows satisfies the relation $t_1 < t_2 < t_3$.

C. c. The magnitude of the acceleration of the particle while crossing the windows, satisfies the relation $a_1 = a_2 \neq a_3$.

D. d. The change in the speed of the particle, while crossing the windows, would satisfy the relation $\Delta v_1 < \Delta v_2 < \Delta v_3$.

Answer: A::B::D

Watch Video Solution

9. Ship A is located 4 km north and 3 km east of ship B. Ship A has a velocity of $20 kmh^{-1}$ towards the south and ship B is moving at $40 kmh^{-1}$ in a direction 37° north of east. X and

Y-axes are along east and north directions, respectively

A. a.Velocity of A relative to B is $-32\hat{i} - 44\hat{j}$

B. b.Position of A relation to B as a function of time is given by

$\overrightarrow{r}_{AB} = (3 - 32t)\hat{i} + (4 - 44)\hat{j}$

where t = 0 when the ships are in position described above.

C. c. Velocity of B relative to A is $-32\hat{i} - 44\hat{j}$.

D. d. At some moment A will be west of B.

Answer: A::B

Watch Video Solution

10. An object moves with constant acceleration a. Which of the following expressions are also constant?

A. $\frac{d\left|\vec{v}\right|}{dt}$

B. $\left|\frac{d\vec{v}}{dt}\right|$

C. $\frac{d\left(v^2\right)}{dt}$

D. $\frac{d\left(\vec{v} / \left|\vec{v}\right|\right)}{dt}$

Answer: B

Watch Video Solution

11. A ball is dropped from a height of 49 m. The wind is blowing horizontally. Due to wind a constant horizontal acceleration is provided to the ball. Choose the correct statement (s).

A. Path of the ball is a straight line

B. Path of the ball is a curved one.

C. The time taken by the ball to reach the ground is $3.16s$.

D. The angle made by the line joining initial and final positions (on ground after 1st strike) of the ball with horizontal is greater than 45°.

Answer: A::C::D

Watch Video Solution

12. An object may have

A. varying speed without having varying velocity.

B. varying velocity without having varying speed.

C. non-zero acceleration without having varying velocity.

D. non-zero acceleration without having varying speed.

Answer: B::D

Watch Video Solution

13. From the top of a tower of height $200m$, a ball A is projected up with $10ms^{-1}$. And $2s$ later another ball B is projected vertically down with the same speed. Then

A. Both A and B will reach the ground simultaneously

B. Ball A with hit the ground 2 s later than B hitting the ground

C. Both the balls will hit the ground with the same velocity

D. Both will rebound to the same height from the ground, if both have same coefficient of restitution.

Answer: A::C::D

 Watch Video Solution

14. A particle is projected at an angle $\theta = 30^{\circ}$ with the horizontal, with a velocity of $10ms^{-1}$. Then

A. After 2 s, the velocity of particle makes an angle of 60° with initial velocity vector.

B. After 1 s, the velocity of particles makes an angle of 60° with initial velocity vector.

C. The magnitude of velocity of particle after 1 s is $10ms^{-1}$.

D. The magnitude of velocity of particle after 1 s is $5ms^{-1}$.

Answer: B::C

Watch Video Solution

15. A particle moves along positive branch of the curve, $y = \frac{x}{2}, wherex = \frac{t^3}{3}$, x and y are measured in meters and t in seconds, then

A. The velocity of particle at $t = 1sis\hat{i} + \frac{1}{2}\hat{j}.$

B. The velocity of particle at $t = 1sis\frac{1}{2}\hat{i} + \hat{j}.$

C. The acceleration of particle at $t = 2sis2\hat{i} + \hat{j}.$

D. The acceleration of particle at $t = 2sis\hat{i} + 2\hat{j}.$

Answer: A::C

View Text Solution

16. If T is the total time of flight, h is the maximum height and R is the range for horizontal motion, the x and y coordinates of projectile motion and time t are related as

A. $y = 4h\left(\frac{t}{T}\right)\left(1 - \frac{t}{T}\right)$

B. $y = 4h\left(\frac{x}{R}\right)\left(1 - \frac{x}{R}\right)$

C. $y = 4h\left(\frac{T}{t}\right)\left(1 - \frac{T}{t}\right)$

D. $y = 4h\left(\frac{R}{x}\right)\left(1 - \frac{R}{x}\right)$

Answer: A::B

Watch Video Solution

17. If acceleration is constant and initial velocity of the body is 0, then choose the correct statement. Symbols have their usual meaning.

A. $v \propto \sqrt{t}$

B. $v \propto \sqrt{x}$

C. $v \propto t$

D. $v \propto x^2$

Answer: B::C

View Text Solution

18. The velocity - time graph of two bodies A and B is shown in figure. Choose correct statement.

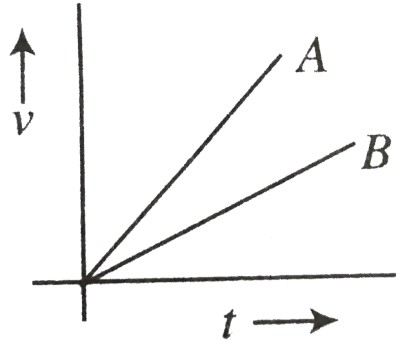


Fig. A.30

A. acceleration of Bgt acceleration of A

B. acceleration of A gt acceleration of B

C. both are starting from same point

D. A covers greater distance than B in the same time.

Answer: B::D

Watch Video Solution

19. A particle starts moving along a straight line path with velocity $10m/s$. After $5s$ the distance

of the particle from the starting point is $50m$. Which of the following statements about the nature of motion of the particle are correct?

A. The body may be speeding up with constant positive acceleration.

B. The motion may be moving with constant velocity.

C. The body may have constant negative acceleration.

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

Answer: B::C::D

Watch Video Solution

20. Consider a shell that has a muzzle velocity of $45ms^{-1}$ fired from the tail gun of an airplane moving horizontally with a velocity of $215ms^{-1}$. The tail gun can be directed at any angle with the vertical in the plane of motion of the airplane. The shell is fired when the plane is above point A on ground, and the plane is above point B on ground when the shell hits the

ground. (Assume for simplicity that the Earth is flat)

A. Shell may hit the ground at point A.

B. Shell may hit the ground at point B.

C. Shell may hit a point on earth which is behind point A.

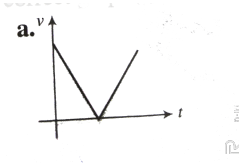
D. Shell may hit a point on earth which is behind point B.

Answer: B::D

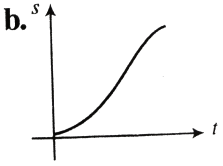
Watch Video Solution

21. A ball is projected from ground with speed u, at an angle θ above horizontal. Let v be its speed at any moment t and s be the total distance covered by it till this moment, the correct graph (s) $is/are.$

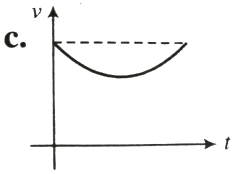
A.

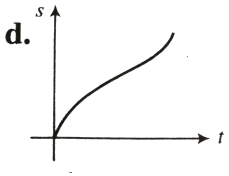


B.



C.



D. d. 

Answer: C::D

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22. A boat is travelling due east at $12ms^{-1}$. A flag on the boat flaps at $53^{\circ} NofW$. Another flag on the shore flaps due north.

A. Speed of wind with respect to ground is $16ms^{-1}$

B. Speed of wind with respect to ground is

$20ms^{-1}$

C. Speed of wind with respect to boat is

$20ms^{-1}$

D. Speed of wind with respect to boat is

$16ms^{-1}$

Answer: A::C

Watch Video Solution

23. A particle has initial velocity $4i + 4jms^{-1}$ and an acceleration $-0.4ims^{-2}$, at what time will its speed bbe $5ms^{-1}$?

A. 2.5 s

B. 17.5 s

C. s

D. 8.5 s

Answer: A::B

Watch Video Solution

24. A cubical box dimension $L = 5/4$ m starts moving with an acceleration $\overrightarrow{a} = 0.5ms^{-2}\hat{i}$ form the state of rest. At the same time, a stone is thrown form the origin with velocity $\overrightarrow{V} = v_1\hat{i} + v_2\hat{j} - v_3\hat{k}$ with respect to earth. Acceleration due to gravity $\overrightarrow{g} = 10ms^{-2}\left(-\hat{j}\right)$. The stone just touches the roof of box and finally falls at the diagonally opposite point. then:

A. $v_1 = \dfrac{3}{2}$

B. $v_2 = 5$

C. $v_3 = \frac{5}{4}$

D. $v_3 = \frac{5}{2}$

Answer: A::B::C

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25. A particle of mass m moves on the x- axis as follows : it starts from rest at $t = 0$, from the point $x = 0$, and comes to rest at $t = 1$ at the point $x = 1$. No other information is available about its motion at intermediate times

$(0 < t < 1)$. If α denotes the instantaneous accelartion of the particle , then :

A. A. α cannot remain positive for all t in the interval

B. B. $|\alpha|$ cannot exceed 2 at any point in its path.

C. C. $|\alpha|$ must be $>$ =4 at some point or points in its path.

D. D. α must change sign during the motion, but no other assertion can be made with the information given.

Answer: A::D

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26. The coordinates of a particle moving in a plane are given by $x = a\cos pt$ and $y = b\sin pt$ where $a, b(< a)$ and p are positive constants of appropriate dimensions. Then,

A. The path of the particle is an ellipse.

B. The velocity and acceleration of the particle are normal to each other at

$t = \pi / 2p.$

C. The acceleration of the particle is always directed towards a focus.

D. The distance travelled by the particles in time interval $t = 0 \to t = \pi / 2p$ is a.

Answer: A::B

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Linked Comprehension Type

1. An inquistive student, determined to test the law of gravity for himself, walks to the top of a building og 145 floors, with every floor of height 4 m, having a stopwatch in his hand (the first floor is at a height of 4 m from the ground level). From there he jumps off with negligible speed and hence starts rolling freely. A rocketeer arrives at the scene 5 s later and dives off from the top of the building to save the student. The rocketeer leaves the roof with an initial downward speed v_0. In order to catch the student at a sufficiently great height above

ground so that the rocketeer and the student slow down and arrive at the ground with zero velocity. The upward acceleration that accomplishes this is provided by rocketeer's jet pack, which he turns on just as he catches the student, before the rocketeer is in free fall. To prevent any discomfort to the student, the magnitude of the acceleration of the rocketeer and the student as they move downward together should not exceed 5 g.

