PHYSICS

BOOKS - CENGAGE PHYSICS (HINGLISH)

KINEMATICS-1

Illustration

1. A particle moves in the the $x-y$ Plane according to the scheme $x-8\sin\pi t$, where t is time. Find equation to the path of the particle. Show the path on a graph.

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2. A particle move in $x-y$ plane such that its position vector varies with time as $\overrightarrow{r}=(2\sin 3t)\hat{j}+2(1-\cos 3t)\hat{j}$. Find the equation of the

trajectory of the particle.

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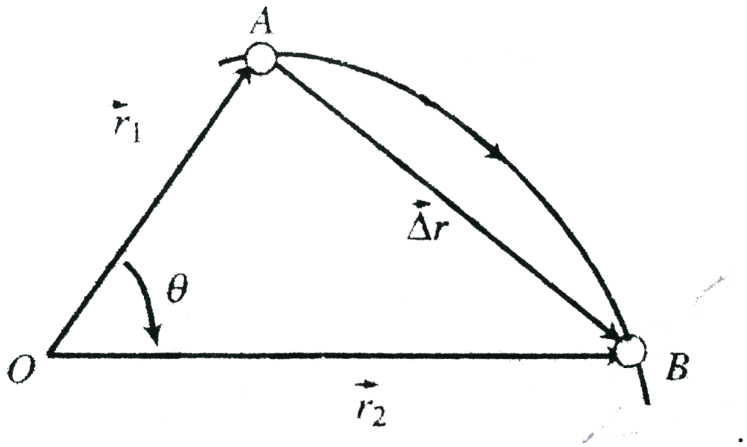
3. A particle moves from position A to position B in a path as shown in If the poit vectors $\overrightarrow{r}_1$ and $\overrightarrow{r}_2$ making an angle θ between them are give, find the magnitude of displacement.



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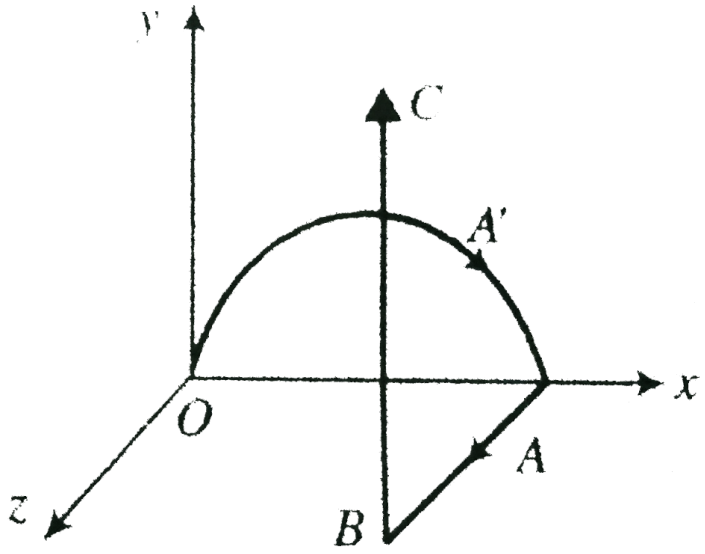
4. A particle move in a semicircular of radius R from O to A . Then it moves parallel to z-axis covering distance R upto B. Finally it moves

along BC parallel to y-axis throuth a distance $2R$. Find the ratio of D/s.



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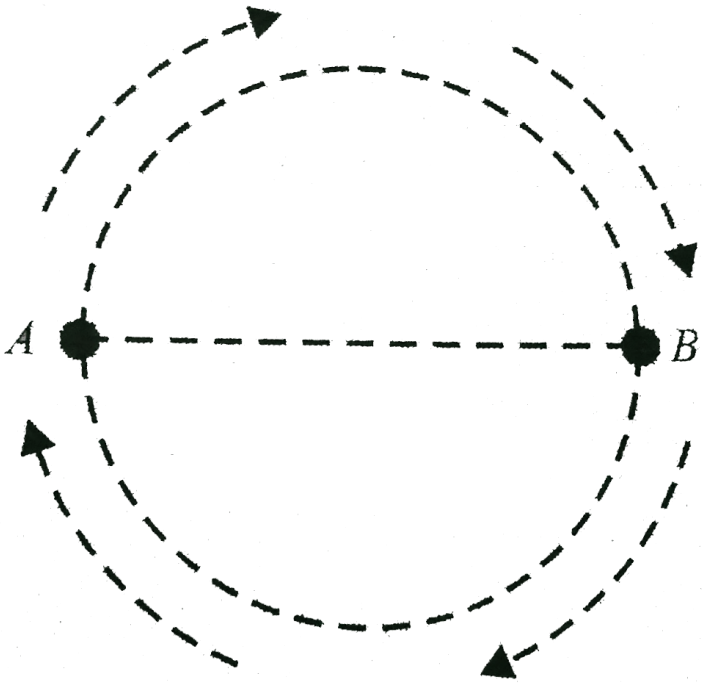
5. A particle is moving in a circle of radius R.

a. What is its displacement when it covers (i) half the circle, (ii) full circle?

b. What is its distance when it comers (i) half the the circle and (ii) full

circle ?.



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6. A teain tramels from city A to city B with constant speed of $10ms^{-1}$ and returns back to city A with a constant spiid of $20ms^{-1}$. Finde its average speed during its entire journey.

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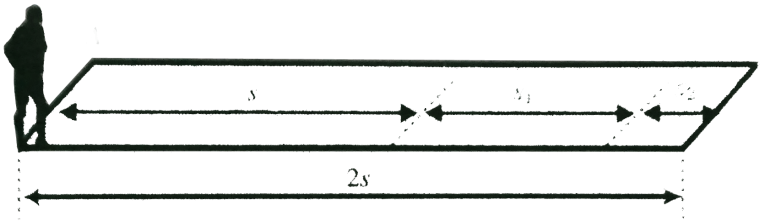
7. A man traversed half the distance with a velocity v_0. The remaining part of the distance was covered with velocity V^1. For half the time and with velocity v_2 for the other half of the time . Find the average speed of the man over the whole time of motion.



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8. A particle moves along the curve $\frac{x^2}{9}+\frac{y^2}{4}=1$, with constant speed v. Express its "velocity vectorially" as a function of x, y.

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9. A particle move so that its position verctor varies with time as $\vec{r}=A\cos\omega t\hat{i}+A\sin\omega t\hat{j}$. Find the

a. initial velocity of the particle,

b. angle between the position vector and velocity of the particle at any time, and

c. speed at any instant.

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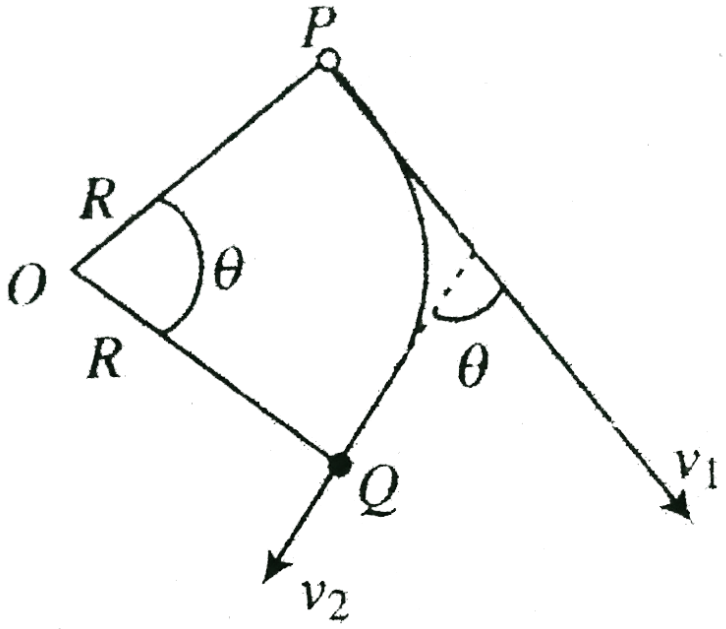
10. A particle describes an angle θ in a circular path with a constant speed v. Find the a charge in the velocity of the particle and b average acceleration of the particle during the motion in the curve (circle).



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11. 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 s^{-1}. Find the time interval for which the particle retards.

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12. The position of a particle moving along x-axis is related to time t as follow: $x = 2t^2 - t^3$, where x is in meters and t is in seconds.

a. What is the maximum positive displacement of the particle along the x axis and at what instant does it attain it?

b. Describe the motion of the particle.

c. What is the destamce covered in the first three seconds?

d. What is its desplacement in the first four seconds ?

e. What is the particle $savera \geq speed$ and $avera \geq velocty \in thefirst3$ $\sec onds? f. W\hat{p}artic \leq s \in s\tan\tan eousae \leq rationatthe \in s\tan tofits$

x

$displacement? < bt > g. W\hat{i}stheavera \geq ae \leq rationbetweenthe \int erval$

t=2 $\rightarrow$ t=4 s`?.

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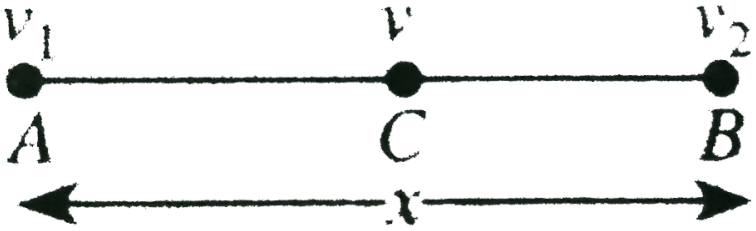
13. A particle moving with uniform acceleration from A to B along a straight line has velcities v_1 and v_2 at A and B respectively. If C is the mid-point between A and B then determine the velocity of the particle at C.



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14. Two trains P and Q are moving along parallel tracks same uniform speed of 20 m s^{-1}. The driver of train P decides to overtake train Q and accelerate his train by $1ms^{-2}$, After $50s$, train P crosses the engine of train Q. Find out what was the distance between the two trains initially. provided the length each is $400m$.

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15. Consider a particle intially moving with a velocity of 5 m s^{-1} starts decelerating at a constant rate of 2 m s^{-2}.

a. Determine the time at which the particle becomes stationary.

b. Find the distance travelled in the second second.

c. Find the distance travelled in the third second.

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16. In a car race, A takes a time of t s, less than car B at the finish and passes the finishin point with a velocity v more than car B. Assuming that

the cars stat from rest and travel with constant accelerations a_1 and a_2. Respectively, show that $v\sqrt{a_1 a_2 t}$.

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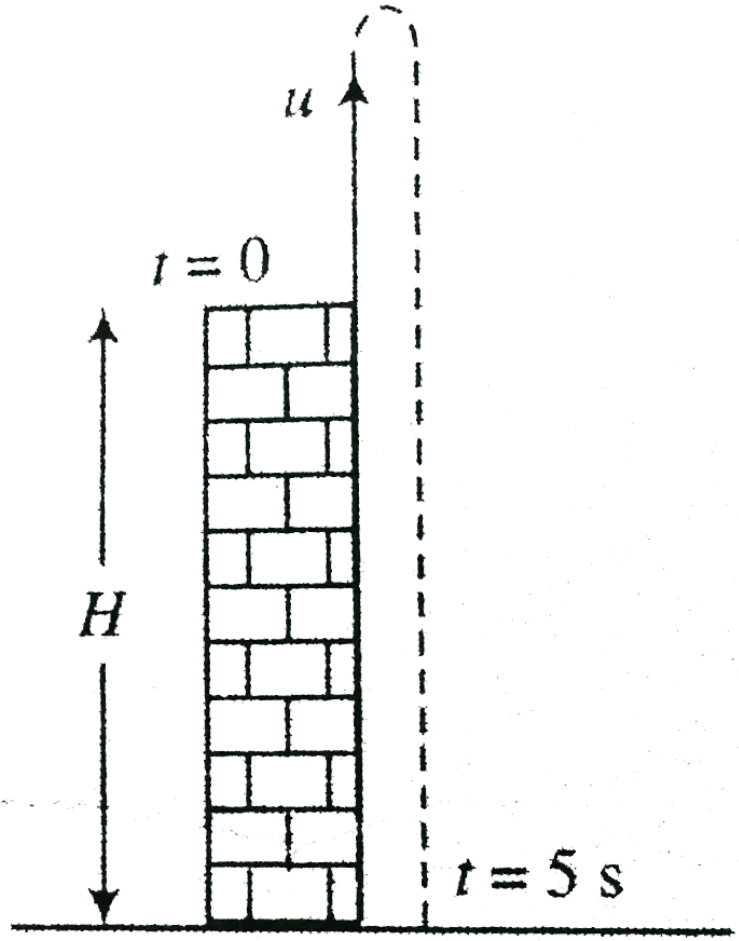
17. A particle is projected up with initial speed $u = 10ms^{-1}$ from the top of a building at time $t = 0$. At time $t = 5s$ the particle strikes the ground.

Find the height of the building in meter.



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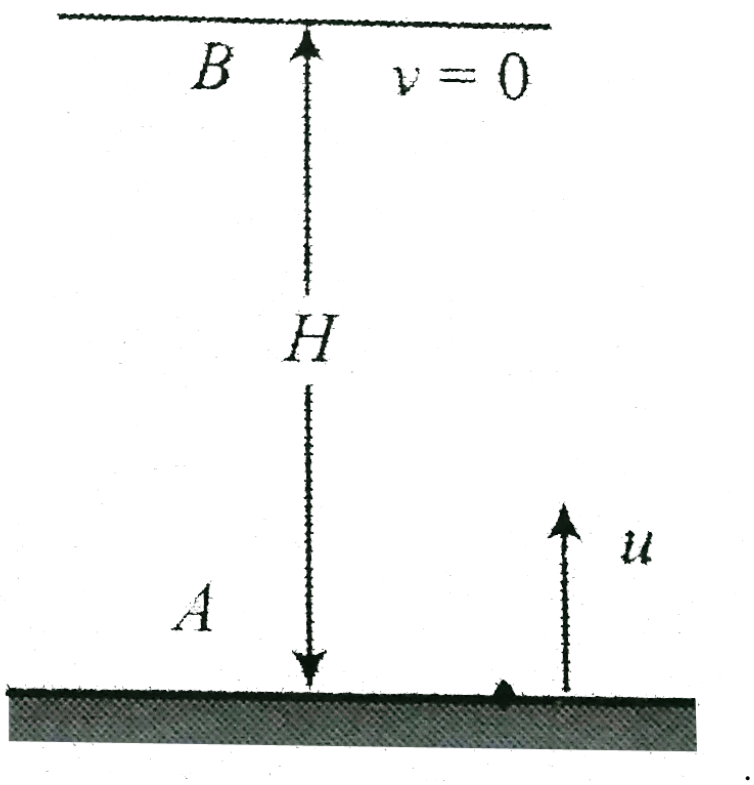
18. A particle is parojected vertically upwards from grund with initial velocity u.

a. Find the maximum height H the particle will attain and time T that it will attain and time T that it will take to return to the ground .



b. What is the velocity when the particle returns to the ground?

c. What is the displacement and distance travelled by the particle during this time of whole motion.

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19. A ball is projected vertically up such that it passes thorugh a fixes point after a time t_0 and t_2 respectively. Find

a. The height at which the point is located with respect to the point of projeciton

b. The speed of projection of the ball.

c. The velocity the ball at the time of passing through point P.

d. (i) The maximum height reached by the balll relative to the point of projection A (ii) maximum height reached by the ball relative to point P under consideration.

e. The average speed and average velocity of the ball during the motion from A to P for the time t_1 and t_2 respectively.

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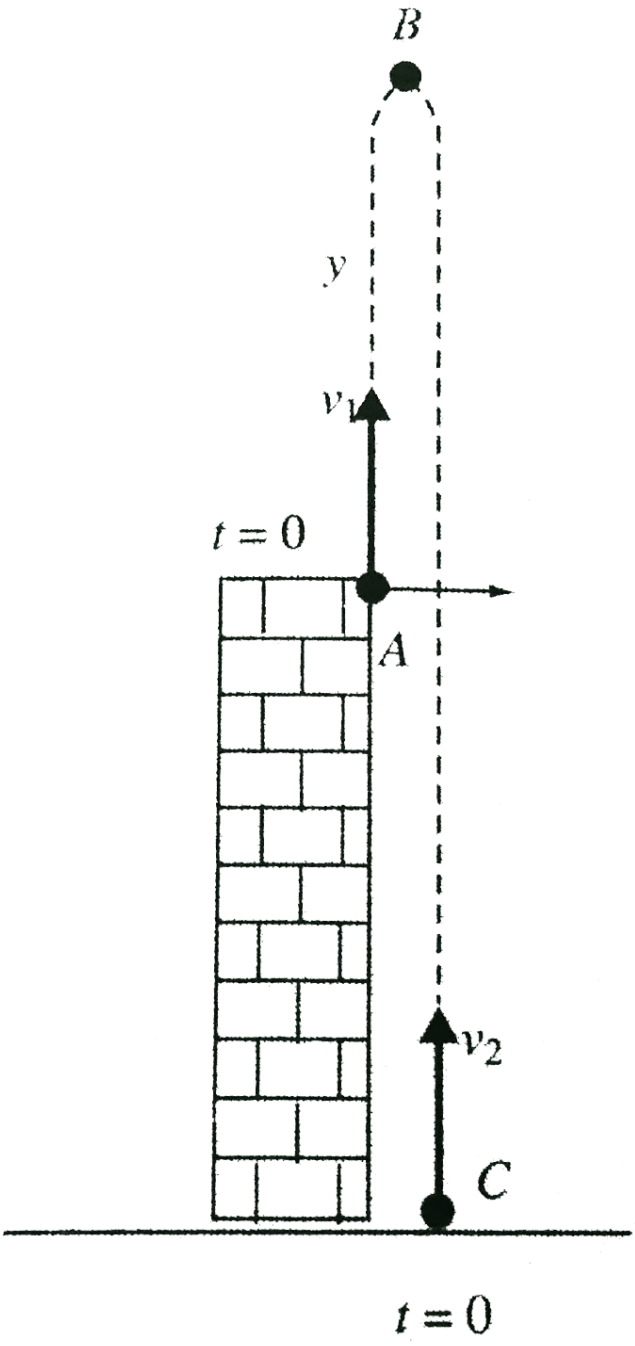
20. Two paarticles 1 and 2 are projected simultaneusly with velocities v_1 and v_2, respectively. Particle 1 is projectected vertically up from the top of a cliff of heitht h and particle 2 is projected vertically up from the bottom

of the cliff. If the bodies meet (a) above the top of the cliff, (b) between the top and bottom of the the cliff, and (c) below the bottom of the cliff,

find the time of meeting of the particles.



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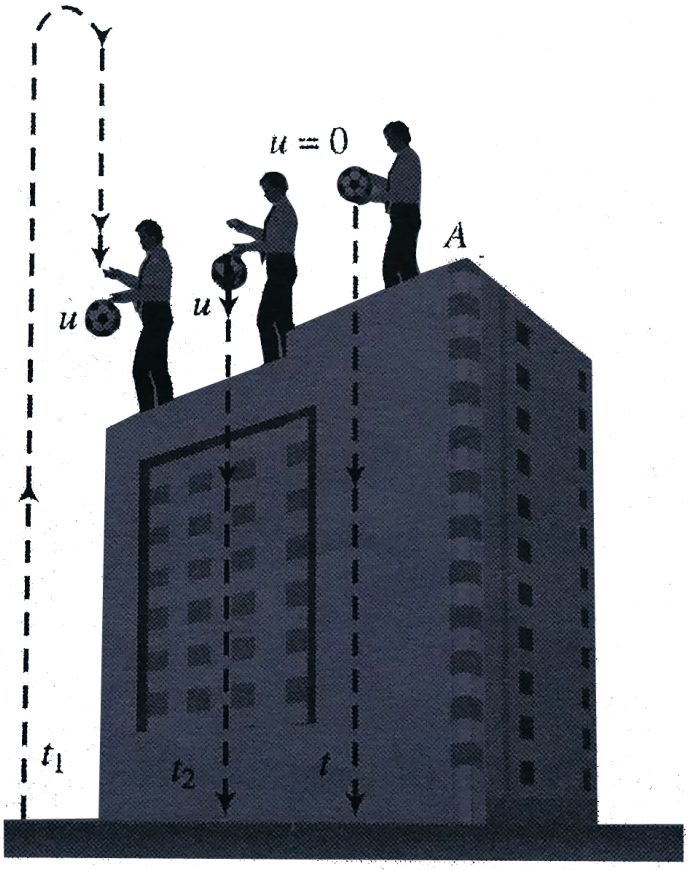
21. A body is thrown vertically upwards from A. The top of a tower . It reaches the fround in time t_1. It it is thrown verically downwards from A with the same speed it reaches the ground in time t_2, If it is allowed to fall freely from A. then the time it takes to reach the ground.



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22. A body is projected upwards with a velocity u. It passes through a certain point above the grond after t_1, Find the time after which the body posses thoruth the same point during the journey.

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23. From a point $A, 80m$ above the ground, a particle is projected vertically upwards with a velocity of $29.4. ms^{-1}$, Five seconds later, another particle is dropped from a point $B, 34. 3m$ vertically below A Derermine when and where one voertakes the other. Take $g = 9.8ms^{-2}$.

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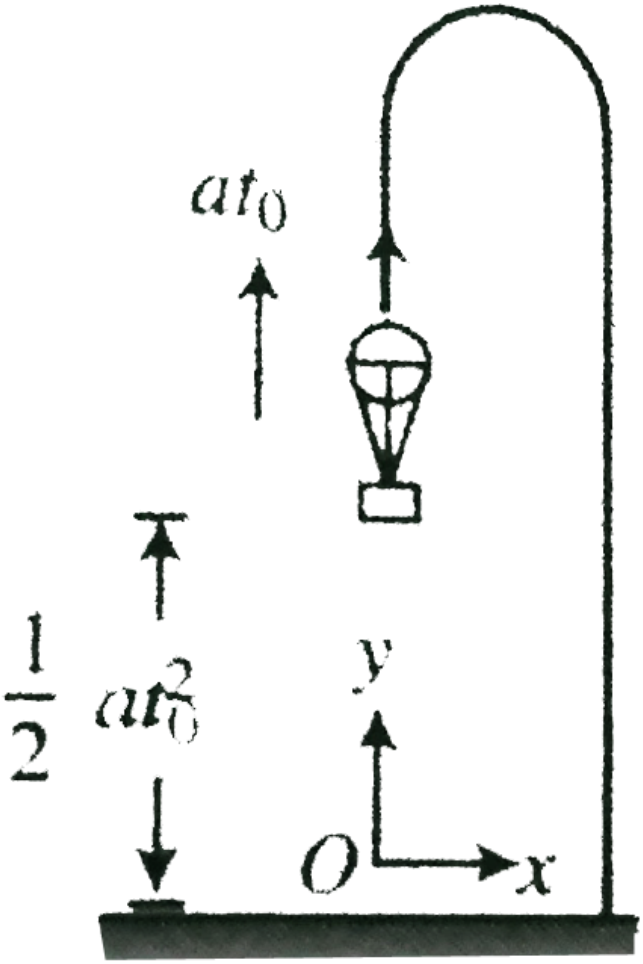
24. A balloon starts rising upwards with constant acceleration a and afrer time t_0, second, a packet is dropped from it which reaches the ground

aftre t seconds of dropping . Derermine the value of t



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25. (a) Show that the velocity acquired by a particle in sliding down an inclined plane is the same as that acquired by a particle falling freely from frst though a distance equal to the height of the inclined plane. (b) Find the time taken in sliding a particle down the whole length of the incline.

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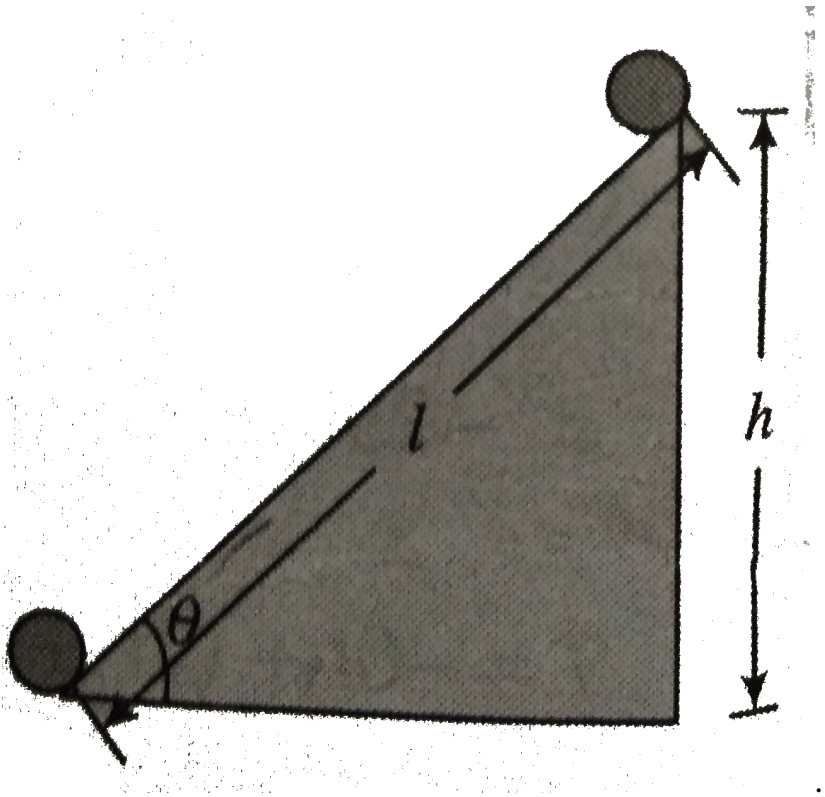
26. Ball 1 is released from the top of a smooth inclined plane, the at the same instant ball 2 is projected from the foot of the plance with such a velocity that they meet halfway up the incline. Determine:

a.the velocity with which balls are projected and

b. the velocity of each ball when they meet.



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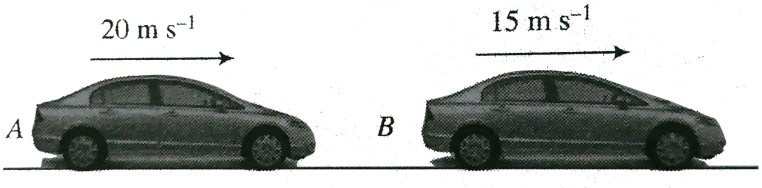
27. A car A moves with velocit $20ms^{-1}$ and car B with velocity $15ms^{-1}$ as shown is. Find the relativety B$w.\ r.\ t.$ A$w.\ r.\ t.$ B`.



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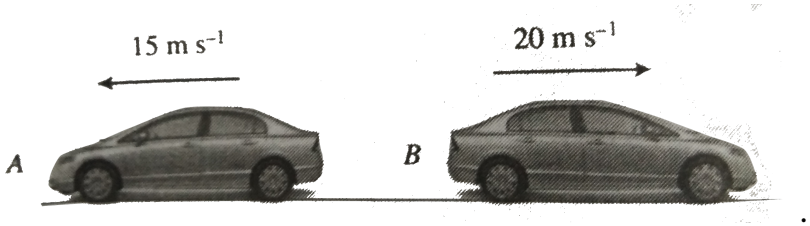
28. A car A moves with velocity $15ms^{-1}$ and B with velocity $20ms^{-1}$ are moving in opposite directions as shown in . Find the relative velocity of B w.r.t. A and w.r.t. B.



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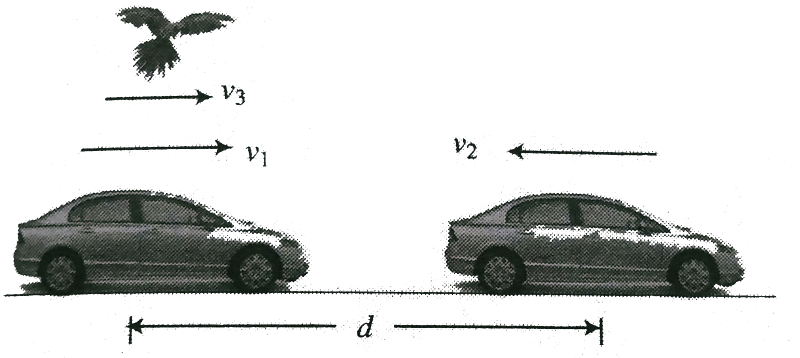
29. A bird flies to and fro between two cars wich move with velocities v_1 and v_2, If the speed of the bird is v_3 and the initial distance ofseparation between then is d, find the total distance covered bythe bird till the cars

meet.



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30. A person walks up a stationary escalator in t_1 second. If he remains stationary on the escalator. Then it can take him up in t_2 swcond. If the length of the escalator is L, then

a. Determine the speed of man with with respect to the escalator. b. Derermine the speed of the escalator.

How much time would take him to walk up the moving escaltor?.

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31. Suppose you are reding a bike with a speed of $10ms^{-1}$ due relative to a person A person A who is walking on the ground towards east. If your friend B walking on the ground due west measures you speed as $15ms^{-1}$, find the relative velocitur between two refence frames A and B.

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32. Two paarallel rail tracks run north-south Train A moves north with a speed of $54kmh^{-1}$ and train B moves south with a speed of $90kmh^{-1}$. What is the

a. relative velocity of B with respect to A?

b. relaity of a monkey running on the roof of the train A against its motion (with its velocity of $18kmh^{1}$ with respect ot the train A) as observed by a man standing on the fround?

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33. Two towns A and B are connected by a regular bus service with a bus leaving in either direction every T min A man cycling with a speed of $20kmh^{-1}$ in the direction A to B notices that a bus goes past him every $18\ \text{min}$ in the direction of his motion, and every $6\ \text{min}$ in the opposite direction. What is the period T of the bus service and with what speed (assumed constant)do the buses ply on the road?

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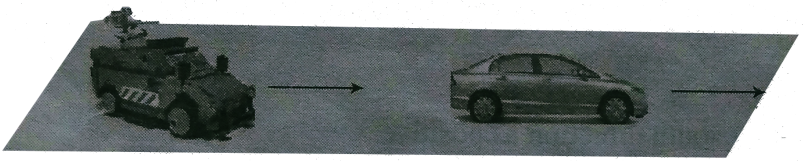
34. A police van moving on a highway with a speed of $30kmh^{-1}$ Fires a bullet at a thief's car speeding away in a same direction with a speed of $192kmh^{-1}$. If the muzzle speed of the buller is $150ms^{-1}$, with what speed does the bullet hit thief's car? .



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35. On a two lane road, car A is travelling with a speed of $36kmh^{-1}$, Two cars B and C approach car A in opposite directions with a speed of $34kmh^{-1}$. At a certain instant, when the distance AB is equal to AC, both 1 km B decided to overtake A before C does. What minimum acceleration of car B is required to avoid and accident?.

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36. A car travelling ast 60 km/h overtakes another car travellign at 42 km/h. Assuming each car to be 5.0 m long, find the time taken during the overtake aned the total road distance used for the overtake.

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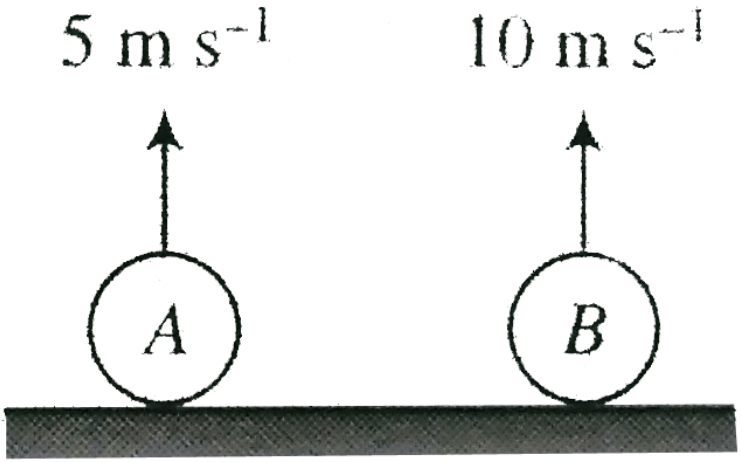
37. Two particles A and B are thown vertically upward with velocity, vertically upward with velocity, $5ms^{-1}$ and $10ms^{-1}$ respectively (g=10 m

s^(-2)), Find separation between them after $1s$.



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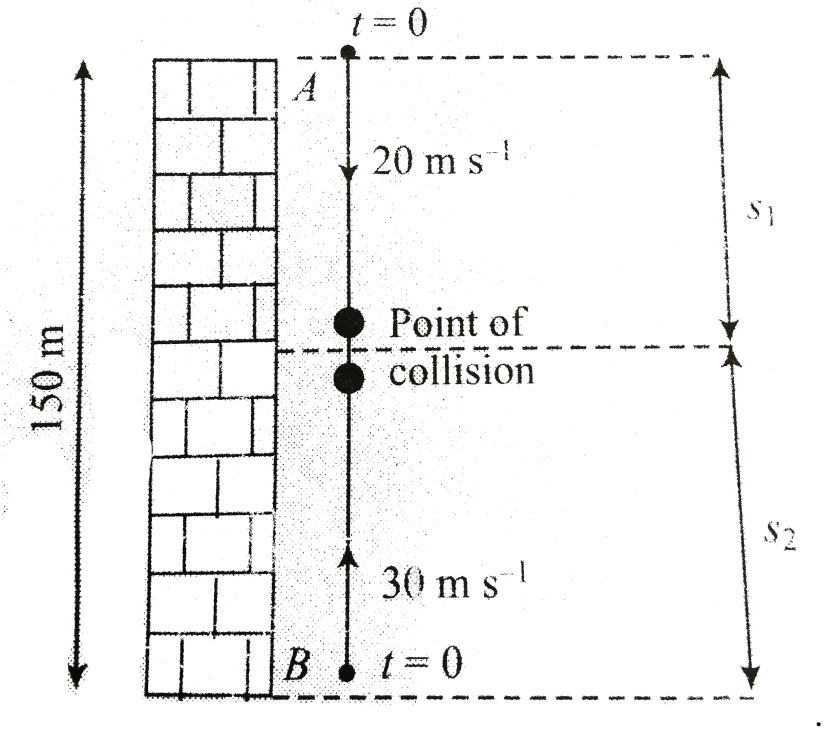
38. A ball is thrown downwards with a speed of $20ms^{-1}$, from the top of a buling $150m$ high and simultane-ously another ball is throun vertically upwrds wuth a speed of $30ms^{-1}$ from the foot ot the building . Find the

time after wguch both the balls will meet. (g=10 m s^(-2))



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39. An elevator is moving with an upward acceleration a, A coin is dropped from rest from the roof of the elevator, frlative to you. After what time the coin will strike the base of the elevator?