Just as the student starts his free fall, he presses the button of the stopwatch. When he reaches at the top of 100th floor, he has observed the

reading of stopwatch as 00:00:06:00 `(hh:mm:ss:100 th part of the second). Find the value of g. (correct upt ot two decimal places).

A. $10.00ms^{-2}$

B. $9.25ms^{-2}$

C. $9.75ms^{-2}$

D. $9.50ms^{-2}$

Answer: A

Watch Video Solution

2. An inquistive student, determined to test the law of gravity for himself, walks to the top of a building og 145 floors, with every floor of height 4 m, having a stopwatch in his hand (the first floor is at a height of 4 m from the ground level). From there he jumps off with negligible speed and hence starts rolling freely. A rocketeer arrives at the scene 5 s later and dives off from the top of the building to save the student. The rocketeer leaves the roof with an initial downward speed v_0. In order to catch the student at a sufficiently great height above

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Just as the student starts his free fall, he presses the button of the stopwatch. When he reaches at the top of 100th floor, he has observed the

reading of stopwatch as 00:00:06:00. What should be the initial downward speed of the rocketeer so that he catches the student at the top of 100 the floor for safe landing ?

A. A. It can have many values

B. B. $180ms^{-1}$

C. C. $175ms^{-1}$

D. D. Cannot be determined

Answer: C

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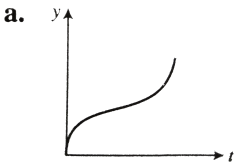
3. An inquistive student, determined to test the law of gravity for himself, walks to the top of a building og 145 floors, with every floor of height 4 m, having a stopwatch in his hand (the first floor is at a height of 4 m from the ground level). From there he jumps off with negligible speed and hence starts rolling freely. A rocketeer arrives at the scene 5 s later and dives off from the top of the building to save the student. The rocketeer leaves the roof with an initial downward speed v_0. In order to catch the student at a sufficiently great height above

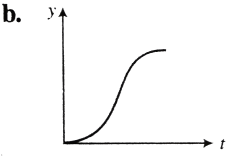
ground so that the rocketeer and the student slow down and arrive at the ground with zero velocity. The upward acceleration that accomplishes this is provided by rocketeer's jet pack, which he turns on just as he catches the student, before the rocketeer is in free fall. To prevent any discomfort to the student, the magnitude of the acceleration of the rocketeer and the student as they move downward together should not exceed 5 g.

The correct velocity - time graph for the rocketeer would be

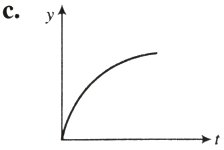
A.



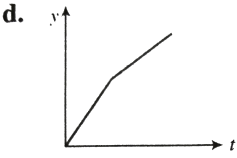
B.



C.



D.



Answer: B

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4. An inquistive student, determined to test the law of gravity for himself, walks to the top of a building og 145 floors, with every floor of height 4 m, having a stopwatch in his hand (the first floor is at a height of 4 m from the ground level). From there he jumps off with negligible speed and hence starts rolling freely. A rocketeer arrives at the scene 5 s later and dives off from the top of the building to save the student. The rocketeer leaves the roof with an initial downward speed v_0. In order to catch the student at a sufficiently great height above

ground so that the rocketeer and the student slow down and arrive at the ground with zero velocity. The upward acceleration that accomplishes this is provided by rocketeer's jet pack, which he turns on just as he catches the student, before the rocketeer is in free fall. To prevent any discomfort to the student, the magnitude of the acceleration of the rocketeer and the student as they move downward together should not exceed 5 g.

In Q.1, what would be the approximate retardation to be given by jet pack along for safe landing?

A. $5gms^{-2}$

B. $2gms^{-2}$

C. $4gms^{-2}$

D. Cannot be determined

Answer: A

 Watch Video Solution

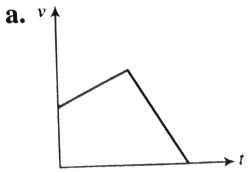
5. An inquistive student, determined to test the law of gravity for himself, walks to the top of a building og 145 floors, with every floor of height

4 m, having a stopwatch in his hand (the first floor is at a height of 4 m from the ground level). From there he jumps off with negligible speed and hence starts rolling freely. A rocketeer arrives at the scene 5 s later and dives off from the top of the building to save the student. The rocketeer leaves the roof with an initial downward speed v_0. In order to catch the student at a sufficiently great height above ground so that the rocketeer and the student slow down and arrive at the ground with zero velocity. The upward acceleration that accomplishes this is provided by rocketeer's jet

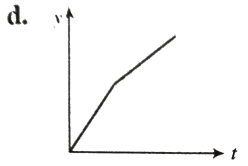
pack, which he turns on just as he catches the student, before the rocketeer is in free fall. To prevent any discomfort to the student, the magnitude of the acceleration of the rocketeer and the student as they move downward together should not exceed 5 g.

The correct velocity - time graph for the rocketeer would be

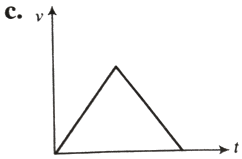
A.



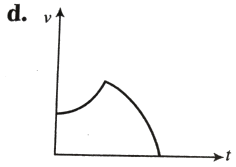
B.



C.



D.



Answer: B

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6. An elevator without a ceiling is ascending up with an acceleration of $5ms^{-2}$. A boy on the elevator shoots a ball in vertical upward direction from a height of 2 m above the floor of

elevator. At this instant the elevator is moving up with a velocity of $10ms^{-1}$ and floor of the elevator is at a height of 50 m from the ground. The initial speed of the ball is $15ms^{-1}$ with respect to the elevator. Consider the duration for which the ball strikes the floor of elevator in answering following questions. ($g = 10ms^{-2}$)

1. The time in which the ball strikes the floor of elevator is given by

A. 2.13 s

B. 4.26 s

C. 1.0 s

D. 2.0 s

Answer: A

Watch Video Solution

7. An elevator without a ceiling is ascending up with an acceleration of $5ms^{-2}$. A boy on the elevator shoots a ball in vertical upward direction from a height of 2 m above the floor of elevator. At this instant the elevator is moving up with a velocity of $10ms^{-1}$ and floor of the elevator is at a height of 50 m from the ground.

The initial speed of the ball is $15ms^{-1}$ with respect to the elevator. Consider the duration for which the ball strikes the floor of elevator in answering following questions. ($g = 10ms^{-2}$)

2. The maximum height reached by ball, as measured from the ground would be

A. 52 m

B. 31.25 m

C. 83.25 m

D. 63.25 m

Answer: C

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8. An elevator without a ceiling is ascending up with an acceleration of $5ms^{-2}$. A boy on the elevator shoots a ball in vertical upward direction from a height of 2 m above the floor of elevator. At this instant the elevator is moving up with a velocity of $10ms^{-1}$ and floor of the elevator is at a height of 50 m from the ground. The initial speed of the ball is $15ms^{-1}$ with respect to the elevator. Consider the duration for which the ball strikes the floor of elevator in

answering following questions. ($g = 10ms^{-2}$)

3. Displacement of ball with respect to ground during its night would be

A. 32.64 m

B. 2 m

C. 52 m

D. 30.64 m

Answer: D

Watch Video Solution

9. An elevator without a ceiling is ascending up with an acceleration of $5ms^{-2}$. A boy on the elevator shoots a ball in vertical upward direction from a height of 2 m above the floor of elevator. At this instant the elevator is moving up with a velocity of $10ms^{-1}$ and floor of the elevator is at a height of 50 m from the ground. The initial speed of the ball is $15ms^{-1}$ with respect to the elevator. Consider the duration for which the ball strikes the floor of elevator in answering following questions. ($g = 10ms^{-2}$)

3. Displacement of ball with respect to ground during its night would be

A. 32.64 m

B. 31.86 m

C. 52 m

D. 30.64 m

Answer: B

Watch Video Solution

10. An elevator without a ceiling is ascending up with an acceleration of $5ms^{-2}$. A boy on the elevator shoots a ball in vertical upward direction from a height of 2 m above the floor of elevator. At this instant the elevator is moving up with a velocity of $10ms^{-1}$ and floor of the elevator is at a height of 50 m from the ground. The initial speed of the ball is $15ms^{-1}$ with respect to the elevator. Consider the duration for which the ball strikes the floor of elevator in answering following questions. ($g = 10ms^{-2}$)

4. The maximum separation between the floor of elevator and the ball during its flight would be

A. 30 m

B. 15 m

C. 7.5 m

D. 9.5 m

Answer: D

Watch Video Solution

11. Projectile motion is a combination of two one-dimensional motion: one in horizontal and other in vertical direction. Motion in 2D means in a plane. Necessary condition for 2D motion is that the velocity vector is coplanar to the acceleration vector. In case of projectile motion, the angle between velocity and acceleration will be $0^\circ < \theta < 180^\circ$. During the projectile motion, the horizontal component of velocity ramains unchanged but the vertical component of velocity is time dependent. Now answer the following questions:

A particle is projected from the origin in the x-y plane. The acceleration of particle in negative y-direction is α. If equation of path of the particle is $y = ax - bx^2$, then initial velocity of the particle is

A. $\sqrt{\frac{\alpha}{2b}}$

B. $\sqrt{\frac{\alpha(1+a^2)}{2b}}$

C. $\sqrt{\frac{\alpha}{a^2}}$

D. $\sqrt{\frac{\alpha b}{a^2}}$

Answer: B

Watch Video Solution

12. Projectile motion is a combination of two one-dimensional motion: one in horizontal and other in vertical direction. Motion in 2D means in a plane. Necessary condition for 2D motion is that the velocity vector is coplanar to the acceleration vector. In case of projectile motion, the angle between velocity and acceleration will be $0^\circ \text{lt} \theta \text{lt} 180^\circ$. During the projectile motion, the horizontal component of velocity ramains unchanged but the vertical component of velocity is time dependent. Now answer the

following questions:

An object is projected from origin in x-y plane in which velocity changes according to relation $\overrightarrow{v} = a\hat{i} + bx\hat{j}$. Path of particle is

A. Hyperbolic

B. Circular

C. Elliptical

D. parabolic

Answer: D

Watch Video Solution

13. Projectile motion is a combination of two one-dimensional motion: one in horizontal and other in vertical direction. Motion in 2D means in a plane. Necessary condition for 2D motion is that the velocity vector is coplanar to the acceleration vector. In case of projectile motion, the angle between velocity and acceleration will be $0^\circ < \theta < 180^\circ$. During the projectile motion, the horizontal component of velocity ramains unchanged but the vertical component of velocity is time dependent. Now answer the following questions:

A body is projected at angle of 30° and 60° with the same velocity. Their horizontal ranges are R_1 and R_2 and maximum heights are H_1 and H_2, respectively, then

A body is projected at angle of 30° and 60° with the same velocity. Their horizontal ranges are R_1 and R_2 and maximum heights are H_1 and H_2, respectively, then

A. $\frac{R_1}{R_2} > 1$

B. $\frac{H_1}{H_2} > 1$

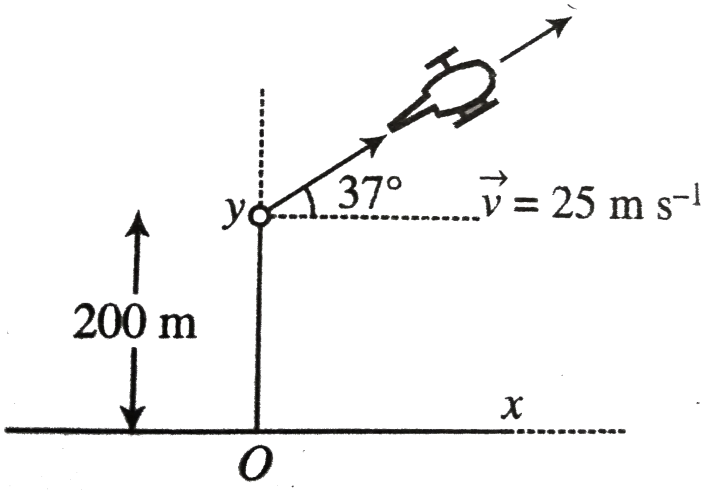
C. $\frac{R_1}{R_2} < 1$

D. $\frac{H_1}{H_2} < 1$

Answer: D

Watch Video Solution

14. A helicopter is flying at $200m$ and flying at $25ms^{-1}$ at an angle 37° above the horizontal when a package is dropped from it.



The distance of the point O where the package lands is

A. 80 m

B. 100 m

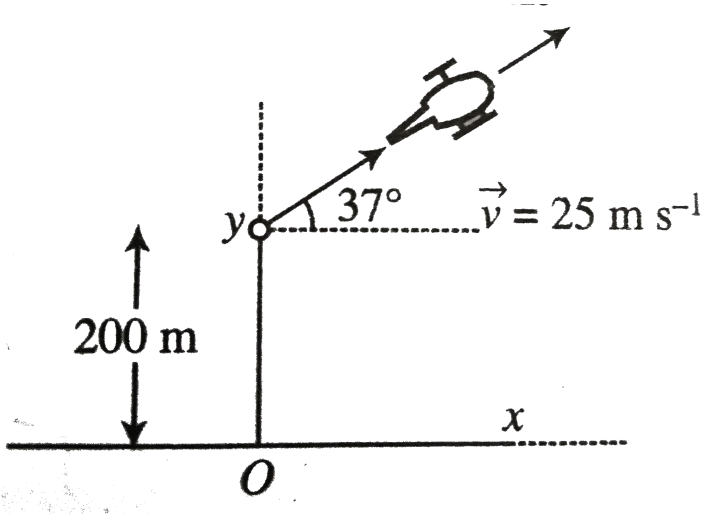
C. 200 m

D. 160 m

Answer: D

Watch Video Solution

15. A helicopter is flying at $200m$ and flying at $25ms^{-1}$ at an angle 37° above the horizontal when a package is dropped from it.



If the helicopter flies at constant velocity, find the x and y coordinates of the location of the helicopter when the package lands.

A. 160 m, 320 m

B. 100m, 200 m

C. 200 m , 400 m

D. 50 m, 100 m

Answer: A

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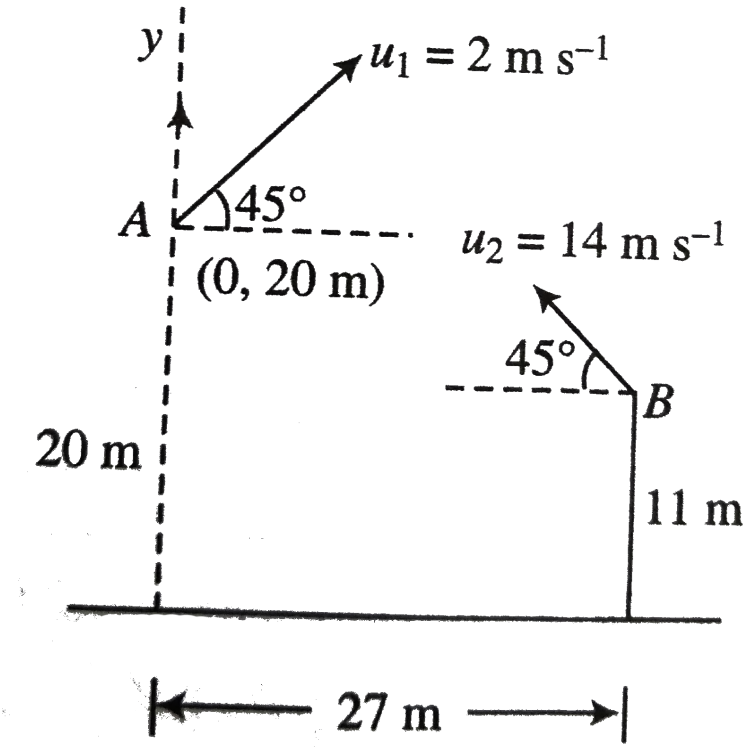
16. Two particles are thrown simultaneously from points A and B with velocities $u_1 = 2ms^{-1}$ and $u_2 - 14ms^{-1}$, respectively, as shown in figure.



The relative velocity of B as seen from A in

A. $-8\sqrt{2}\hat{i} + 6(\sqrt{2})\hat{j}$

B. $4\sqrt{2}\hat{i} + 3(\sqrt{3})\hat{j}$

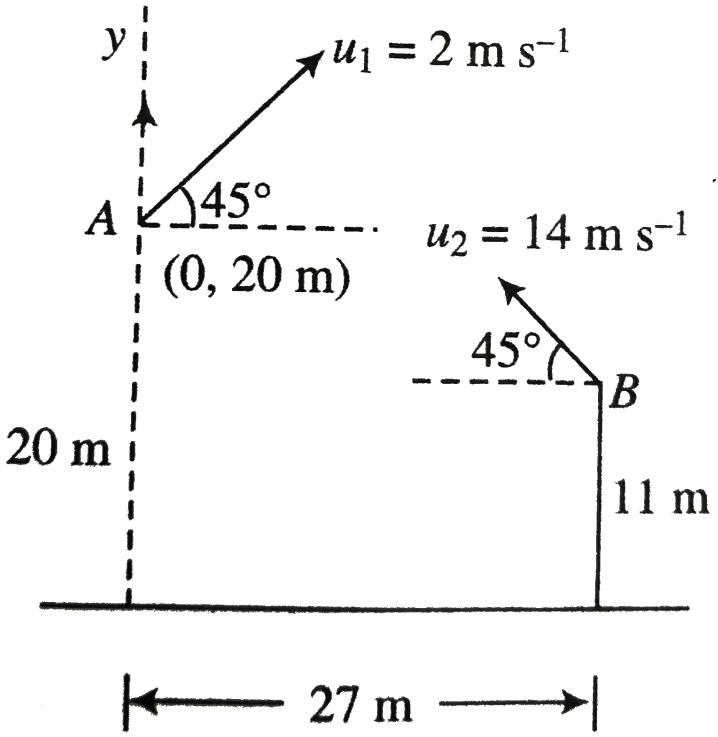
C. $3\sqrt{5}\hat{i} + 2(\sqrt{3})\hat{j}$

D. $3\sqrt{2}\hat{i} + 4(\sqrt{3})\hat{j}$

Answer: A

Watch Video Solution

17. Two particles are thrown simultaneously from points A and B with velocities $u_1 = 2ms^{-1}$ and $u_2 = 14ms^{-1}$, respectively, as shown in figure.