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40. Two cars 1 and 2 move with velocities v_1 and v_2, respectively, on a straight road in same direction When the crs are separated by a destance d the driver of car 1 applies brakes and the car moves with uniform retardation a_1, Simultaneously, car 2 starts accelerating with a_2, If $v_1 < v_2$, find the minimum initial separation between the cars to avoid collision between then.

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41. A swimmer capable of swimming with velocity v relative to water jumps in a flowing friver having velocity u. The man swims a distance d down stream and returns back to the priginal position. Find out the time taken in complete motion.

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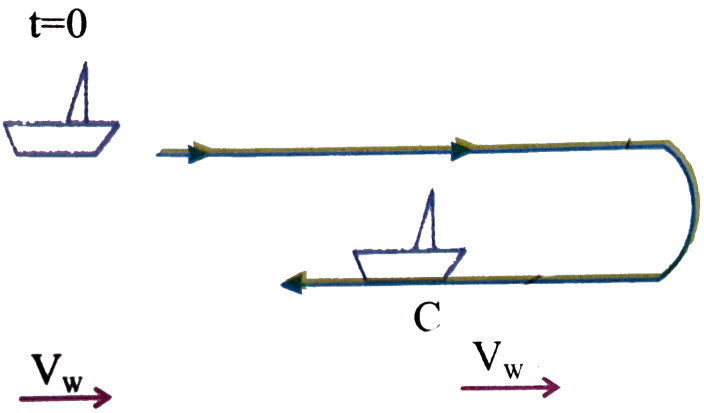
42. A boat is moving with a velocity $v_{bw} = 5km/hr$ relative to water. At time $t = 0$.the boat passes through a piece of cork floating in water while

moving down stream.If it turns back at time $t_1 = 30\ \text{min}$.

a) when the boat meet the cork again?

b) The distance travelled by the boat during this time.



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43. The position verus time graph time graph for a certain particle moving along the x-axis is shown in . Find the average velocity in the time

intervals (a) 0 to $2s$, (b) $2s$ to $4s$, and (c) 4, s to $7s$,

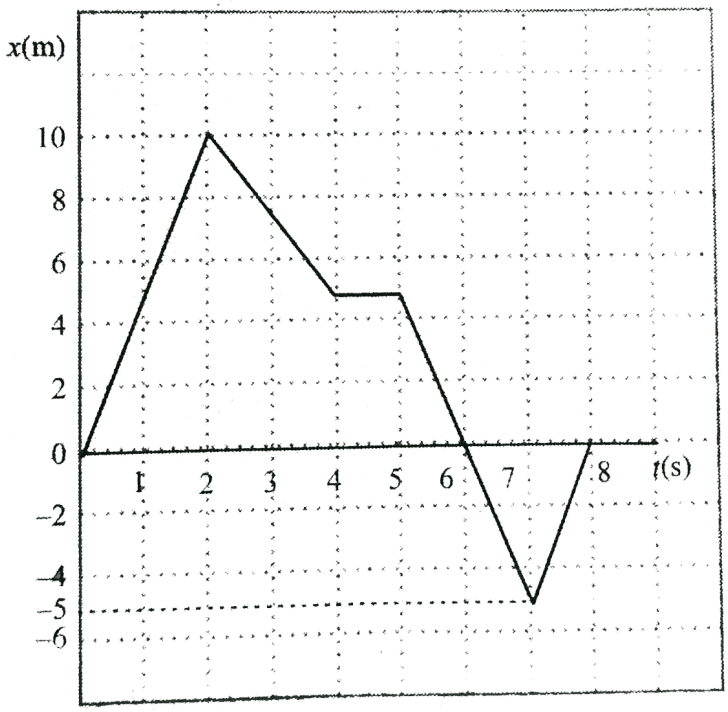

Fig. 4.70

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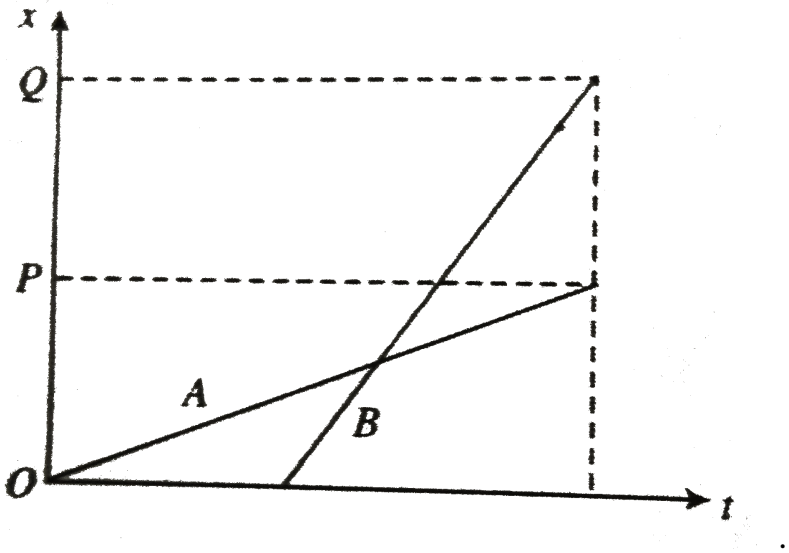
44. The position-time (x-t) graphs for two children A and B returning from their school O to their homes P and Q, respectively, are shown in . Choose the



a.(A/B) lives closer to school than (B/A).

b. (A/B) starts from the school earlier than (B/A).

c. (A/B) walks faster than (B/A).

d. A and B reach home at the (same//differnt) time.

e. (A//B) overtakes on the road (once//twice).

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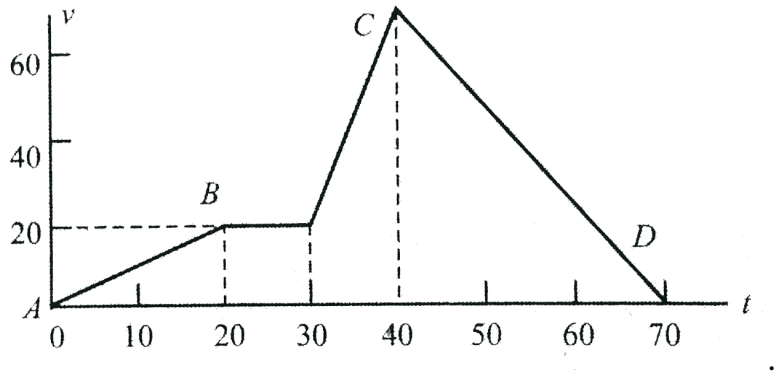
45. The velocity time curve of a moving point is shown in Fig. Find the retardation of the particle for the porion CD.



A. $4ms^{-2}$

B. $2ms^{-2}$

C. $3ms^{-2}$

D. $6ms^{-2}$

Answer: B

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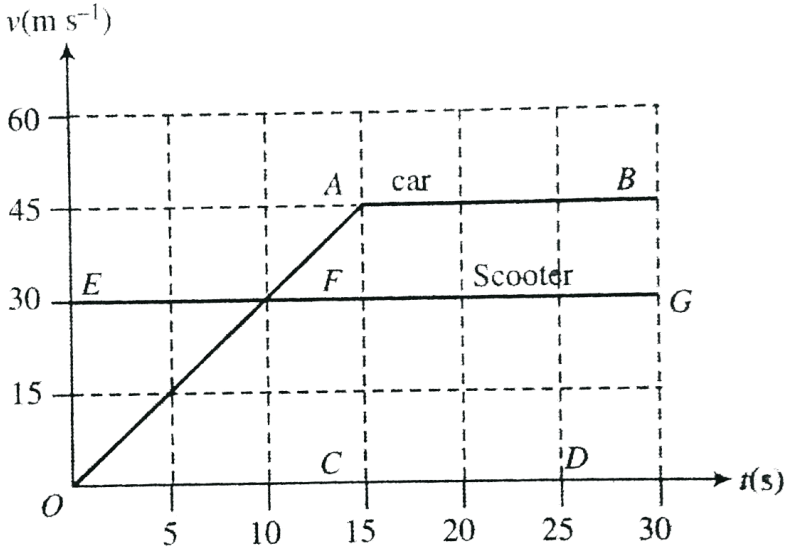
46. As soon as a car just starts from rest in a certain dercation, a scooter moveing with a uniform speed overtakes the car. Their velocity-time graph is shown in . Calculate



a. The difference between the distances travlled by the car and the scooter in $15s$,

b. Find the time at which the car passes the scooter and the distance of car and scooter from the starting point at that instant.

A. $110m$ $22.5s$ $600m$

B. $112.5m$ $25s$ $675m$

C. $112.5m$ $22.5s$ $675m$

D. $1125m$ $22.5s$ $675m$

Answer: C

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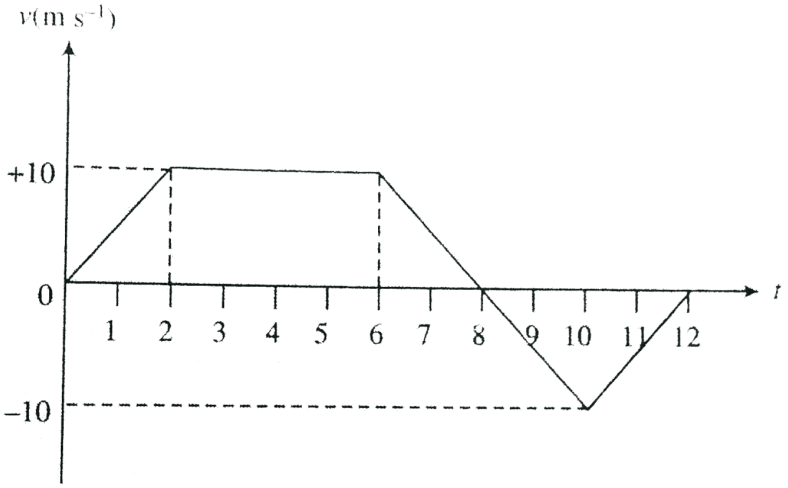
47. The velocity-time graph of a bosy moving along a straight line is given bellow dind:

Average velocity in whole time of motion

(b) Average speed in whole time of motion

(c) Draw acceleration vs time graph.



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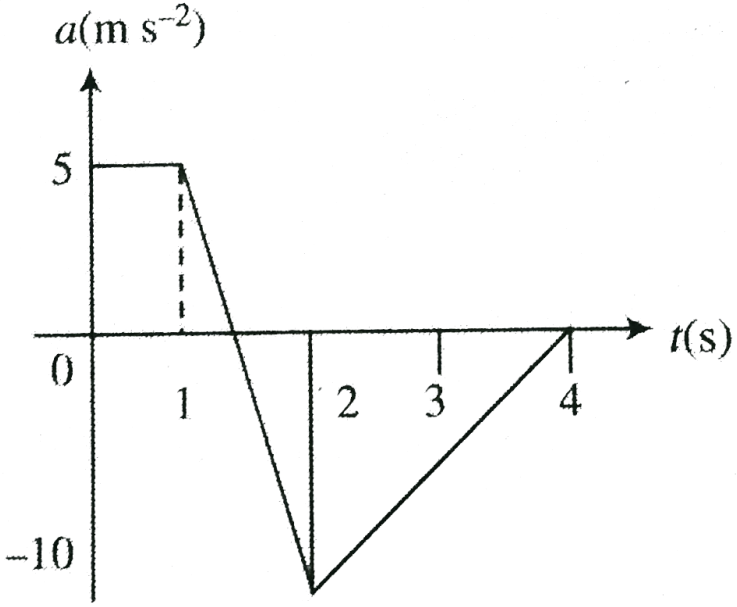
48. A particle moves aling x-axis with an initial speed $v_0 = 5ms^{-1}$. If its acceleration varies with with time asshown in $a - t$ graph in .



a. Find the .

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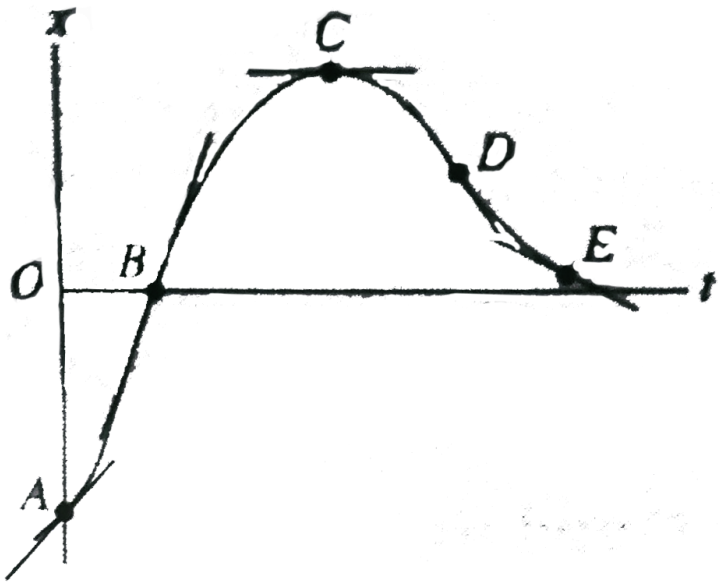
49. Consiedr the following $x - t$ garaph to be parabolic. Draw the velocity-time graph and acceleration-time graph analyze the motion of

the particle regarding its velocity and acceleration.



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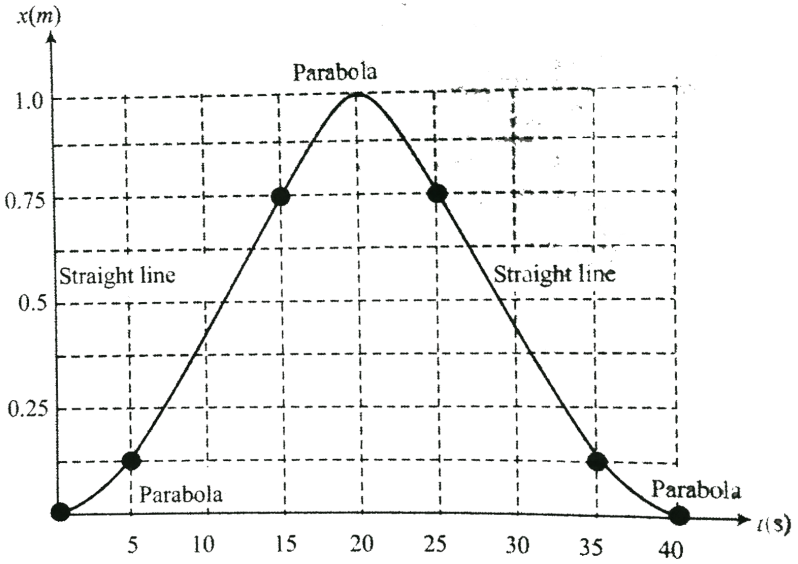
50. Figure is a graph of the coordinate of a spider crawling along the x-axis. (a) Fraph tis velocity and acceleration as functionsof time. (b) In a motion diagram, show the position, velocity, and acceleration of the

spider at the five times: $t = 2.5s$, t=10 s, t=20 s, t=30 s`,



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51. A car starts moving rectilinearly first with acceleration $\alpha = 5ms^{-2}$ (the initial velocity is equal to zero), then uniformly, and finally, deceleration at the same rate α comea to a stop. The time of motion equals $t = 25s$. The average velocity during this time is equal to =72 km h^(-1)` How long does the car move unitromly?

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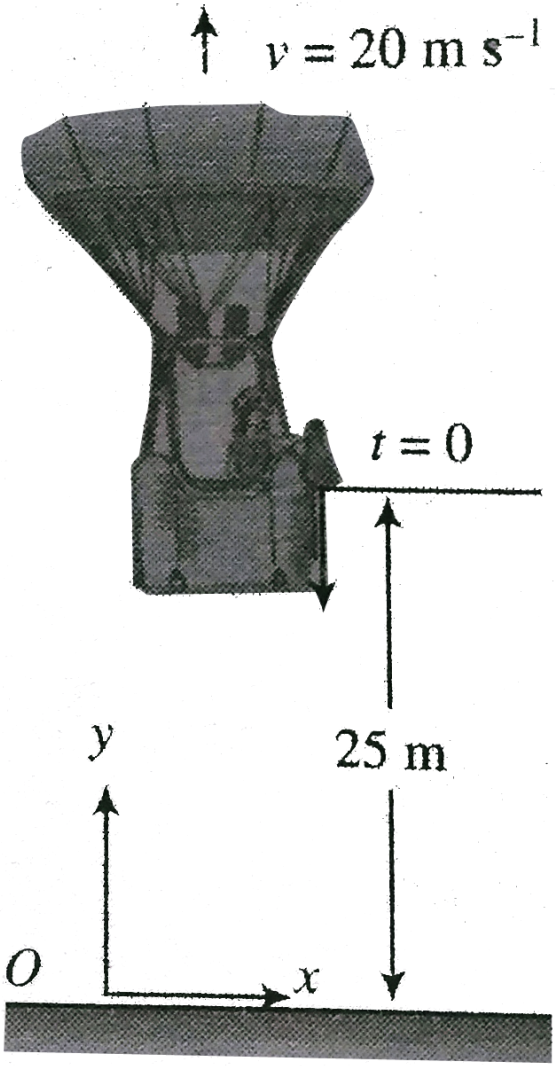
52. A hot-air balloonist, rising vertically with a constant velocity of magnitude $20ms^{-1}$, releases a sandbag at an instant when the balloon is $25m$ above the ground . Afere it is released, the sandbag is in free fall. Skerch $a_y - t, v_y - t$, and $y - t$ graphs for motion, taking origin at

ground.