The direction (angle) with horizontal at which B will appear to move as seen from A is

A. 37°

B. 53°

C. 15°

D. 90°

Answer: B

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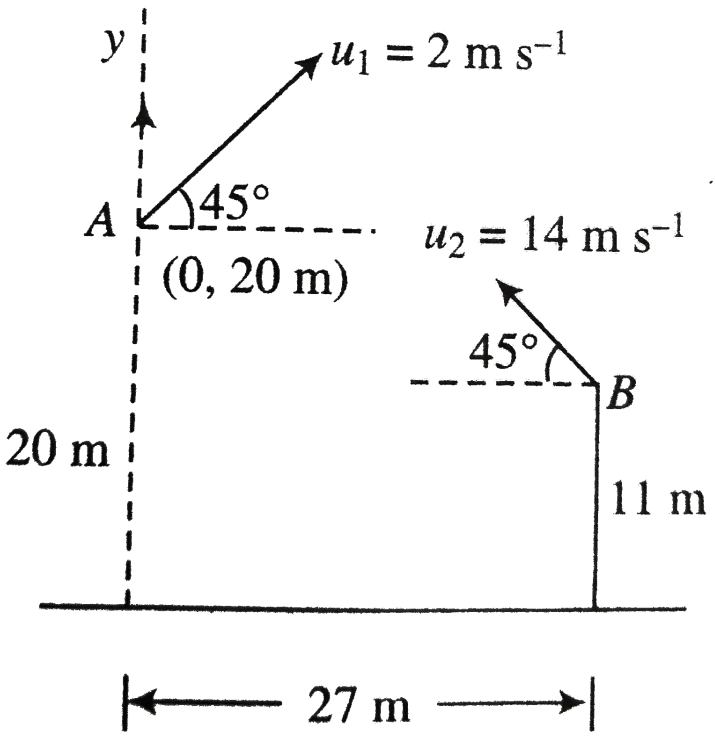
18. Two particles are thrown simultaneously from points A and B with velocities $u_1 = 2ms^{-1}$ and $u_2 - 14ms^{-1}$, respectively, as shown in figure.



Minimum separation between A and B is

A. 3 m

B. 6 m

C. 12 m

D. 9 m

Answer: A

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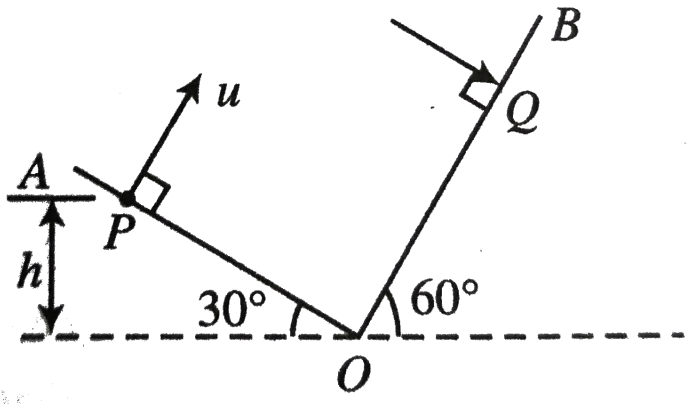
19. Two inclined planes OA and OB having inclination (with horizontal) 30° and 60°, respectively, intersect each other at O as shown in figure. A particle is projected from point P with velocity $u = 10(\sqrt{3})ms^{-1}$ along a direction perpendicular to plane OA. If the particle strikes plane OB perpendicularly at Q, calculate



The velocity with which particle strikes the plane OB,

A. $15ms^{-1}$

B. $30ms^{-1}$

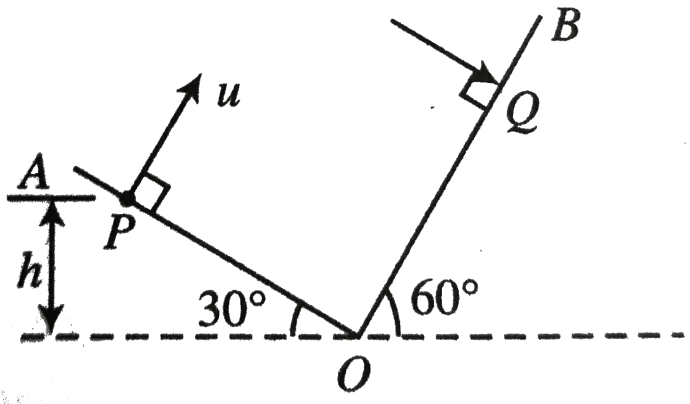
C. $20ms^{-1}$

D. $10ms^{-1}$

Answer: D

Watch Video Solution

20. Two inclined planes OA and OB having inclination (with horizontal) 30° and 60°, respectively, intersect each other at O as shown in figure. A particle is projected from point P with velocity $u = 10\left(\sqrt{3}\right)ms^{-1}$ along a direction perpendicular to plane OA. If the particle strikes plane OB perpendicularly at Q, calculate



The velocity with which particle strikes the plane OB,

A. 8 s

B. 6 s

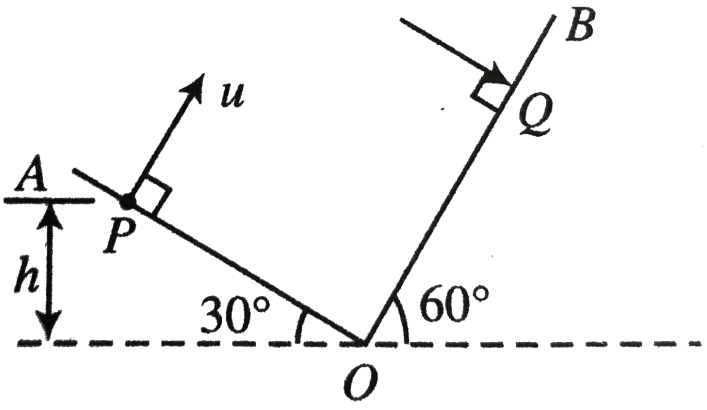
C. 4 s

D. 2 s

Answer: D

Watch Video Solution

21. Two inclined planes OA and OB having inclination (with horizontal) $30^\circ \text{ and } 60^\circ$, respectively, intersect each other at O as shown in figure. A particle is projected from point P with velocity $u = 10\sqrt{3}ms^{-1}$ along a direction perpendicular to plane OA. If the particle strikes plane OB perpendicularly at Q, calculate



The vertical height h of P from O,

A. 10 m

B. 5 m

C. 15 m

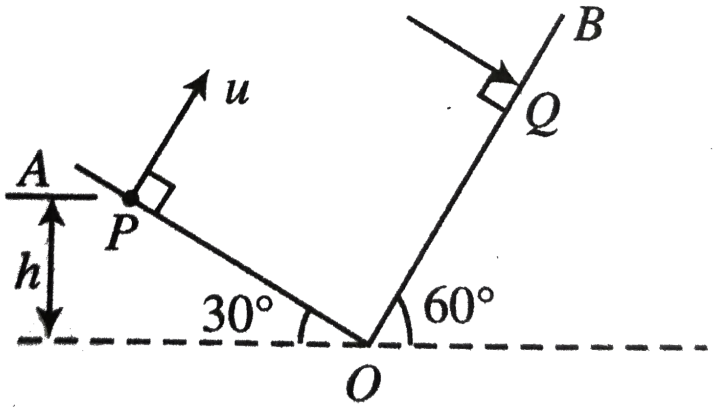
D. 20 m

Answer: B

Watch Video Solution

Watch Video Solution

22. Two inclined planes OA and OB having inclination (with horizontal) 30° and 60° (with horizontal), respectively, intersect each other at O as shown in figure. A particle is projected from point P with velocity $u = 10\sqrt{3} ms^{-1}$ along a direction perpendicular to plane OA. If the particle strikes plane OB perpendicularly at Q, calculate



The maximum height attained by the particle (from the line O)

A. 20.5 m

B. 5 m

C. 16.25 m

D. 11.25 m

Answer: C

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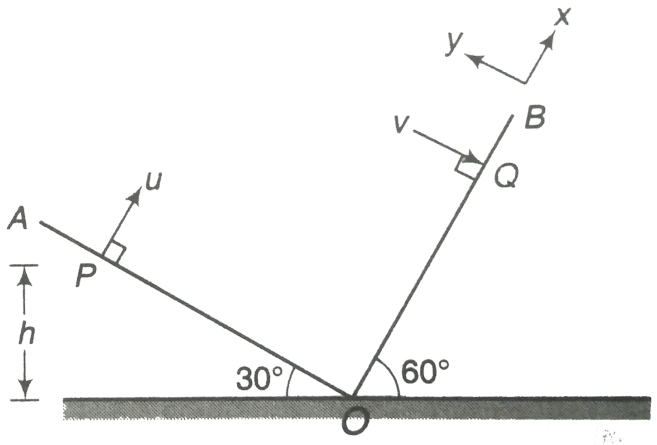
23. Two inclined planes OA and OB having inclinations 30° and 60° with the horizontal respectively intersect each other at O, as shown in figure. A particle is projected from point P with velocity $u = 10\sqrt{3}m/s$ along a direction perpendicular to plane OA. If the particle strikes plane OB perpendicular at Q. Calculate.



(a) time of flight,

(b) velocity with which the particle strikes the plane OB,

(c) height h of point P from point O,

(d) distance PQ. (Take $g = 10m/s^2$)

A. 20 m

B. 10 m

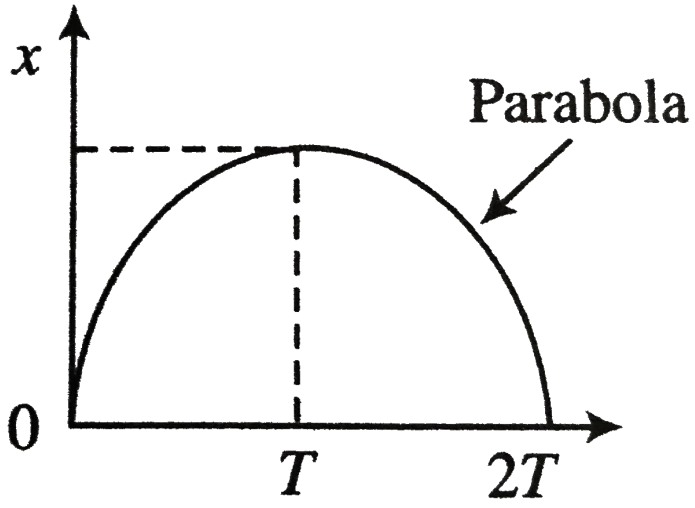
C. 5 m

D. 2.5 m

Answer: A

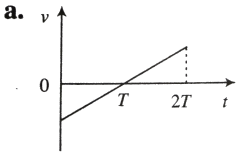
Watch Video Solution

24. The x-t graph of a particle moving along a straight line is shown in figure

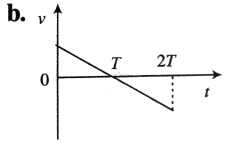


The v-t graph of the particle is correctly shown by

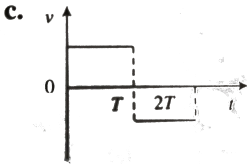
A.

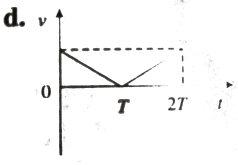


B.



C.

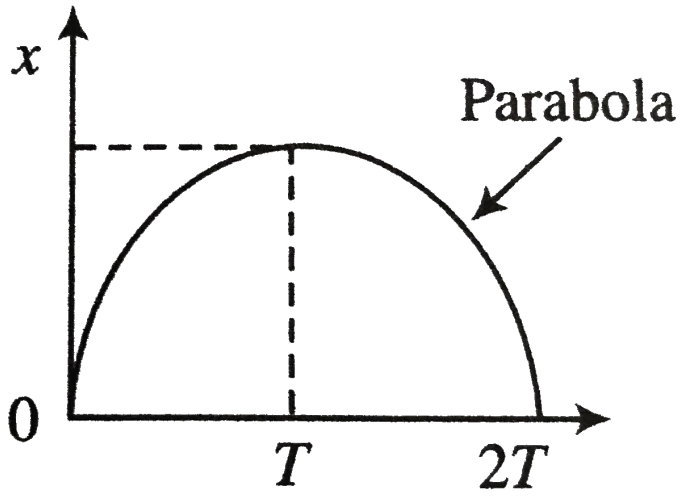


D. 

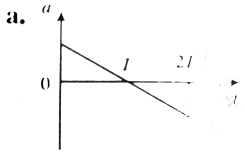
Answer: B

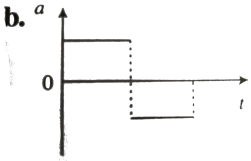
Watch Video Solution

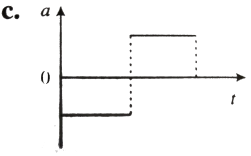
25. The x-t graph of a particle moving along a straight line is shown in figure

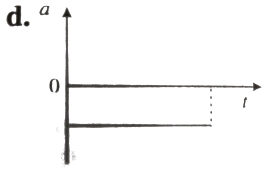


The a-t graph of the particle is correctly shown by

A. 

B. 

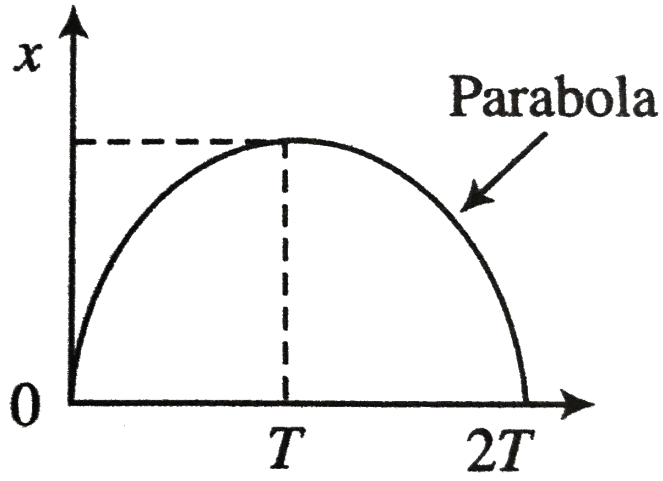
C. 

D. 

Answer: D

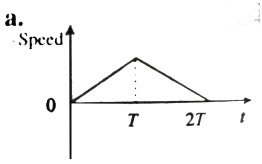
Watch Video Solution

26. The x-t graph of a particle moving along a straight line is shown in figure

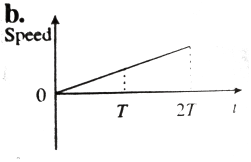


The speed-time graph of the particle is correctly shown by

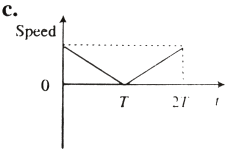
A.

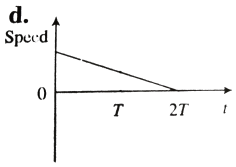


B.



C.

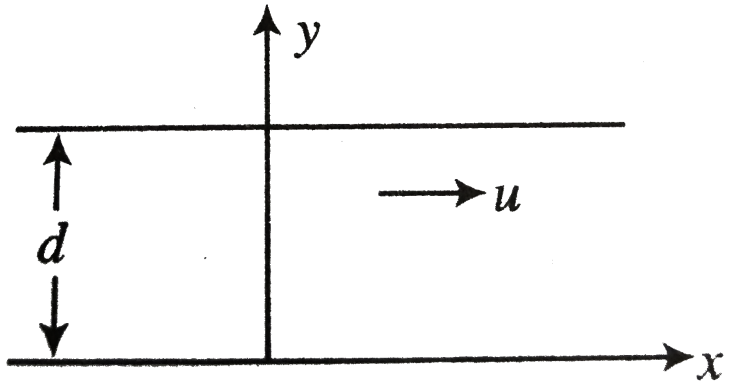


D. 

Answer: C

Watch Video Solution

27. We know that when a boat travels in water, its net velocity w.r.t. ground is the vector sum of two velocities. First is the velocity of boat itself in river and other is the velocity of water w.r.t. ground. Mathematically:



$$\overrightarrow{v}_{boat} = \overrightarrow{v}_{boat,water} + \overrightarrow{v}_{water}.$$

Now given that velocity of water w.r.t. ground in a river is u. Width of the river is d.

A boat starting from rest aims perpendicular to the river with an acceleration of a = 5t, where t is time. The boat starts from point (1,0) of the coordinate system as shown in figure. Assume SI units. Find time taken by him to across the river.

A. $(3d/5)^{1/3}$

B. $(6d/5)^{1/3}$

C. $(6d/5)^{1/2}$

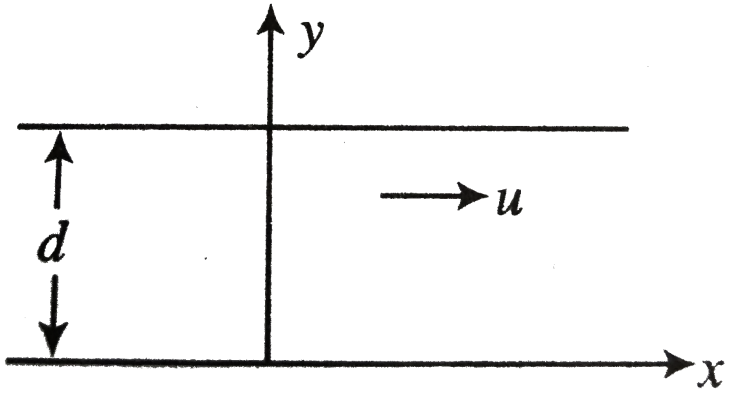
D. $(2d/3)^{1/3}$

Answer: B

Watch Video Solution

28. We know that when a boat travels in water, its net velocity w.r.t. ground is the vector sum of two velocities. First is the velocity of boat itself

in river and other is the velocity of water w.r.t. ground. Mathematically:



$$\overrightarrow{v}_{boat} = \overrightarrow{v}_{boat,water} + \overrightarrow{v}_{water}.$$

Now given that velocity of water w.r.t. ground in a river is u. Width of the river is d.

A boat starting from rest aims perpendicular to the river with an acceleration of a = 5t, where t is time. The boat starts from point (1,0) of the

coordinate system as shown in figure. Assume SI units.