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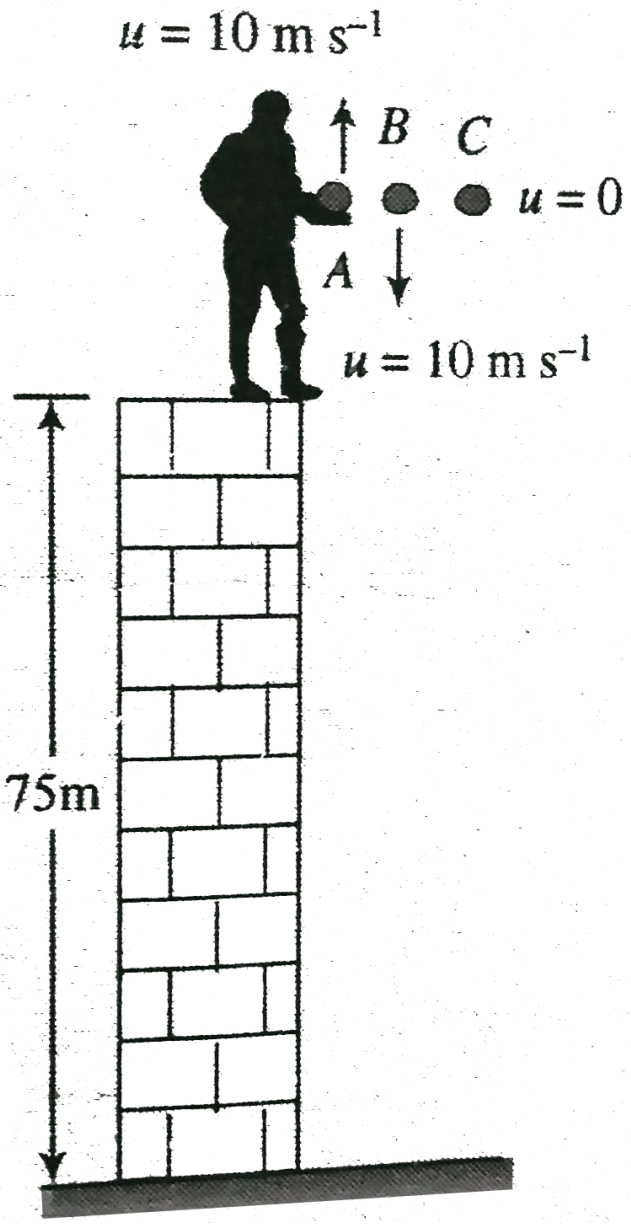
53. At the height of $75m$, a particle A is thrown up with $V = 10ms^{-1}$ and B particle is thorwn down with $V = 10ms^{-1}$ and C particle released with $V = 0mS^{-1}$. Draw graphs of each particle.



a. Displacement-time`

b. Speed-time

c. Velocity-time

d. Acceleration-time.

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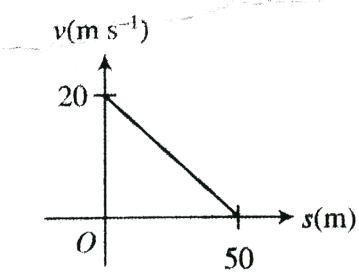
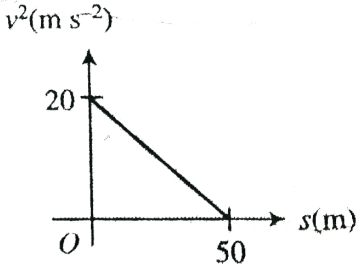
54. The $v - s$ and $v^2 - s$ graph are given for two particles. Find the accelerations of the particles at $s = 0$.





A. -8, -0.2

B. 9, 0.2

C. 8, 0.3

D. 9, 0.3

Answer: A

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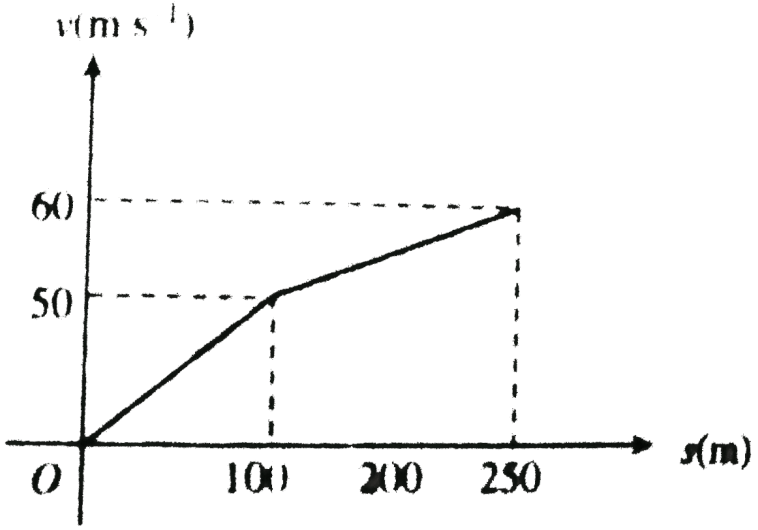
55. The velocity-displacement for a fer plane on a straight runway is shown in . Determine the speed and acceleration of the jet plane at $s = 150m$.



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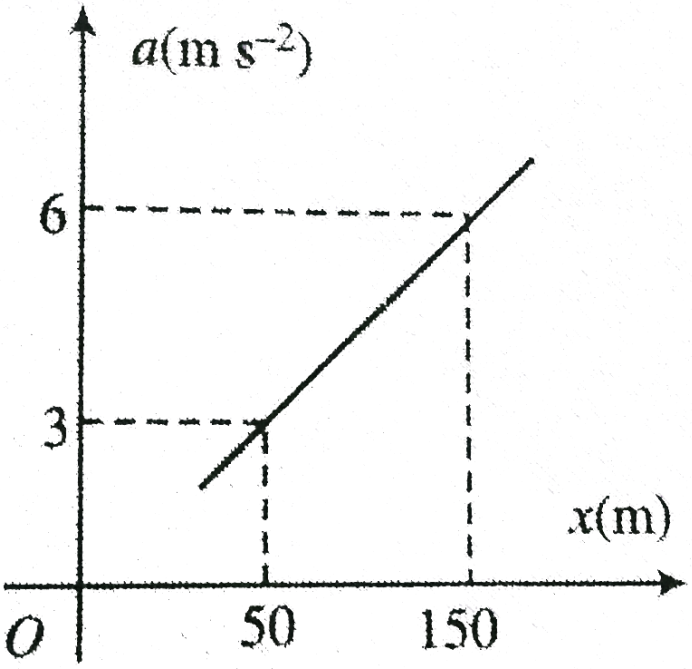
56. Referring to $a - x$ graph, find the velocity when thedisplacement of the particle is $100m$. Assume intial velocity as zero.



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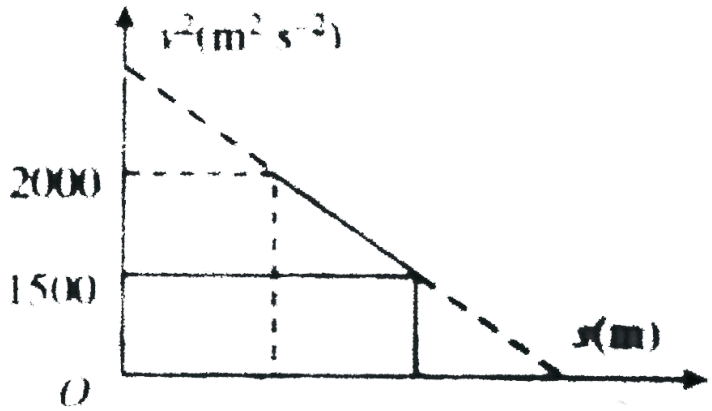
57. Referrring to the $v^2 - s$ diagram of a particle, find the displacement of the particle durticle during the last two seconds.



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Solved Examples

1. A particle moving with uniform acceleration along a straight line ABC rosses point A at $t = 0$ with a velocity $12ms^{-1}$. is $40m$ away from A and C is $64m$ away from A. The particle passes B at $t = 4$ s . $a.\ Afterwt\hat{i}imewillthepartic \leq beatC?\ b.\ W\hat{i}sitsvelocityatC$ $?\ c.\ W\hat{d}oesthepartic \leq reachA$ $aga \in ?\ d.\ Locatethep\oint wherethepartic \leq reversesitsdirectionofmotion.$ 15 s`.

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2. A balloon in ascending vertically with an acceleration of $1ms^{-2}$. Two stones are dropped from it at an interval of $2s$. Find the distance berween them $1.5s$ after the second stone is released.

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3. A rebber ball is released from a height aboout $1.5m$. If is caught after three bounces. Skerch graphs of ist position, velocity, and acceleration as functions of time. Take positive y-direction as upwrad direction.

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4. Determined to test the law of gravity for himself. A student walkd off a skusraper $180m$ high stopwatch in hand, and stars his free fall (zero initial velocity). Five seconds later, Superman arrives at the scene and dives off the roop to same the student.

a. So\uerman leaves the roop with an initial speed v_0 that he produces by pushing himself downward from the edge os the roof with his legs of steel. Fe then falls with the same accelerativon as any feely falling body What must the value of v_0 be so that the Superman catches the student just before they reach the ground ?

b. On the same graph sketch the positions of the student and of the Superman as fuctions fo time. Take Superman`s initial speed to have the value calulated in part (a).

c. If the hdight of the skyscraper is less than some minimum value, even the Superman canot reace the sturdnt student before he hits the ground, what is this minimum height?

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5. A student is running at her top speed of $5.0ms^{-1}$, to catch a bus, which is stopped at the bus stop. When the student is still $40.0m$ from the bus, it starts to pull away, moving with a constant acceleration of $0.2ms^{-2}$.

a For how much time and what distance does the student have to run at

$5.0ms^{-1}$ before she overtakes the bus?

b. When she reached the bus, how fast was the bus travelling?

c. Sketch an $x - t$ graph for bothe the student and the bus.

d. Teh equations uou used in part (a)to find the time have a second solution, corresponding to a later time for which the student and the bus are again at thesame place if they continue their specified motions. Explain the significance of this second solution. How fast is the bus travelling at this point?

e. If the students $\top$ $speedis$3.5 m s^(-1), will she catch the bus?

f. What is the minimum speed the student must have to just catch up with the bus?For what time and what distance dies she have to run in that case?

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6. A particle retards from a velocity v_0 while moving in a straight line. If the magnitude of deceleration is directly proportional to the square root of the speed of the particle, find its average velocity for the total time of its motion.

A. $\frac{v_0}{3}$

B. $\frac{3v_0}{2}$

C. $\frac{2v_0}{3}$

D. $\frac{2v_0}{5}$

Answer: C

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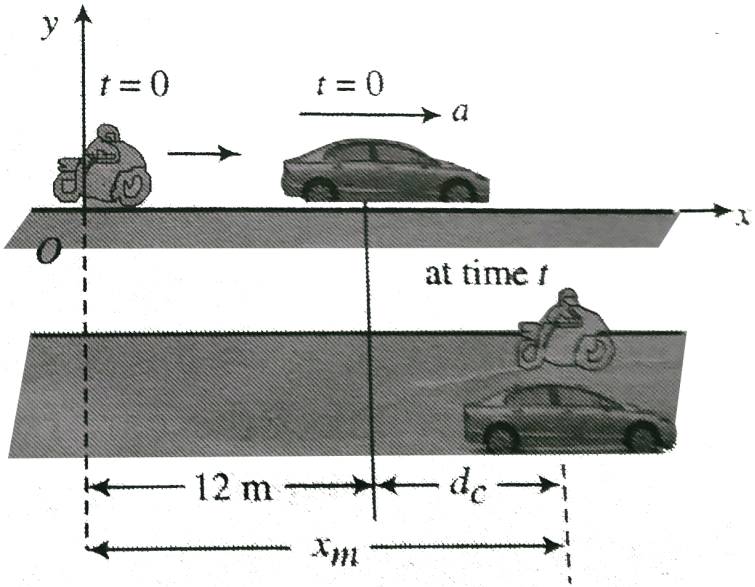
7. A motorcyclist situated at origin is located at a distance $12m$. Behind a car (Fig. 4.150).



At$t = 0$ the motorcyclist stars moving with a constant velocity $v = 8ms^{-1}$ and same time the car starts acceleration from rest with $a = 2ms\&(- 2)$, (a) When and wher do they meet?

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8. A diwali rocket moves vertically up with a constant acceleration $a_1 = 20//3ms^{-2}$. After sometives, its fuel gers exhausted ad then if falls freely with an acceleration $a_2 = 10ms^{-2}$, If themaximum height attained

by the diwalin rocket is (h), using graphicalmerhod, find its speed when the fuel is just exausted. Assume $h = 50m$.

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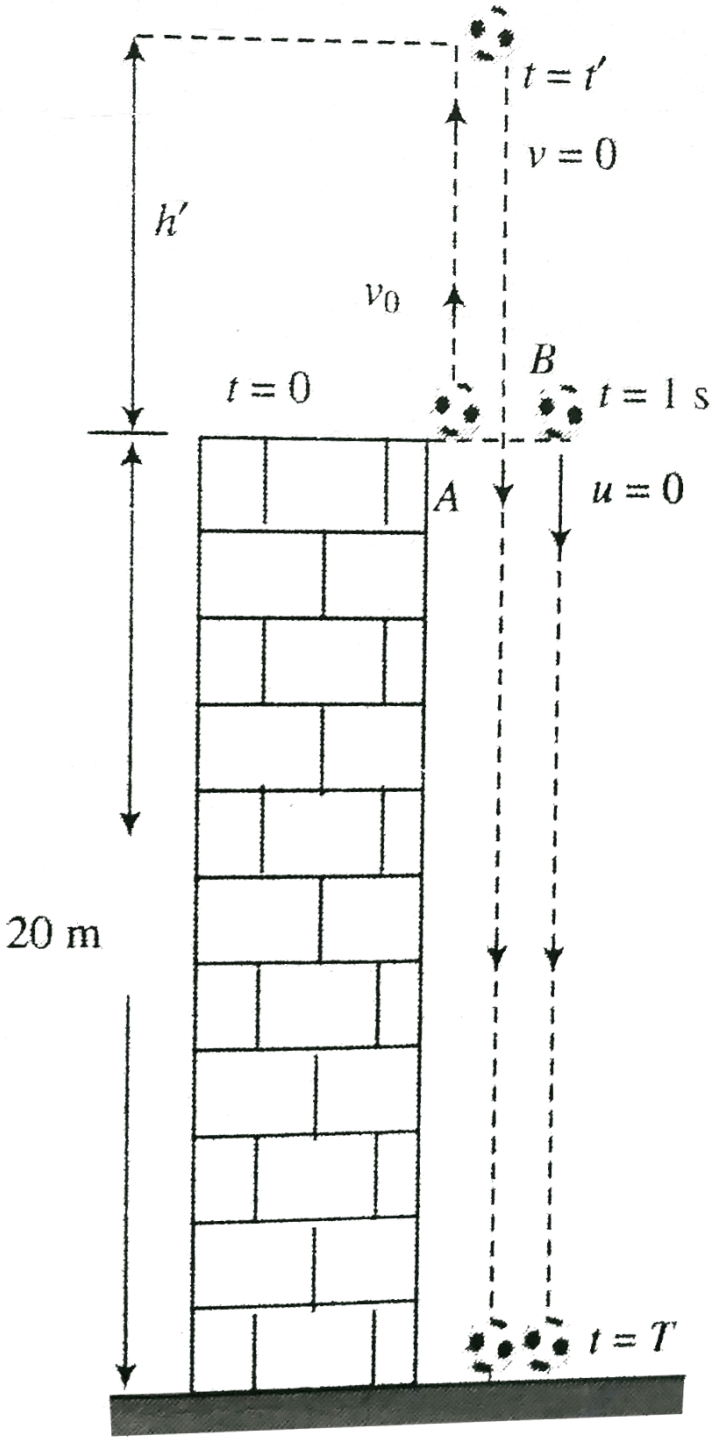
9. A ball (A) is thrown straight upfrom the edge the roof of a building. Another ball (B) is dropped from the of $1.00s$ later. You may ignore air resistance . (a) If the height of the building id $20.0m$, what must the initial speed of ball (A) he if bothe are to hit the ground at the same time? (b) On the function of time, measured fro when the first ball is

thrown and take origin at ground.


$t = t'$
$v = 0$
h'
v_0
B
$t = 0$
$t = 1$ s
A
$u = 0$
20 m
$t = T$

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Exercise 4.1

1. a. If the velocity of a body is zero, does it mean that its acceleration is also zero ? (Yes//No)

b. If the acceleration of a body is zero does it mean that its velocity is also zero ? (Yes//No)

c. If a body travels with uniform acceleration a_1 for a time t_2 thenthe average acceleration is given by

$$a_{av} = \frac{a_1 t_1 + a_2 t_2}{t_1 + t_2 (Yes / No) d. If a body \star t so m rest \text{ and } moves with un \text{ if or}}$$

1 s, 2 s, 3 s, $etc.$, $are \in therationof (1:4:9), etc. (True / False)$

e. For a body moving whith uniform acceleration, the displacent of the bosy in successive seconds is in the ration of $1:3:5:7$..... (True//False) .

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2. Say Yes or No:

a. Can an object moving towards north have acceleration towards south?

b. Can an object reverse the direction of its motion even thouth it has reverse the direcleration?

C. Can an object reverse the derction of its acceleration even though it continues to move in the same dirction?

d. Average speed is the magnitude of average velocity

e. At any instant of time. the directions of change in velocity and acceleration are differnt.

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3. Can a body have

a. Zero instantaneous velocity and yet be accelerating?

b. Zero average speed but non-zero average velocity?

c. Negative acceleration and yet be speeding up?

d. Magnitude of average velocity be equal to average speed ?

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4. A body moves at a speed of $100ms^{-1}$ for $10s$ and then moves at a speed of $200ms^{-1}$ for $20s$ along the same direction. The average speed is .....,

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5. A body moves in the southern direction for $10s$ at the speed of $10ms^{-1}$. It then starts moving in the eastern direction at the speed of $20ms^{-1}$ for $10s$, The magnitude of the average velocity is ....., The averge speed is ....., The total displacement will be .....,

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6. A car trvelling at $108kmh^{-1}$ has its speed reduced to $36kmh^{-1}$ after traelling a distance of $2000m$ Find the retardation (assumed uniform) and time taken for this process.

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7. A car starts form rest and accelerates uniformly for $10s$ to a velocity of $8ms^{-1}$. It then runs at a constant velocity an dis finally brought to rest in $64m$ with a constant retardation. The total distance covered by the car is $584m$ Find the value of acceleration, retardation, and total time taken.

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8. A body covera $10m$ in the seconds second and $25m$ in finfth second of its motion. If the motion is uniformly accelerated, how farwill it go in the the seventh second?

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9. A body moving with uniform acceleration a stratght line describes $25m$ in the fifth second and $33m$in the seventh second. Find its initial velocity an dacceleration.

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10. Two trains, each of length $100m$ moveing in opposite direction along parallel lines, meet each other with speeds of $50kmh^{-1}$ and $40kmh^{2}$. If their acceleration are $30cms^{-2}$ and $20cms^{2}$ respectively, find the time they will take to pass each other.

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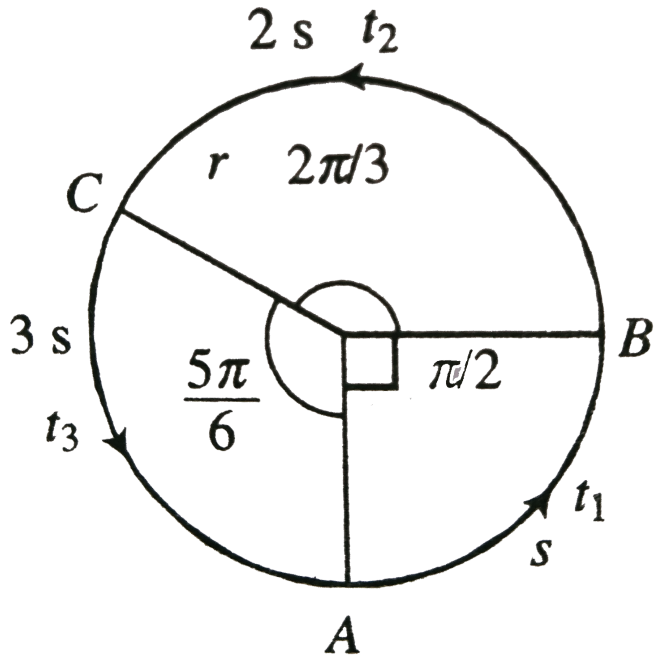
11. Shows a particle starting from point A,travelling up to B with a speed s, then up to point C with aspeed $2s$, and finally upto A with a speed of

$3s$, Derermine its averagespeed.



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12. A particle moving in a straight line covers half the distance with speed of $3m/s$. The half of the distance is covered in two equal intervals with speed of $4.5m/s$ and $7.5m/s$ respectively. The average speed of the particle during this motion is :

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13. Find the ratio of the distance moved bya free-falling body from rest in fourth and fifth seconds of its journey.

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14. Two balls of different masses (one lighter and other heaver) are thrown vertically upwards with the same speed. Which one will pass through the point of projection in the downward direction with greater speed?

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15. A car runs at a constant speed on a circular track of radius $200m$, taking $62.8s$ on each lap. Find the average velocity and average speed on each lap.

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16. A train accelerates from at the constant rate b for time t_2 at a constant rate a and then it retards at the comes to rest. Find the ratio$t_1//t_2$.

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17. An athlete swims the length of $50m$ pool in $20s$ and makes the return trip to the starting position in $22s$, Determine his averge velocity in

a. The first half of the swim

b. The second half of the swim

c. The round trip.

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Exercise 4.2

1. a. Mark the folllllowing statements as true offalse.

i. A ball thrown vertically up takes moretime to go up than to come down.

ii. If a ball starts fallig from the position of rest, then it travels a distance of $25m$ during the third secons of tis fall.

iii. A packet dropped from a rising balloon ferst moves upwards and then moves sownward as observed by a stationary observer on the ground.

iv. In the absence of air resistance, all bodies fall on the surface of earth at the same rate.

b. Fill in the blanks.

i. When a body is thrown vertically upwards, at the highest point.....(both belocity and accelenation are zero//only velocity is zero//ony acceleration is zero). ii. If air drag is not neglected, then which is greater: time of ascent or time of descent?

iiii. A body is projected upward. Up to the maximum height time taken will be greater to travel..... (first half//second half).

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2. A ball thrown up from the ground reaches a maximum height of $20m$ Find:

a. Its initial velocity.

b. The time taken to reach the highest point.

c. Its velocity just before hitting the ground.

d. Its desplacement berween $0.5m$ above the ground.

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3. A body is projected from the bottom of a smooth inclined place with a velocity of $20ms^{-1}$, If it is just sufficient to carry it to the top in $4s$, find the inclination and height of the plane.

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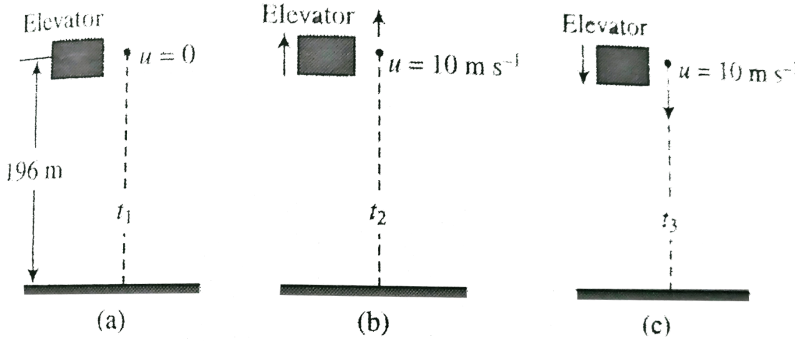
4. A ball is dropped from an elevator at an altitude of $200m$ (Fig.4. 39). How much time will the ball take to reach the ground if the elevatior is



a. Stationary?

b. Ascending with velocity $10ms^{-1}$

c. Descending with velocity `10 m s^(-1)?

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5. A particle is projected vertically upwards. Prove that it will be at three-fourth of its greatest height at times which are in the ratio $1:3$.

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6. A balloon reses from rest on the ground with constant acceleration $g//8$. A stone is dropped from the balloon when the balloon has resen to a height of (H). Find the time taken by the stone to reach the ground.

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7. A parachutist after bailing out falls 50m without friction. When parachute opens, it decelerates at $2m/s^2$. He reaches the ground with a speed of $3m/s$. At what height, did the bail out?

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8. A ball is dropped from the top of a tower of herght (h). It covers a destance of $h//2$ in the last second of its motion. How long does the ball remain in air?

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9. When a ball is thrown up, it reaches a maximum hetght (h) travelling (5 m) in the last second. Find the velocity with which the ball shoud be throun up.

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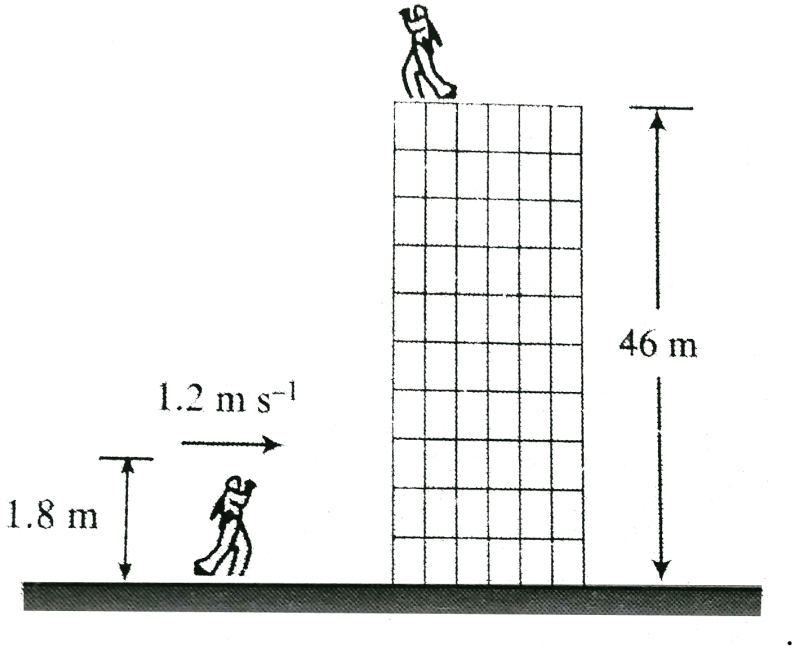
10. You are on the roof of the phusics building, $46, 0m$ above the ground (Fig.4.40). Your physics professor, who is $1.80m$ tall, is walking alongside the bulding at a constant speed of $1.10ms^{-1}$. If you wish to drop a flower on your professor`s head, where should the professor be when you release the flower? Assume that the flower is in free fall.



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11. A ball is thrown straight up from the edge of the roof of a building .A second ball is dropped from the roof $1.00s$ later. You may ignore air

resistance.

a. If the height of the buliding is $20.0m$, what must the initial speed be of the first ball if both are to hit the ground at the same time? Consider the same situation, but now let the initial speed v_0 of the first ball be given and treat the height (h) of the building as an unknown.

b. What must the height of the building be for both balls to reach the ground at the same time for each of the following values of v_0: (i) $6.0ms^{-1}$ (ii) $9.5ms^{-1}$?

c. If v_0 is greater than some values $v_{\max}$, a value of (h) does same time. Solve for $v_{\max}$. The value $v_{\min}$ also has a simple physical interpretation. What is it?

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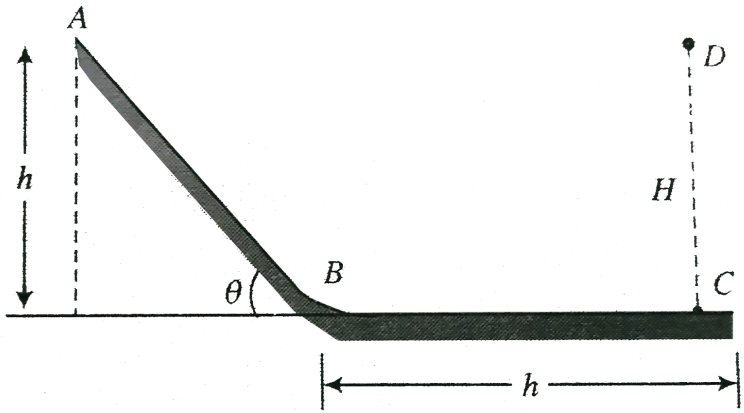
12. Two particles are simultaneously released from points A and D as shown is Fig.4.41. How shold the value of (H) be adjusted inorder that the two particles collide?

Neglect sissipative forces.



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Exercise 4.3

1. A train $200m$ long is moving with a velocity of $72kmh^{-1}$ Find the time taken by the trainto cross the bridge $1km$ logn .

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2. Two cars A and B are moving on the straigh parallel paths with speeds $36kmh^{-1}$ respectively starting from the same point in the same direction. After $20\ \min$, how much behind is car A and from car B?

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3. Two trains $110m$ and $90m$ log respectively, are trunning in opposite directions with velocities $36kmh^{-1}$ and $54kmh^{-1}$ Find the time taken by the trains to completely cross each other.

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4. A moving sidewalk in an airport terminal building moves at a speed of $1.0ms^{-1}$ and is $35.0m$ relative to the moving sidewalk, then find the time that she requires to reach the opposite end a when she walks in the same direction the sidewalk is moving and b when she walks in the opposite derection.

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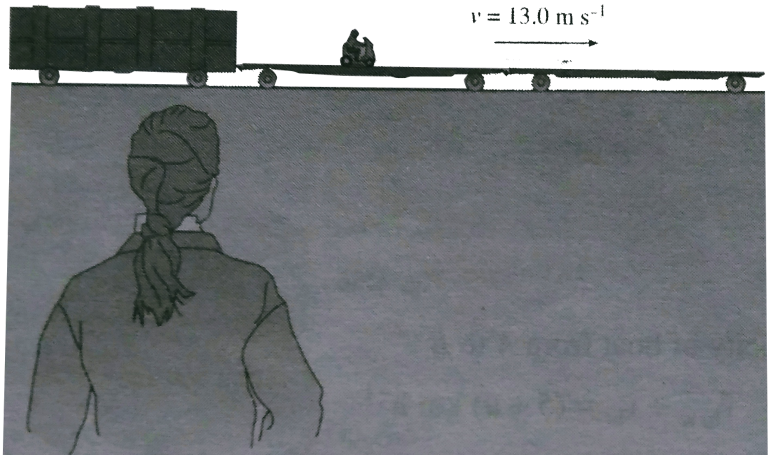
5. A railroad flatcar is traveling to the right at a speed of $13.0ms^{-1}$ relative to an observer standing on the groun . Someone is riding a scooter on the flatcar. Corresponding to the relative velocities $18ms^{-1}$ to the right, $3ms^{-1}$ to the left and $0ms^{-1}$ of scooter w.r.t. ground, find thefrlative velocities (magnitude and direction) of scootre w.r.t. the flatcat.



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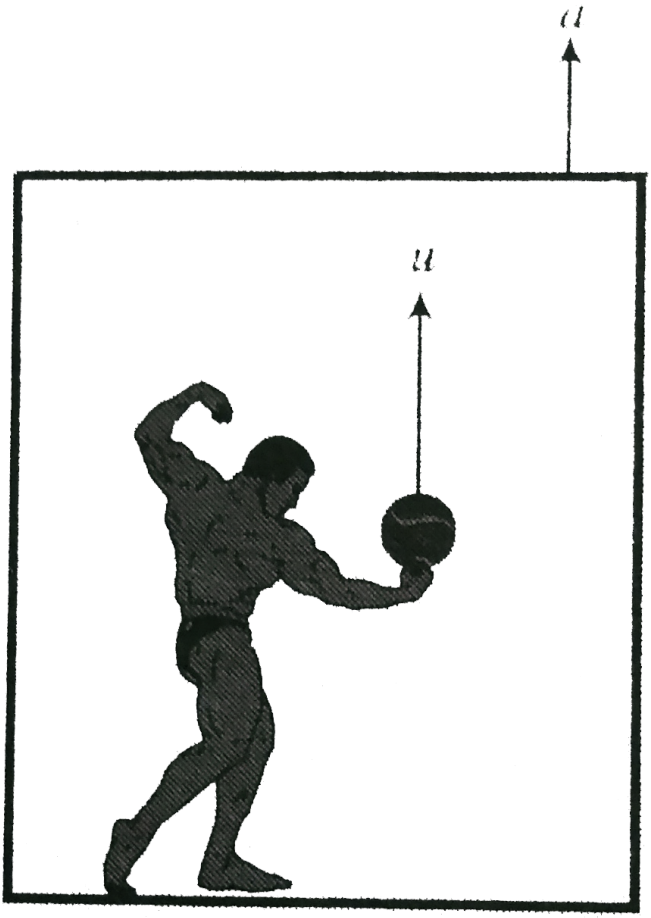
6. A lift is moving up with acceleration a A person inside the ligt throws the ball upwards with a velocity u relativeto hand.

a. What is the time of flight of the ball?

b. What is the maximum height reached by the ball in the lift?