A. $x - 1 = u\left(\frac{3y}{5}\right)^{1/3}$

B. $x = u\left(\frac{6y}{5}\right)^{1/3}$

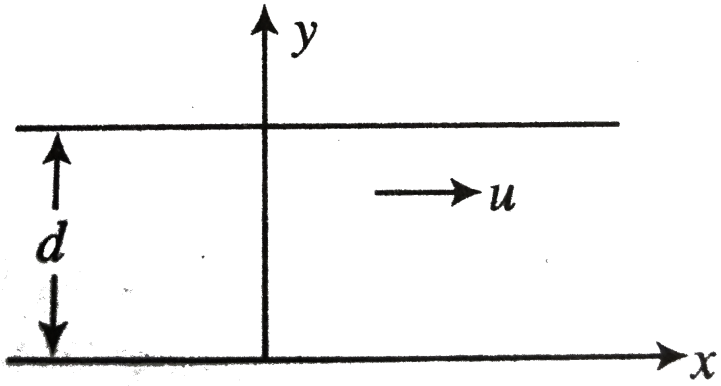
C. $x = 1 - u\left(\frac{6y}{5}\right)^{1/3}$

D. None of these

Answer: C

Watch Video Solution

29. We know that when a boat travels in water, its net velocity w.r.t. ground is the vector sum of two velocities. First is the velocity of boat itself in river and other is the velocity of water w.r.t. ground. Mathematically:



$$\overrightarrow{v}_{boat} = \overrightarrow{v}_{boat,water} + \overrightarrow{v}_{water}.$$

Now given that velocity of water w.r.t. ground in a river is u. Width of the river is d.

A boat starting from rest aims perpendicular to the river with an acceleration of a = 5t, where t is time. The boat starts from point (1,0) of the coordinate system as shown in figure. Assume SI units.

A. $x = u\left(\frac{3d}{5}\right)^{1/3}$

B. $x = u\left(\frac{3d}{5}\right)^{1/3} + 1$

C. $x = u\left(\frac{6d}{5}\right)^{1/3}$

D. None of these

Answer: A

Watch Video Solution

30. Ram Shyam are walking on two perpendicular tracks with speed $3ms^{-1}$ and $4ms^{-1}$, respectively. At a certain moment $(sayt = 0s)$, Ram and Shyam are at 20 m and 40 m away from the intersection of tracks, respectively, and moving towards the intersection of the tracks.

During the motion the magnitude of velocity of ram with respect to Shyam is

A. $1ms^{-1}$

B. $4ms^{-1}$

C. $5ms^{-1}$

D. $7ms^{-1}$

Answer: C

Watch Video Solution

31. Ram Shyam are walking on two perpendicular tracks with speed $3ms^{-1}$ and $4ms^{-1}$, respectively. At a certain moment $(t = 0s)$, Ram and Shyam are at 20 m and 40 m away from the

intersection of tracks, respectively, and moving towards the intersection of the tracks.

During the motion the magnitude of velocity of ram with respect to Shyam is

A. 18 m

B. 15 m

C. 25 m

D. 8 m

Answer: D

Watch Video Solution

32. Ram Shyam are walking on two perpendicular tracks with speed $3ms^{-1}$ and $4ms^{-1}$, respectively. At a certain moment (say t = 0s), Ram and Shyam are at 20 m and 40 m away from the intersection of tracks, respectively, and moving towards the intersection of the tracks. The time t when they are at shortest distance from each other subsequently is -

A. 8.8 s

B. 12 s

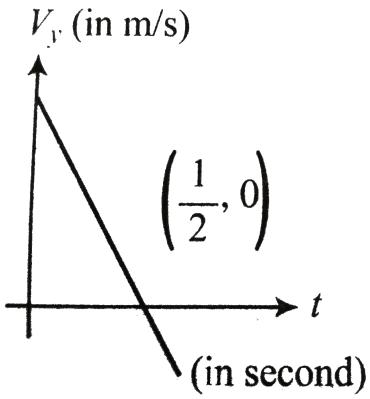
C. 15 s

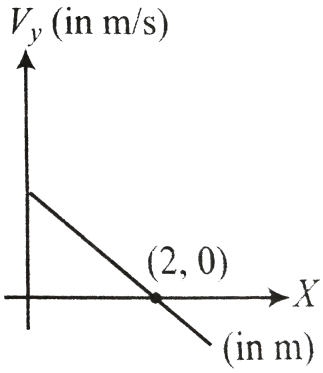
D. 44 s

Answer: A

Watch Video Solution

33. Two graphs of the same projectile motion (in the xy-plane) projected from origin are shown. X-axis is along horizontal direction and y-axis is vertically upwards. Take $g = 10ms^{-2}$.





,

The projection speed is :

A. $\sqrt{37}ms^{-1}$

B. $\sqrt{41}ms^{-1}$

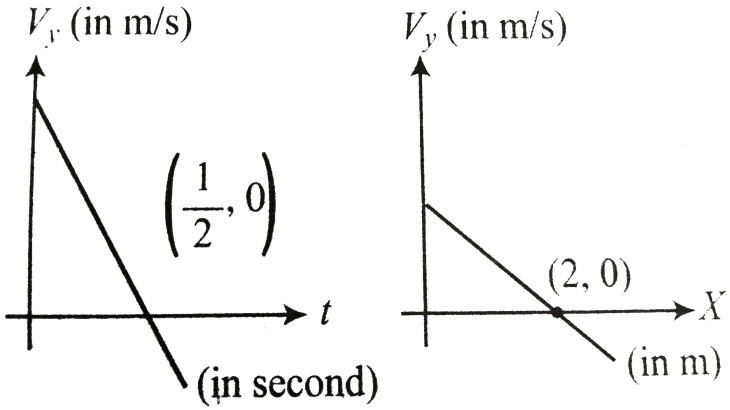
C. $\sqrt{14}ms^{-1}$

D. $\sqrt{40}ms^{-1}$

Answer: B

Watch Video Solution

34. Two graphs of the same projectile motion (in the xy-plane) projected from origin are shown. X-axis is along horizontal direction and y-axis is vertically upwards. Take $g = 10ms^{-2}$.



Projection angle with the horizontal is :

A. $\tan^{-1}\left(\frac{4}{5}\right)$

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

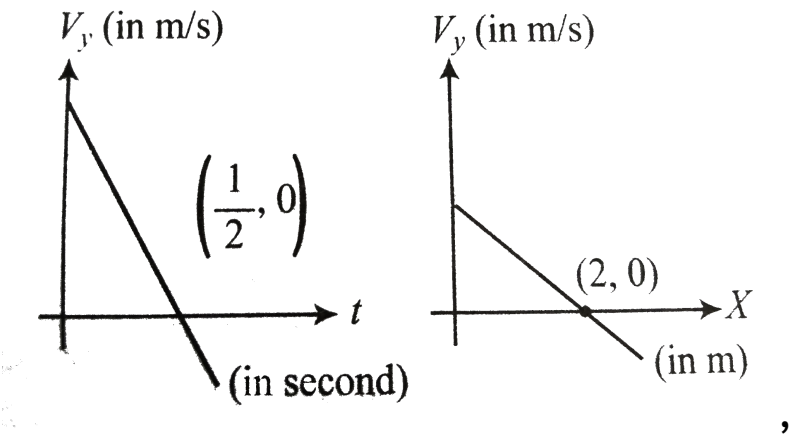
C. $\tan^{-1}\left(\frac{5}{4}\right)$

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

Answer: C

Watch Video Solution

35. Two graphs of the same projectile motion (in the xy-plane) projected from origin are shown. X-axis is along horizontal direction and y-axis is vertically upwards. Take $g = 10ms^{-2}$.



,

Maximum height attained from the point of projection is

A. 1.25 m

B. 12.5 m

C. 2.25 m

D. None of these

Answer: A

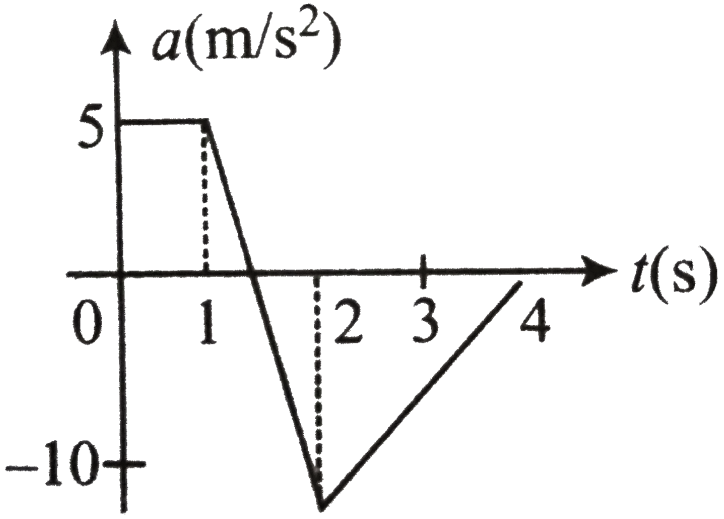
Watch Video Solution

Integer Type

1. In a square cut, the speed of the cricket ball changes from $30ms^{-1}$ to $40ms^{-1}$ during the time of its contact $\Delta t = 0.01s$ with the bat. If the ball is deflected by the bat through an angle of $\theta = 90^{\circ}$, find the magnitude of the average acceleration $\left(\text{in} \times 10^{2}ms^{-2}\right)$ of the ball during the square cut.

Watch Video Solution

2. A particle moves vertically with an upwards initial speed $v_0 = 10.5ms^{-1}$. If its acceleration varies with time as shown in a-t graph in figure, find the velocity of the particles at t = 4s.