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7. Consider two cities P and Q berween which consistent bus servece is available in both directions. Every x mimutes A morning jogging towards Q from P wigh a speed of $10kmh^{-1}$. Every $18mim$ a bus crosses this jogger in its own direction of motion and every $6\ \min$ another bus crosses in opposite derection. What is time prerilod between two consecutive buses and also find the speed of buses ?.

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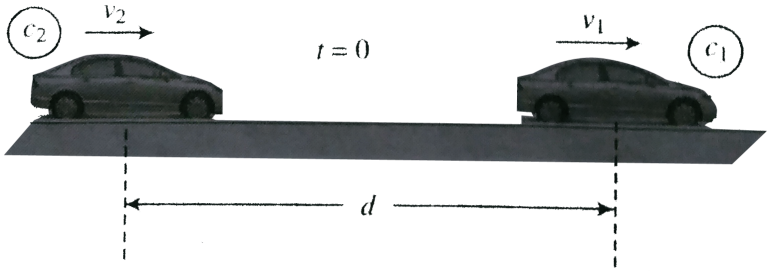
8. Two cars C_1 and C_2 moving in the same direction on a straight single lane road with velocities $v_1 = 12ms^{-1}$ and $v_2 = 10ms^{-1}$, respectively . When the separation between the two was $d = 200m$, C_2 started accelerating to avoid collision. What is the minimum acceleration of car C_2 so that they do not collide?



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9. Two boys enter a running escalator at the ground floor in a shopping mall and they do some fun on it. The first boy repeatedly foolows $p_1 = 1$ step up and then $q_1 = 2$ steps down whereas the second body repeatedly follws $p_2 = 2$ steps up and then $q_2 = 1$ step down. Both of them move rlative to escalator with speed $v_r = 50cms^{-1}$. If the first boy takes $t_1 = 250s$ and the second boy takes the first boy takes $t_1 = 50s$ to reach the first floor, how fast is escalator running ?.

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10. A body is thrown up in a lift with a velocity u relative to the lift, and returns to the lift in time t. Show that the lift$supwardae \leq rationis$(2u-gt)/(t)`.

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11. A passenger and a good train are headed in the same derection on parallel tracks. The passenger train is $240m$ long and has a constant velocity $72kmh^{-1}$ Beginning from the time the engine of the passenger train apprwaches the last wagon of the goods train it takes $25s$ to be in level with the engine of the goods train. It Took $30s$ more to complerly overtake the goods train. Determine the length and speed of the goods train.

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12. The speed of a motor launch with respect to still water in a stream is $8ms^{-1}$ while water current's, speed is $3ms^{-1}$. When the launch began travelling upstream, a float was dropped from it. After travelling a distance of $4.8km$ upstream, the launch turned back and caught up with the gloat. What is the total time which elapsed during the process?

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13. Two boats A and B moved away from a buoy anchored in the middle of a river along the mutually perpendicular straight lines. A moved along the river and B at fight angle to it Having moves off equal destances from the boy, the boats returned. Find the ratio of the times of motion of the boats, if the velocity of each boat with rspect to still warer in η times greater than the velocity of warer current.

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14. A ship of length $l - 150m$ moving with velocity $v_s = 36kmh^{-1}$ on the sea, suddenly discovered straight head a siking boat people having met an acceleident. A rescue boat has been lowered from the mid of the ship, which went to the sinking boat with speed $v_b = 72kmh^{-1}$. When the rescue boat was $x_0 = 3.0km$ away, The rescue boat reaches the sinking boat spends $t_0 = 1.0mim$ there to take the people on board, and then retuned with the same speed to the time taken in the whole rescue it was lowerd. Derermine the time taken in the whole rescue operation from the

moment the rescue boat was lowerd to the moment therescue boat returned to the ship.

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15. A $10 - km$ long straight road connects two towns A and B, Two cyclists dimultaneously start one from town A and the other from town B .On reaching the opposite town, a cyclists simmediaeately retrns to his starting town wheras the other cyclist takes some rest and then returns to his starting town. Both of them can ride at speed $20kmh^{-1}$ in absence of wind but during their whole journey uniform wind from town A and B increase the speed of it decreases the speed of the cyclist going against the wind Both the cyclisrs meet twice, first at 2 km and then 6 km away from one of the tomns. If which town and for what perild does a cyclist rest ?

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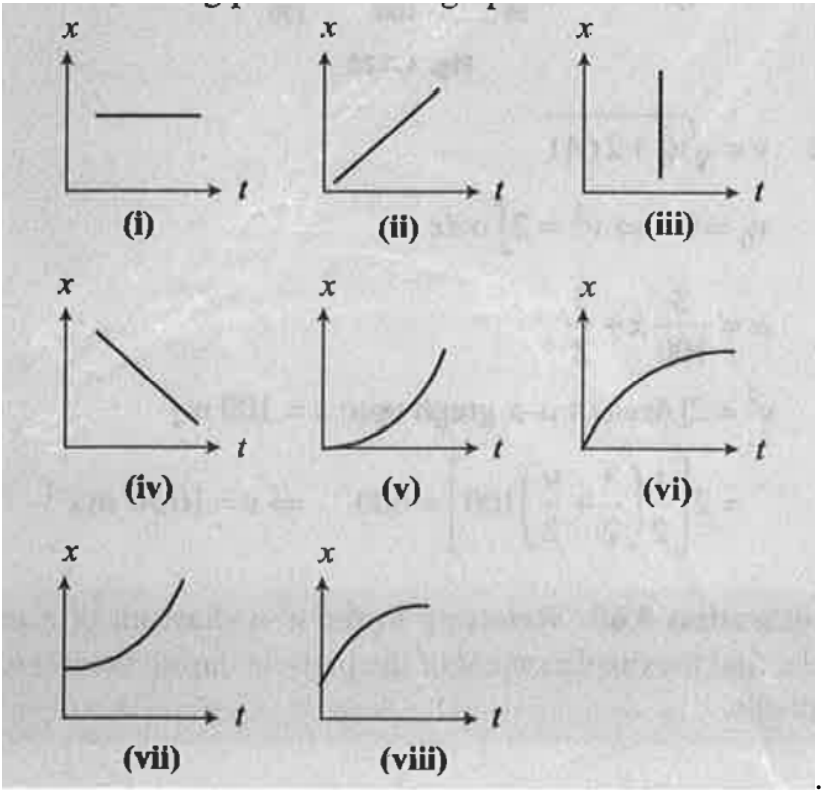
Exercise 4.4

1. a. What can you say about velocity in each of the following position-time graphs?



b. The slope of the velocity-time graph is equal to acceleration. (True//False)

c. What does the area under acceleration-time graph represents?

d. Can velocity-time graph be parallel to the velocity axis? (Yes//No)

e. What is the slope of the $v - t$ fraph in uniform motion? .

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2. a. A ball is thrown vertically upwards. Aftre some time it trturns to the throuer. Draw the velocity-time graph and speed-time graph.

b. A ball is dropped from some height. After rebounding from the floor, it ascends to the same height. Draw the velocity-time graph and speed-time graph.

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3. A body starts at $t = 0$ with velcoity u and travels along a straight linge. The body has a constant acceleration(a). Draw the acceleration-time graph from $t = 0$ to $t = 10s$ for the following cases:

a. $u = 8ms^{-1}$, a=2s^(-2)b. u=8 ms^(-1), $a = -2ms^{-2}$

c. $u = -8ms^{-1}$,a=2 ms^(-2)d. u=-8ms^(-1), $a = -2ms^{-2}$.

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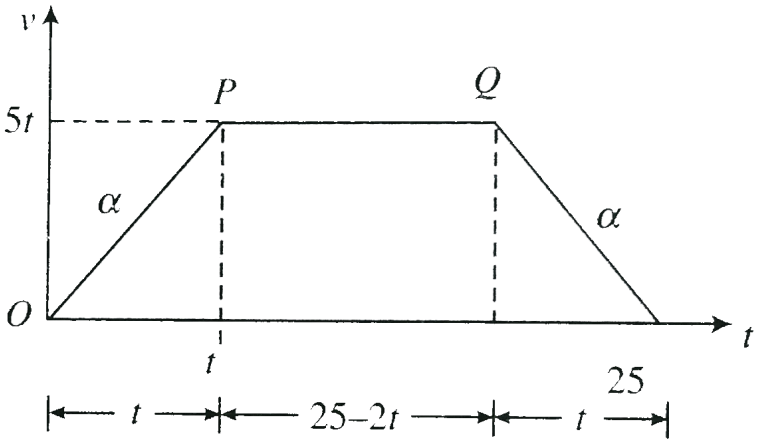
4. Find the average acceleration in first $20s$. (Hint: Area under $a - t$ fraph is equal to the change in velocity).



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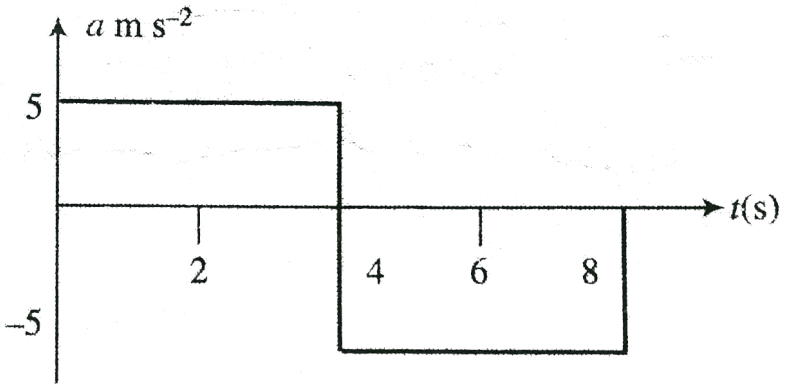
5. At $t = 0$, a particle starts from reat and moves along a straight line, whose acceleration-time graph is shown in .



Convert this graph into velocity-time, From the velocity-time graph, find the maximum velocity attained by the particle. Also find from $v - t$ graph, the sisplacement and distance travelled by the particle from 2 to $6s$,

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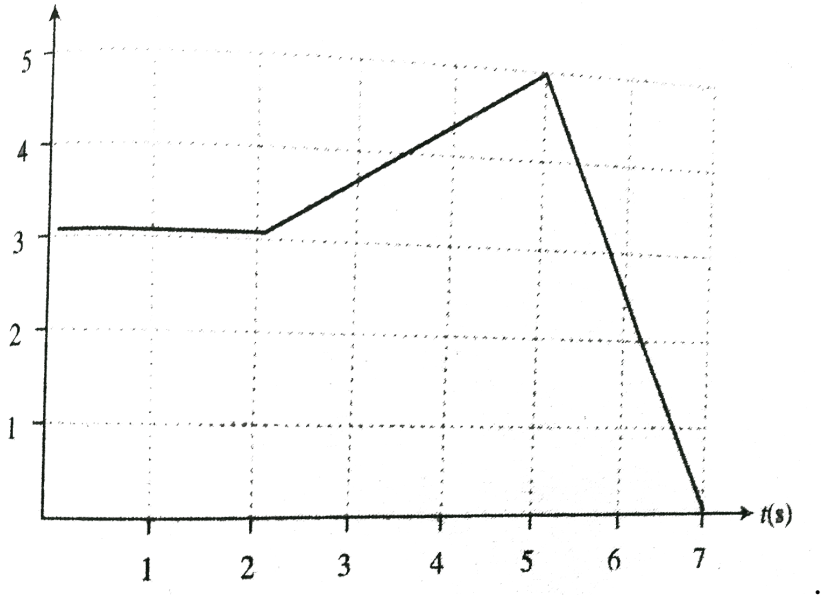
6. Given below shows the desplacemen-time graph for a particle moving along a straight line path.



State true or false.

a. Time during which the particle was at reat is 0 to $2s$

b. Time maximum velocity of the particle is $-2.5ms^{-1}$.

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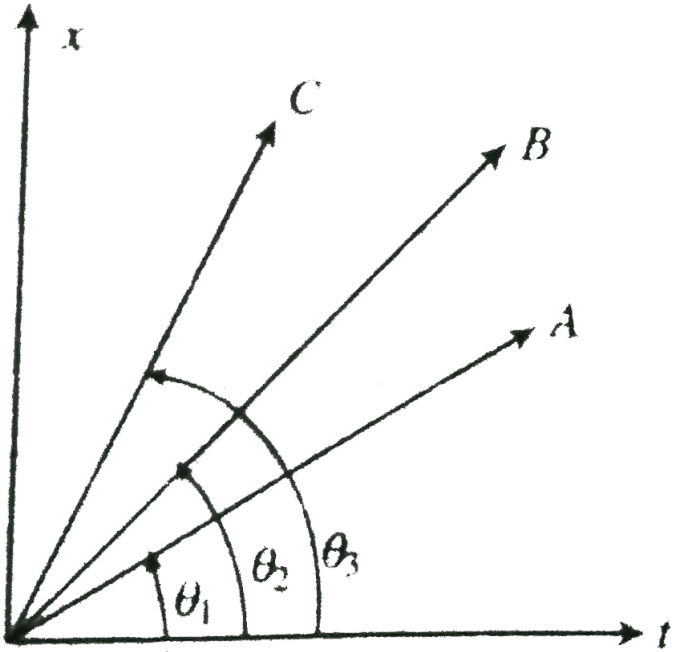
7. You are given the position-time graph of three deffernt bodies A, B, and C, Find which will have grater velocity an which will have least

velocity.



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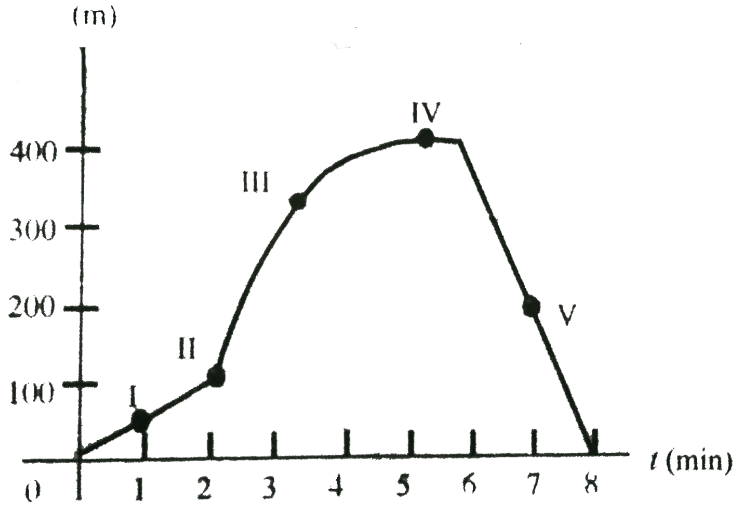
8. A physics professor leaves her house and walks along the sidewalk towards campus. After $5\ \mathrm{min}$, it starts to tain and she terurns home. Her distance from her house as a function of time is shown in .



At which of the labeld points is her velocity

a. Zero

b. Constant and positive

c. Constant and negative

d. Increasing in magnitude .

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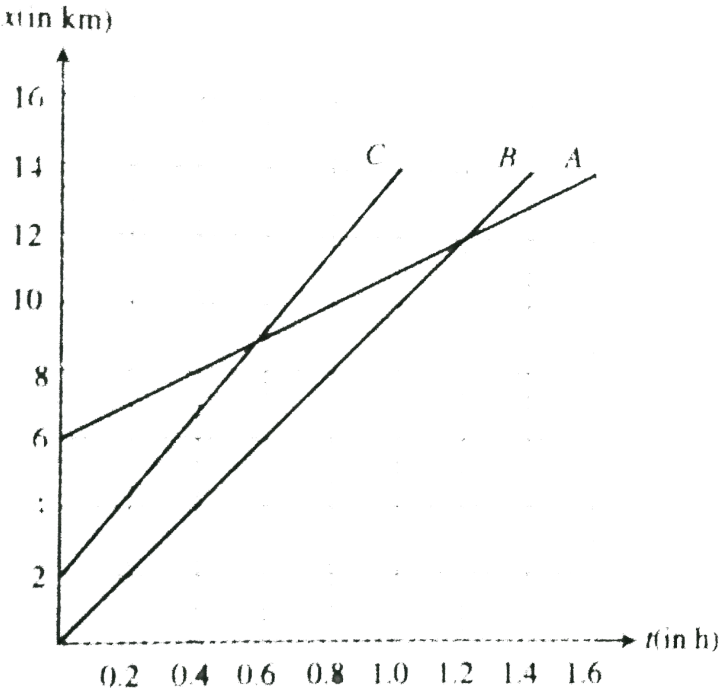
9. Shows the position-time graphs of three cars A, B and C On the basis of the graphs answer the follwing questions:



a. Which car has the highest speed and which the lowest?

b. Are the three cars evrs at the same point on the road?

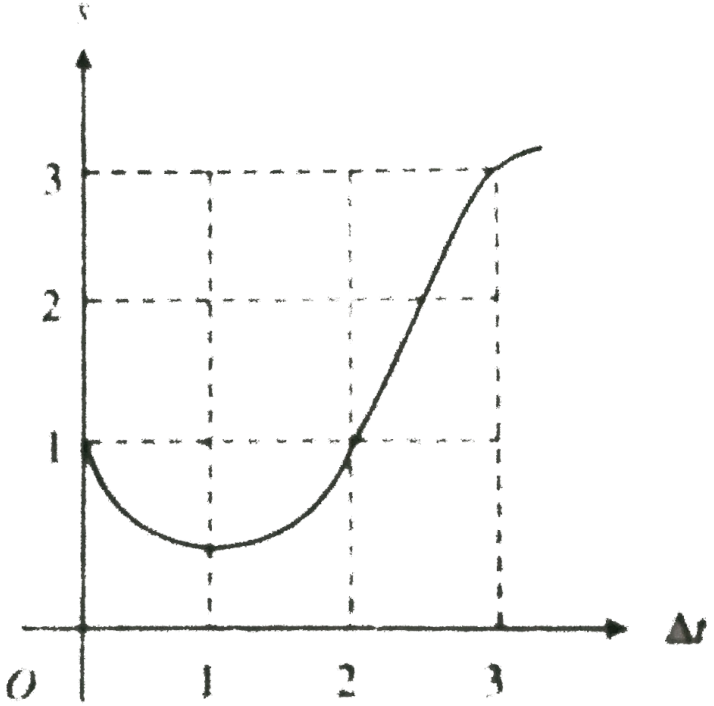
c. When C passes A, wher is B?

d. What is the time interval during car A travel between the time it passed cars B and C ?.

e. What is the relative velocty of car B with respect to car C?

Watch Video Solution

10. A cockroach moves rectilinearly such that after sometime t_0 let its (instantaneous) velocity be equal to its average velocity over that time. Referring to the $S\Delta t$ graph as shown in , for the motion of the cockroach, find the time t_0 and the average velocity of the cockroach over the time t_0



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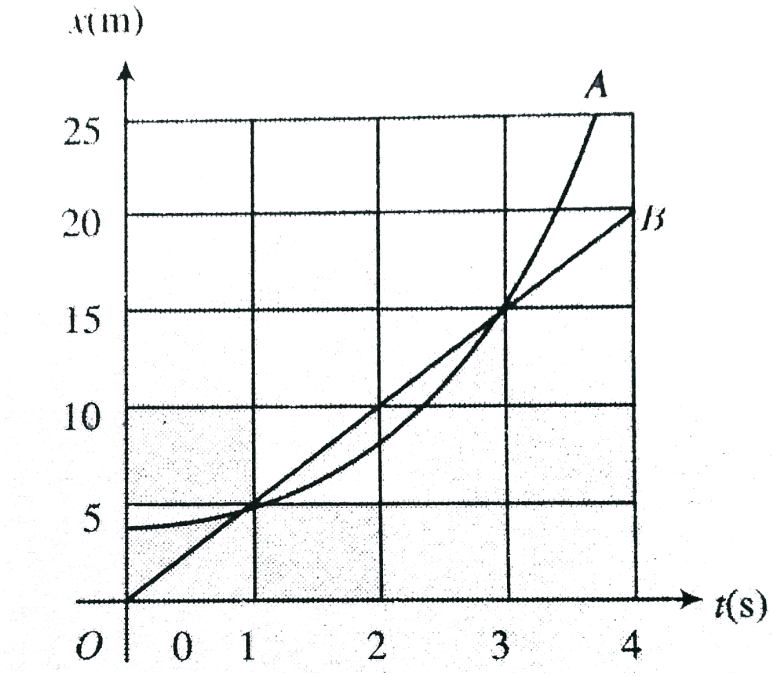
11. A car accelerates from rest at a constant rate α for some time, after which it decelerates at a constant rate β, to come to rest. If the total time elapsed is t seconds. Then evalute (a) the maximum velocity reached and (b) the total distance travelled.

Watch Video Solution

12. Two cars, A and B move along the x-axis. Car A starts from rest with constant accelertion while car B moves with consstant velocity.

a. At what time s, t s, if any, do A and B have the same position?



b. At what time s if any, do A and B have the same velocity? What is the velocity of car B at this time.

c. Graph velocity versus time for both A and B.

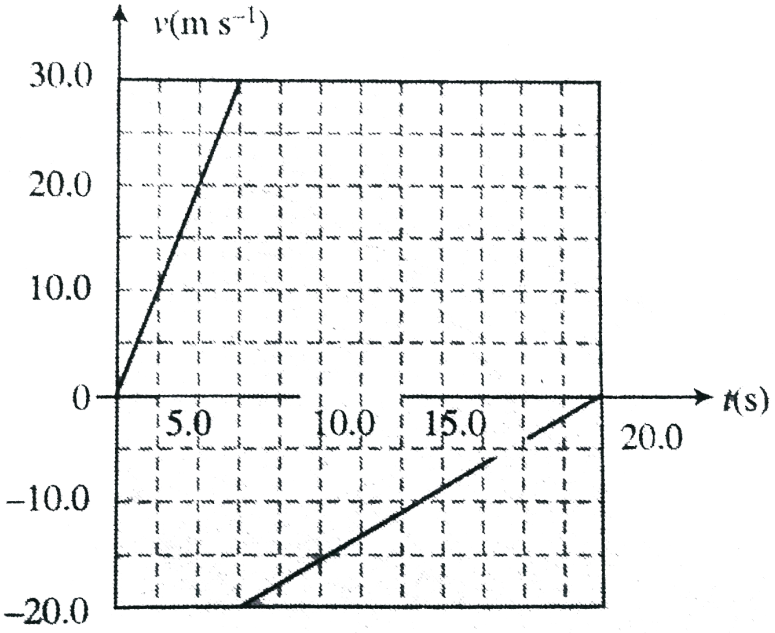
d. At what time s. If any, does car $Apasscar\mathrm{A}?e.\ Atw\hat{t}imes$, if $anydoescar\mathrm{B}passcar\mathrm{A}?$

View Text Solution

13. A rigid ball traveling in a straight line $thex - a\xi s$ hits a soled wall and suddenly rebounds during a brief instant . The $v_x - t$ grap in . shows this

ball s velocty as a function of time. During the first $20s$ of its motion, find (a) its displacement (b) the total destance the ball moves, and (c) skerch a graph of $a_x - t$ for this ball $smotion. (d) Isthegraphshownreallyvertcalat5$ s`?

Explain.



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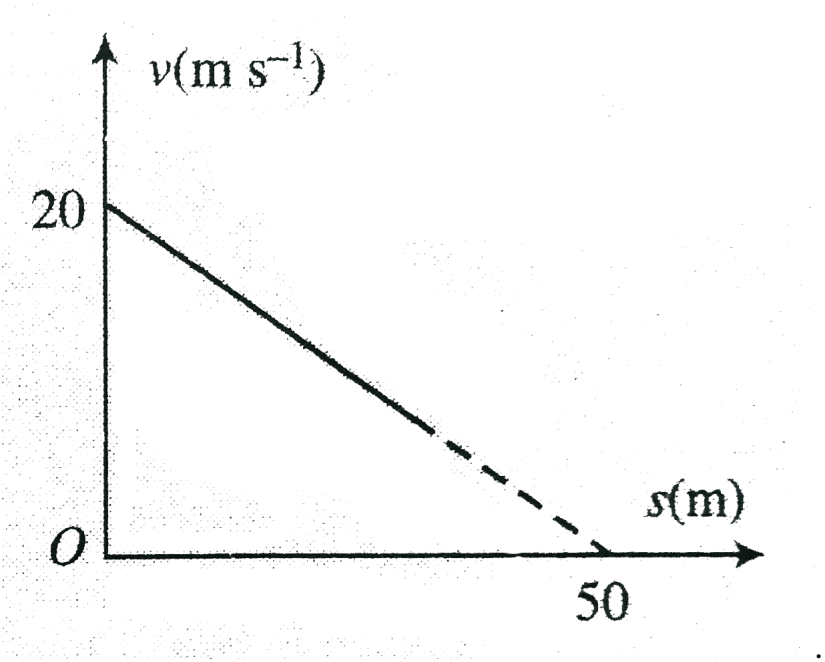
14. Refering to $v - s$ diagram, find:



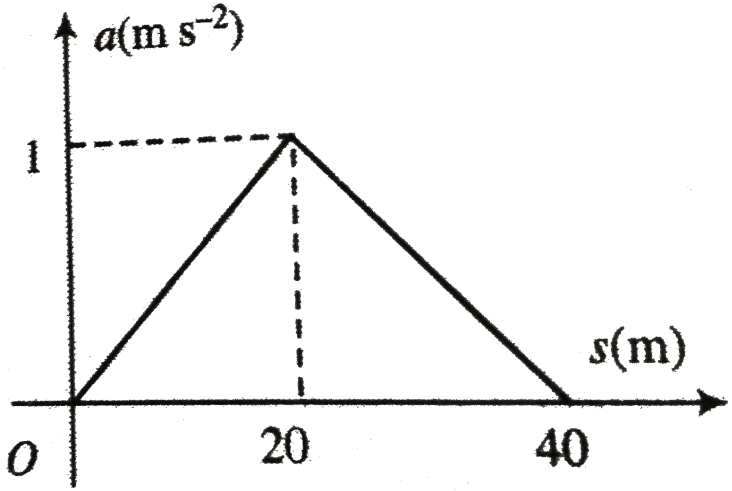
a. Acceleration of the particle when its velocity becomes half of the initial velocity.

b. Total distance covered by the particle.

Watch Video Solution

15. A racing motor boat speeds up in a straight line in a lake, from rest. Referring to the acceleration-displacement graph for the speeding boat

dind its speed when it passes a raft at a distance of $40m$ from the starting poingt.



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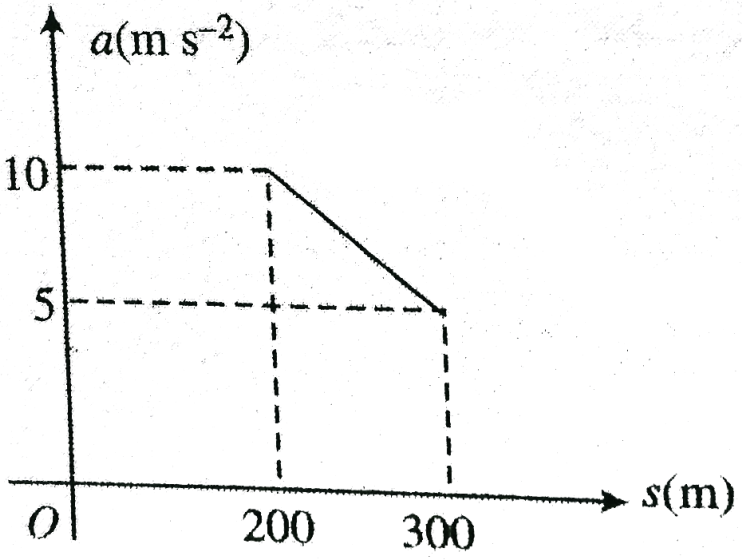
16. Referring $a - s$ diagram in , find the velocity after particle travel $120m$ from starting. Assume $v_0 = 0$.



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Subjective

1. A car starts from rest and moves with constant acceleration and covera the distance between two point $180m$ apart in $6s$. Itsspeed as it passes the second point is $45ms^{-1}$ Find

a. Its acceleration

b. Its speed when it was at the point

c. The distance from the first point when it was at rest`.

View Text Solution

2. A stone is let to fall from a balloon ascending with an acceleration f. Aftre time t. A second stonr is dropped. Prove that the distance between the stones after time t'

since the second stone is dropped, is $\frac{1}{2}(f+g)t(t+2t')$.

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3. A stone falling from the top of a vertical tower has descended x metre when another is dropped from a point y metre, below the top. If they fall from rest and from rest andreach the groundtogerher, show that the height of the tower is $(x+y)^2\frac{)}{4x}m$.

Watch Video Solution

4. Divede a plane $10m$ long and $5m$ high into three parts so that a body starting from rest takes equal times to slide down these. Also find the time taken then.

Watch Video Solution

5. The driver of a car moving at $30ms(-1)$ suddenly sees a truck that is moving in the same direction at $10ms^{-1}$ and is $60m$ head. The maximum deceletation of the car is $5ms(-2)$.

a. Will the collision occur if the driver's reaction time is zero ? If so. then?

b. If the car driver's reaction time of $0.5s$ included, what is the minimum deceleration required to avoied the collision?.

Watch Video Solution

6. A steel ball is dropped from th roof of a building. A man standing in front of a $1-m$ high window in the building notes tha the ball takes $0.1s$ to the fall from the top to the boottom of the window. The ball

continues to fall and strikes the ground. On striking the ground, the ball gers rebounded with the same speed with which it hits the ground. If the ball reappears at the bottom of the window $2s$ after passing the bottom of the window on the way down, dind the height of the building.

Watch Video Solution

7. A particle is dropped from the top a tower h metre high and at the same moment another particle is projected upward from the bottom. They meet the upper one has descended a distance h/n . Show that thevelocities of the two when they meet are in the ratio 2: $(n-2)$ and that the initial velocity of the particle projected upis $\sqrt{(1/2)ngh}$.

View Text Solution

8. An elevator whose floor-to-ceiling destance is $2.50m$ starts ascending with a constant acceleration of $1.25ms^{-2}$ On second after the start, a bolt begins falling from the elevator. Calculate:

a. The free fall time of the bolt

b. The displacement and reference frame of ground.

View Text Solution

9. Two motor cars start from A simultaneously & reach B after 2 hour. The first car travelled half the distance at a speed of $v_1 = 30kmhr^{-1}$ & the other half at a speed of $v_2 = 60kmhr^{-1}$. The second car covered the entire with a constant acceleration. At what instant of time, were the speeds of both the vehicles same? Will one of them overtake the other enroute?

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10. A train of length $l = 350m$ starts moving rectilinearly with constant acceleration $w = 3.0 \cdot 10^{-2} m/s^2, t = 30s$ after the start the locomotive headlight is switched on (event 1), and $\tau = 60s$ after that event the tail signal light is switched on (event 2). Find the distance between these events in the reference frames fixed to be train and to the Earth. How and

at what constant velocity V relative to the Earth must a certain reference frame K move for the two events to occur in it at the same point?

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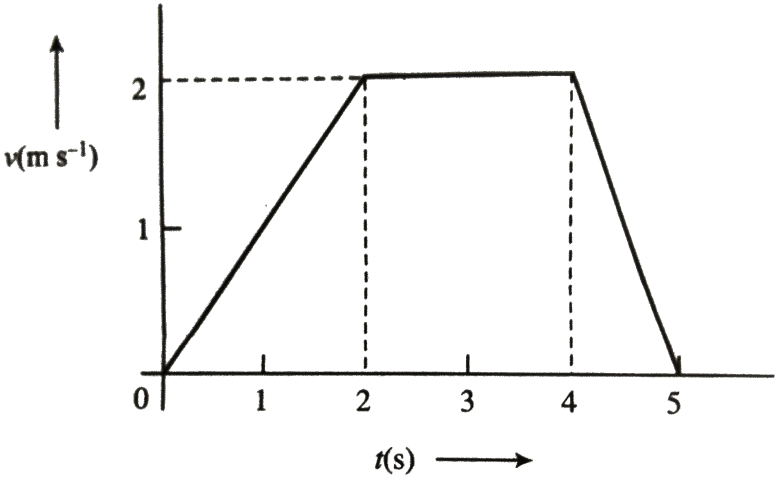
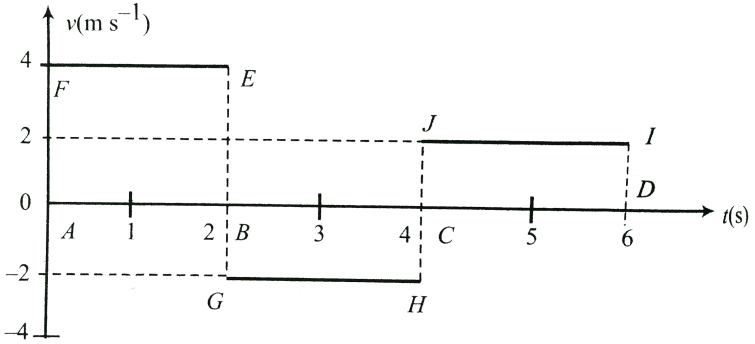
11. Starting at $x = 0$, a particle moves according to the graph of v vs t shown in . Sketch a staph of the instantaneoud acceleration a vs t, indicationg numerical values at significant points of the graph.



Watch Video Solution

12. The velocity-time graph of a particle moving in a staight line is shown in the . Find the displacement and the distance trav elled by the particle in $6s$.