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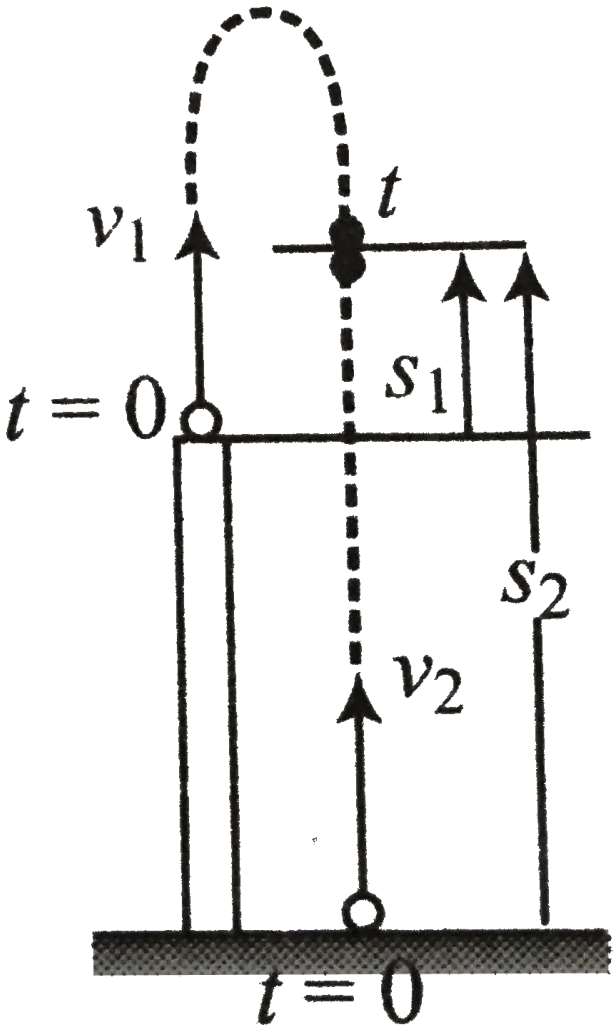
3. Two bodies 1 and 2 are projected simultaneously with velocities $v_1 = 2ms^{-1}$ and $v_2 = 4ms^{-1}$ respectively. The body 1 is projected vertically up from the top of a cliff of height h = 10m and the body 2 is projected vertically up from the bottom of the cliff. If the bodies meet, find the time (in s) of

meeting of the bodies.



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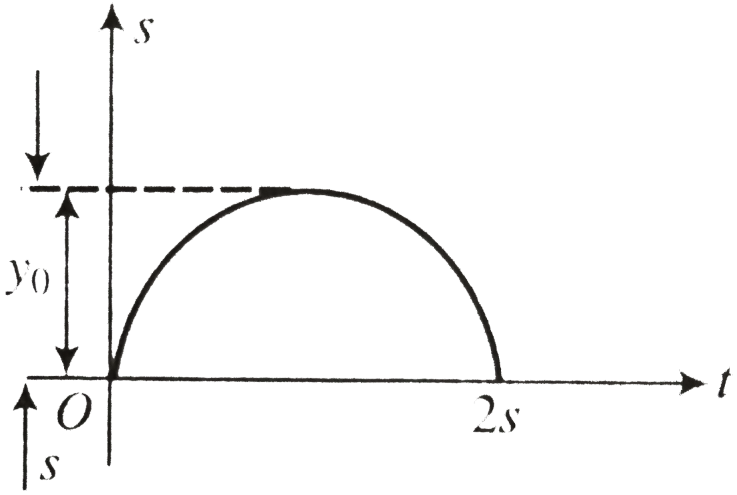
4. A particle moves rectilinearly possessing a parabolic s-t graph. Find the average velocity of the particle over a time interval from $t = \frac{1}{2}s \to t = 1.5s.$



Watch Video Solution

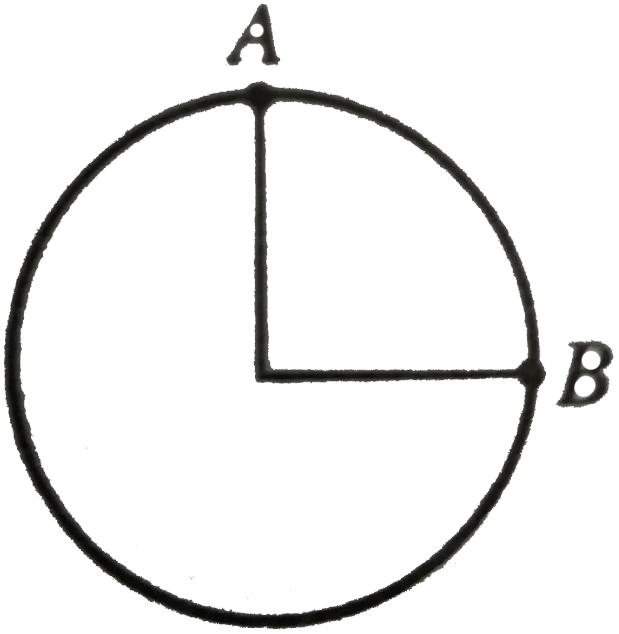
5. A ball is projected from the origin. The x- and y-coordinates of its displacement are given by $x = 3t$ and $y = 4t - 5t^2$. Find the velocity of projection $\left(\text{in} ms^{-1}\right)$.

Watch Video Solution

6. A grasshopper can jump a maximum distance $1.6m$. It spends negligible time on the ground. How far can it go in $10s$?

Watch Video Solution

7. A particle is moving in a circular path of radius 1 m. under the action of a centripetal force, the speed $\sqrt{2}\pi ms^{-1}$ of the particle is constant. Find the average of the velocity $\left(\text{in} ms^{-1}\right)$ between A and B.



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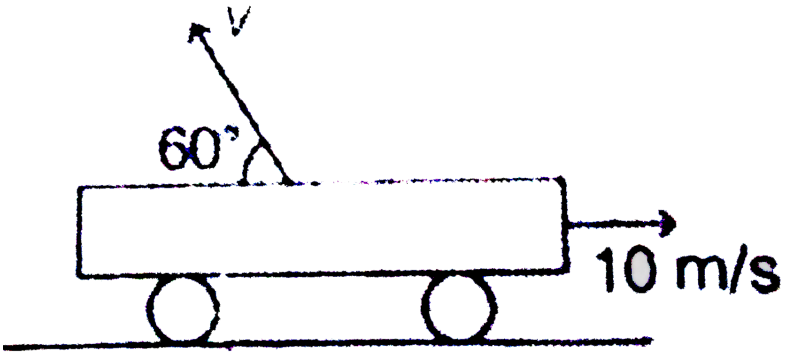
8. In figure, the angle of inclination of the inclined plane is 30°. Find the horizontal velocity V_0 so that the particle hits the inclined plane perpendicularly.

Watch Video Solution

9. The directioin of projection of particle is shown in the figure for an observer on trolley. An

observer on the grond sees the ball rising vertically. The maximum height reached by the ball as seen from the troelley is



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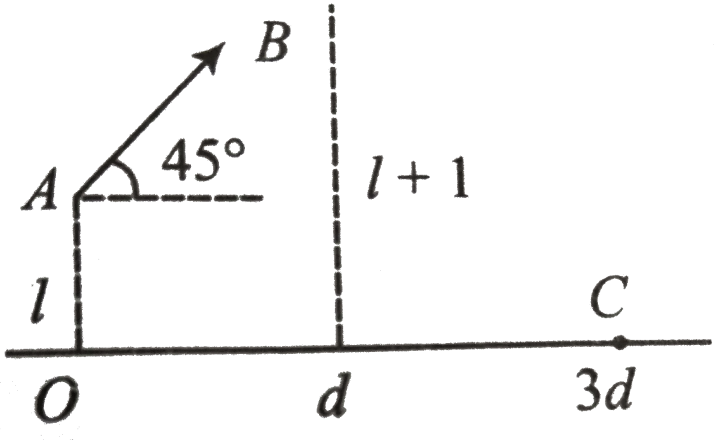
10. A projectile is launched at time t = 0 from point A which is at height 1 m above the floor with speed vms^{-1} and at and angle $\theta = 45^{\circ}$

with the floor. It passes through a hoop at B which is 1 m above A and B is the highest point of the trajectory. The horizontal distance between A and B is d meters. The projectile then falls into a basket, hitting the floor at C a horizontal distance 3 d meters from A. Find l (in m).



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11. A particle moves in a straight line. Its position (in m) as function of time is given by

$x = \left(at^2 + b\right)$

What is the average velocity in time interval $t = 3s \rightarrow t = 5s \in ms^{-1}$. (where a and b are constants and a $= 1ms^{-2}, b = 1m$).

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12. The three initial and final positions of a man on the x-axis are given as

(i) (-3 m, 7 m) (ii) (7 m, -3 m)

(iii) (-7 m, 3 m)

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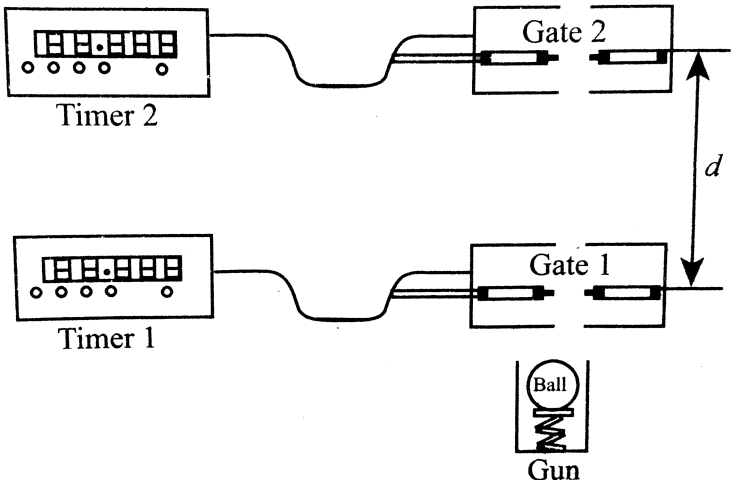
13. Figure shows a method for measuring the acceleration due to gravity. The ball is projected upward by a gun. The ball pases the electronic gates 1 and 2 as it rises and again as it falls. Each gate is connected to a separate timer. The first passage of the ball through each gate stars the corresponding timer, and the second passage through the same gate stops the timer.

the time intervals $\triangle t_1$ and $\triangle t_2$ are thus measured. The vertical distance between the two gates is d. If $d = 5m$, $\triangle t_1 = 3s$, $\triangle t_2 = 2s$, then find the measured value of acceleration due to gravity (in m/s^2)



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14. Acceleration of particle moving rectilinearly is $a = 4 - 2x$(where x is position in metre and a in ms^(-2)) . $Itsiat \in s\tan tan eousrestatx = 0.\ Atw\hat{p}osition$ x 9`in meter) will the particle again come to instantaneous rest?

Watch Video Solution

15. A big Diwali rocket is projected vertically upward so as to attain a maximum height of 160 m. The rocket explodes just as it reaches the top

of its trajectory sending out luminous particles in all possible directions all with same speed v. The display, consisting of the luminous particles, spreads out as an expanding, brilliant sphere. The bottom of this sphere just touches the ground when its radius is 80 m. With what speed $(\text{in} m / s)$are the luminous particles ejected by the explosion?

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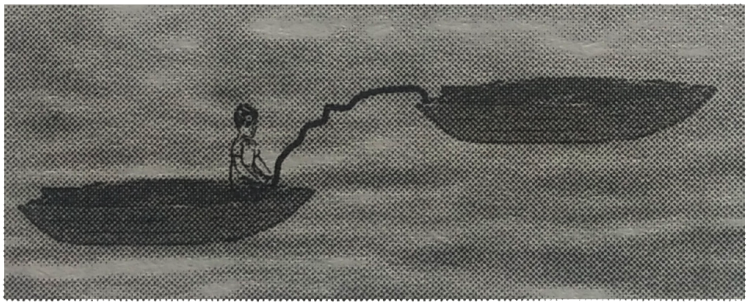
16. A student throws soft balls out of the window at different angles to the horizontal. All

soft balls have the same initial speed $v = 10\sqrt{3}ms^{-1}$. It turns out that all soft balls landing velocities make angles 30° or greater with the horizontal. Find the height h (in m) of the window above the ground.

Watch Video Solution

17. A rope is strecthed between two boats at rest. A sailor in the first boat pulls the rope with a constant force of 100N. First boat with the sailor has mass of 250kg. Whereas the mass of second boat is double of this mass. If the initial

distance between the boats was 100m. The time taken for two boats to meet each other is (neglect water resistance between boats and water)



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Fill In The Blanks

1. A particle moves in a circle of radius R. In half the period of revolution its displacement is ..... and distance covered is ..... .

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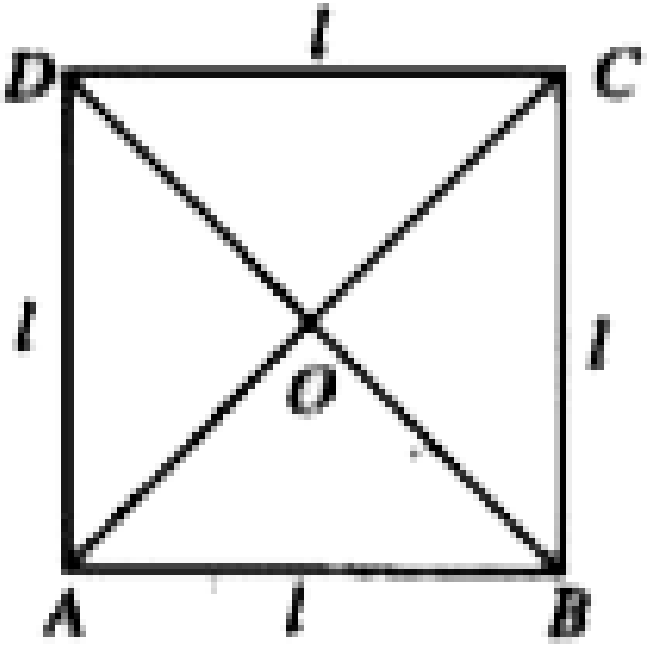
2. Four children are standing at the corners A, B, C and D of a square of side l. They simultaneously start running such that A runs towards B, B towaards C, C runs towards D and D runs towards A, each with a velocity v.They will

meet after a time



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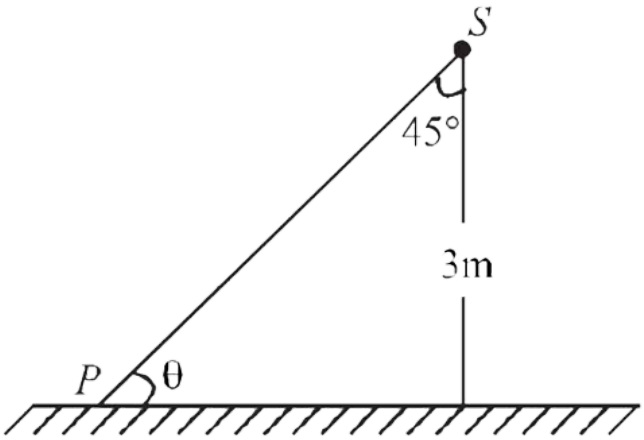
3. Spotlight S rotates in a horizontal plane with constant angular velocity of 0.1 rad/s The spot of

light P moves along the wall at a distance of 3 m

The velocity of the spot P when θ = 45 is m/s (see

- fig.) is ..... m/s



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4. The trajectory of a projectile in a vertical plane is $y = ax - bx^2$, where a and b are constant

and x and y are, respectively, horizontal and vertical distances of the projectile from the point of projection. The maximum height attained by the particle and the angle of projectile from the horizontal are.

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True Or False

1. Two balls of different masses are thrown vertically upwards with the same speed . They pass through the point of projection in their

downward motion with the same speed (Neglect air resistance).

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2. A projectile fired from the ground follows a parabolic path. The speed of the projectile is minimum at the top of its path.

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Interger Type

1. A train is moving along a straight line with a constant acceleration 'a' . A boy standing in the train throws a ball forward with a speed of $10m/s$, at an angle of $60_{\circ}$ to the horizontal. The boy has to move forward by $1.15m$ inside the train to catch the ball back at the initial height . the acceleration of the train , in m/s^2 , is

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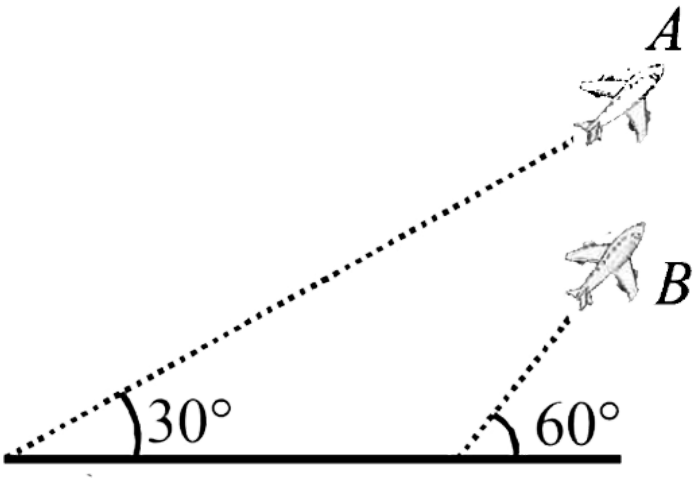
2. Airplanes A and B are flying with constant velocity in the same vertical plane at angles 30° and 60° with respect to the horizontal respectively as shown in figure . The speed of A is $100\sqrt{3}m/s$. At time $t = 0s$, an observer in A finds B at a distance of $500m$. The observer sees B moving with a constant velocity perpendicular to the line of motion of A . If at $t = t_0$, A just escapes being hit by B, t_0 , A just escapes being

hit by B, t_0 in seconds is



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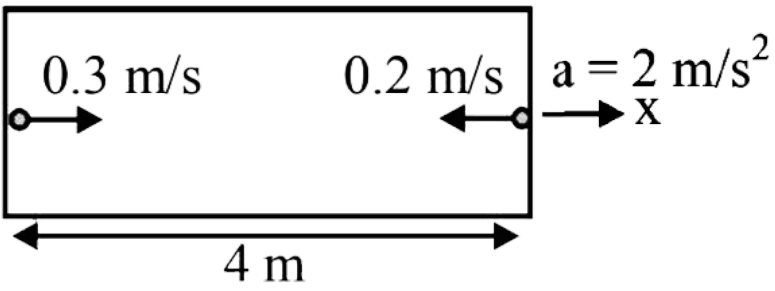
3. A rocket is moving in a gravity free space with a constant acceleration of $2m/s^2$ along $+x$ direction (see figure). The length of a chamber inside the rocket is $4m$. A ball is thrown from the

left end of the chamber in $+x$ direction with a speed of $0.3m/s$ relative to the rocket . At the same time , another ball is thrown in $+x$ direction with a speed of $0.2m/s$ drom its right end relative to the rocket . The time in seconds when the two balls hit each other is



Watch Video Solution