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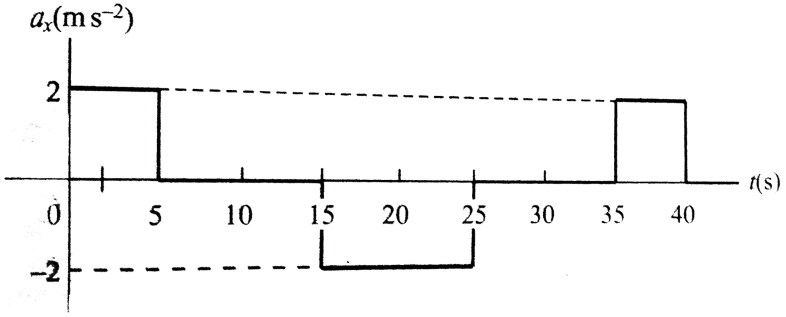
13. Shows a graph of the acceleration of a model railroad locomotive moving on the x-axis. Graph its velocity and coordinate as functions of time if $x = 0$ and $v_x = 0$ at $t = 0$.



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14. A woman starts from her home at 9.00 a. m., walks with a speed of $5kmh^{-1}$ on straight road up to her office $2.5km$away, stays at the offiec up to $5.00p.\ m.$, and returnshome by anauto with a seed of $25kmh^{-1}$. Plot the position-time graph of the woman taking home as origin.

Watch Video Solution

15. A runner jogs a along a straight road (in the $+x$ direction) for $30\ \min$, travelling a distance of $6km$. She then turns around and walks back towards her starting point for $20\ \min$, travelling $2km$ during this time.

State true/ false:

a. The final displacement of the entire trip is $0.16km\ \min^{-1}$.

b. Her average speed for the entire is $0.16km\ \min^{-1}$.

c. The average velocity for the entire trip is $0.4km\ \min^{-1}$.

d. The runner's average velocity while jogging is $0.4km\ \min^{-1}$.

e. Her average velocity while walking is $0.1km\ \min^{-1}$.

View Text Solution

16. At the instant, the traffic light turns green, a car that has been waiting at an intersection starts ahead with a constant acceleration of $3.20ms^{-2}$, At the some instant, a truck travelling with a constant speed of $20.0ms^{-1}$, overtakes and passes the car.

a. At what distance from its starting point does the car overtake the truck?

b. Calculate the speed of the car when it overtakes the truck.

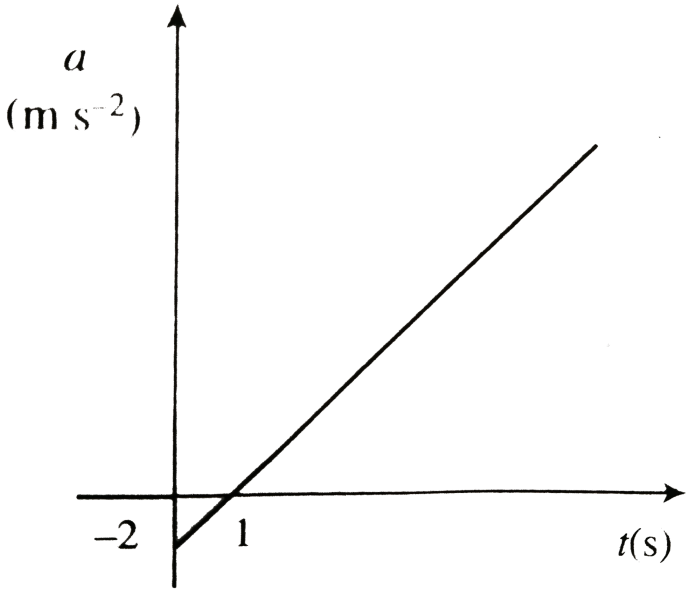
c. Sketch an $x - t$ graph of themotion of both vehicles.

Take $x - 0$ at the intersection.

d. Sketch a $v_x - t$ graph of the motion of both vehicles.

Watch Video Solution

17. The acceleration of a particle varies with time as shown in .



a. Find an expression for velocityinterms of t. Assume that $v = 0$ at $t = 0$

b. Calculate the displacement of the paarticle in the time interval from $t = 2s$ s.

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18. A ball is prouected vertical up from the top of a cliff of height h with a speed v_1 Another ball is projected vertically up with a speed v_2 from the

bottom of the cliff, after a time t_0 from the instantof projection of the first ball, When will the balls meet?.

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19. A body moving along a straight line traversed one third of the total distance with a velocity $4m/\sec$ in the first stretch. In the second stretch, the remaining distance is covered with a velocity $2m/\sec$ for some time t_0 and with $4m/s$ for the remaining time. If the average velocity is $3m/\sec$, find the time for which body moves with velocity $4m/\sec$ in second stretch:

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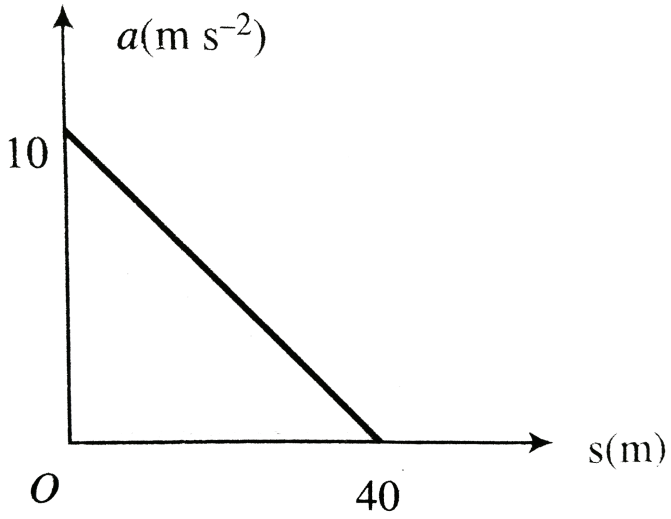
20. A passenger reaches the platform and finds that the second last boggy of the train is passing him. The second last boggy takes $3s$ to pass the passenger, and the last boggy takes $2s$ to pass him. Find the time by which the passnger late for the departure of the trains? Assume that the train accelerates at constant rate and all the boggies are of equal length.

Watch Video Solution

21. Referring to $a - s$ diagram as shown in , findthe velocity of the particle when the particle when the spaarticle justcovers $20m$, $(v_0 = \sqrt{50}ms^{-1}$.



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22. A ballon starts risintg from ground from rest at some constant acceleration. After some time, a storne is dropped from it. If the stone

reaches the ground in the same time in which balloon reached the dropping poing from ground, find the acceleration of the balloon.

Watch Video Solution

23. The balls are released from the top of a tower of heigh H at regular interval of time. When first ball reaches at the grund, the nthe ball is to be just released and $\frac{(n+1)}{2}th$ ball is at some distance h from top of the tower. Find the value of h.

View Text Solution

24. A car moves in a straight line, the car accelerates from rest with a constant acceleraation α on a straight foad. After gaining a velocity v, the car moves with that velocity for somerime. Then car decelerates with a retardation β, If the total distance covered by the car is equal to s find the total time of its motion.

Watch Video Solution

25. A ball is released from the top of a multistory tower. The ball taked $1s$ to fall pasta floor of the tower $8m$ height of a floor some distance from the top of thetower. Find the velocities of the ball at the top and at the bottom of the window.

Watch Video Solution

26. A particle is projected vertically from the ground takes time $t_1 = 1s$ upto point A, $t_2 = 3s$ from point A to B, and time $t_3 = 4s$ from point B to highest point. Find the height of the middle point of A and B from the ground.

Watch Video Solution

27. The loaded bucket of a craneachievers a maximum velocity $5m/s$ in some time at a uniform rate and thentakes half of this time to stop at a uniform rate after the application of brake. The time differnce between

the instants when half of the maximum velocity is achieved is $t(\sec)$. Find the displacement of the bucket.

View Text Solution

28. At the same instant, ball A is ball B is projected vertically building of height h and ball B is projected vertically upward from the ground with velocity u. The ration of velocty of A to the velocity of B at the point of cllistion is same asthe ratio of height of this point from top of the building to the height from the ground, find the height of the point of collision above theground.

View Text Solution

29. A railway track runs parallel to a road until a turn brings the road to railway corssing. A cyclist rides along the road every day at a constant speed $20km/hr$. He normally meets a train that travels in same direction at the crossing. One day he was late by 25 minutes and met the train $10km$ before the railway crossing. Find the speed of the train.

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Single Correct

1. If the displacement of a body is zero is the distance covered by it necessarily zero ? Explain with suitable illustration.

A. Must be zero

B. May or may not be zero

C. Cannot be zero

D. Depends upon the particle

Answer: B

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2. If the displacement of a body is zero is the distance covered by it necessarily zero ? Explain with suitable illustration.

A. Must vbe zero

B. May or may not be zero

C. Cannot be zero

D. Depends upon the particle

Answer: A

Watch Video Solution

3. The ratio of the numerical values of the average velocity and average speed of a body is always.

A. Always less than 1

B. $Alwaysewual \rightarrow 1$`

C. Always more than 1

D. Equal to or than 1

Answer: D

Watch Video Solution

4. The numuerical value of the ratio of instantaneous velocity to instantaneous spedd is.

A. Always less than 1

B. Always equal to 1

C. Always more than 1

D. Equal to or less than 1

Answer: B

Watch Video Solution

5. The location of a particale is changed. What can we say about the displacement and distance coverd by the particle?

A. Both cannot be zero

B. One of the two may be zero

C. Both must be zero

D. Both must be equal

Answer: A

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6. The magintude of displacemnt is equal to the distance coverd in a given interval of time if the particle .

A. Moves with constant acceleration along any path

B. Moves with constant speed

C. Moves in same direction with constant velocity or with variable velocity.

D. Moves with constant velocity

Answer: C

Watch Video Solution

7. The distance travelled by a particle in a straight line motion is directly poroportional to $t^{1/2}$, where t is the time elapsed.

A. Increasing acceleration

B. Decreasing acceleration

C. Increasing retardation

D. Decreasing retardation

Answer: D

Watch Video Solution

8. The position x of a particle varies with time t as $x = at^2 - bt^3$. The acceleration at time t of the particle will be equal to zero, where (t) is equal to .`

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

B. $\frac{a}{b}$

C. $\frac{a}{3b}$

D. zero

Answer: C

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9. Between two stations a train starting from rest first accelerates uniformly, then moves with constant velocity and finally retarts uniformly to come to rest. If the ratio of the time taken be $1:8:1$ and the maximum speed attained be $60km/h$, then what is the average speed over the whole journey ?

A. $48kmh^{-1}$

B. $52kmh^{-1}$

C. $45kmh^{-1}$

D. $56kmh^{-1}$

Answer: C

Watch Video Solution

10. The velocity acquired by a body moving with uniformaccelertion is $30ms^{-1}$ in $2s$ and $60ms^{-1}$ in $4s$, The initial velocity is .

A. zero

B. $2ms^{-1}$

C. $3ms^{-1}$

D. $10ms^{-1}$

Answer: A

Watch Video Solution

11. A particle starts from the origin with a velocity of $10ms^{-1}$ and moves with a constant acceleration till the velocity increases to $50ms^{-1}$. At that instant, the acceleration is suddenly reversed. What will be the velocity of the particle, when it returne to the starticng point?

A. Zero

B. $10ms^{-1}$

C. $50ms^{-1}$

D. $70ms^{-1}$

Answer: D

Watch Video Solution

12. A particle is moveint along the x-axis whose instantaneous speed is given by $v^2 = 108 - 9x^2$. The acceleration of the particle is.

A. $-9xms^{-2}$

B. $-18xms^{-2}$

C. $\frac{-9x}{2}ms^{-2}$

D. None of there

Answer: A

Watch Video Solution

13. A ball is released from the top of a tower of height h metre. It takes T second to reach the ground. What is the position of the ball in $\frac{T}{3}$ second?

A. $h/9m$

B. $7h/9m$

C. $8h/9m$

D. $17h/18m$

Answer: C

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14. Taxies leave station X for station Y every $10\ \min$. Simultaneously, a taxi also leaves station Y for station X every $10\ \min$. The taxies move at the same constant speed and go from X and Y or vice-versa in $2h$, How many taxies coming from the other side will meet each taxi enroute from Y and X?.

A. 24

B. 23

C. 12

D. 11

Answer: B

Watch Video Solution

15. When the speed of a car is u, the mimimum distance over which it canbe stopped is a, If speed becomes ν, what will be the mimimum distance over which it can be stopped during the same time?

A. s/h

B. ns

C. s/n^2

D. $n^2 s$

Answer: D

Watch Video Solution

16. A thief is running away on a straitht road in a moving with a speed of $9ms^{-1}$. A policeman chases him on a motor cycle moving at a speed of $10ms^{-1}$. If the instananeous separation of the jeep from the motor cycle is $100m$, how long will it take for the policeman to catch the thief ?.

A. $1s$

B. $19s$

C. $90s$

D. $100s$

Answer: D

Watch Video Solution

17. A ball is released from the top of a tower of height Hm. After $2s$ is stopped and then instantaneously released. What will be its heitht after next $2s$?.

A. $(H-5)m$

B. $(H-10)m$

C. $(H-20)m$

D. $(H-40)m$

Answer: D

Watch Video Solution

18. A stone is dropped from the top of a tower of height h. Aftre $1s$ another stone is droppped from the balcony $20m$ below the top. Both reach the bottom simultaneously. What is the value of h ? Take $g = 10ms^{-2}$.

A. $315m$

B. $312.5m$

C. $3125m$

D. $25, 31$

Answer: C

Watch Video Solution

19. A train $100m$ long travelling at $40ms^{-1}$ starts overtaking another train $200m$ long travelling at $30ms^{-1}$. The time taken by the first train to pass the second train completely is .

A. $30s$

B. $40s$

C. $50s$

D. $60s$

Answer: A

Watch Video Solution

20. A juggler throws ball into air. He throus one whenever the previus one is at its highest point. How high do the balls rise if he throus (n) balls each second. Acceleration the to gravity=g`.

A. $5m$

B. $3, 75m$

C. $2.50m$

D. $1.25m$

Answer: A

Watch Video Solution

21. A stone thrown upwards with speed u attains maximum height h. Ahother stone thrown upwards from the same point with speed $2u$ attains maximum height H. What is the relation between h and H?

A. $2h = H$

B. $3h = H$

C. $4h = H$

D. $5h = H$

Answer: C

Watch Video Solution

22. A bolldropped from the top of a tower covers a distance $7x$ in the last second of its journey, where x is the distance coverd int the first second. How much time does it take to reach to ground?.

A. $3s$

B. $4s$

C. $5s$

D. $6s$

Answer: B

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23. The relation between time t and displacement x is $t = \alpha x^2 + \beta x$, where α and β are constants. The retardation is

A. $2\alpha v^3$

B. $2\beta v^3$

C. $2\alpha\beta v^3$

D. $2b^2v^3$

Answer: A

Watch Video Solution

24. The displacement x of a particle moving in one dismension under the action of a constant force is frlated to time t by the equation $t\sqrt{x}+3$, where x is in merers and t is in seconds, Find the displacemect of the particle when its velocity is zero.

A. Zero

B. $12m$

C. $6m$

D. $18m$

Answer: A

Watch Video Solution

25. The distance moved by a freely falling body (startibg from rest) during $st, 2nd, 3nd, \ldots\ldots nth$ second of its motion are propotional to .

A. Even numbers

B. Odd numbers

C. All integral numbers

D. Squares of integral numbere

Answer: D

Watch Video Solution

26. A drunkard is walking along a stsraight road. He takes five steps forward and three steps backward and so on. Each step is $1m$ long and

takes $1s$. There is a pit on the road $11m$, away from the starting point. The drunkard will fall into the pit after.

A. $29s$

B. $21s$

C. $37s$

D. $31s$

Answer: A

Watch Video Solution

27. A stone is dropped from a certain heitht which can reach the ground in $5s$. It is stopped aftre $3s$ of its fall and then it is again released. The total time taken by the stone to reach the ground will be .

A. $6s$

B. $6.5s$

C. $7s$

D. $7.5s$

Answer: C

Watch Video Solution

28. A body travels a distance of 2 m in 2 seconds and 2.2m next 4 secs. What will be the velocity of the body at the end of $7th$second from the start ?

A. $5cms^{-1}$

B. $10cms^{-1}$

C. $15cms^{-1}$

D. $20cms^{-1}$

Answer: B

Watch Video Solution

29. A body starts from rest and travels a distance S with uniform acceleration, then moves uniformly a distance $2S$ uniformly , and finally cones to rest after moving further $5S$ under uniform retardation. The ratio of the average velocity to maximum velocity is.

A. $2/5$

B. $3/5$

C. $4/7$

D. $5/7$

Answer: C

Watch Video Solution

30. A body sliding on a smooth inclined plane requires $4s$ to reach the bottom, starting from rest at the at the top. How much time does it take to cover ont-foruth the distance startion from rest at the top?

A. 1 s`

B. $2s$

C. $4s$

D. $16s$

Answer: B

Watch Video Solution

31. B_1,B_2, and B_3, are three balloos ascending with velocities v, $2v$, and $3v$, respectively, If a bomb is dropped from each when they are at the same height, then.

A. Bomb from B_1 reaches ground first

B. Bomb from B_2 reaches ground first

C. Bomb from B_3 reaches ground first

D. They reach the ground simultaneously

Answer: A

Watch Video Solution

32. A particle is dropped from rest from a large height Assume g to be constant throughout the motion. The time taken by it to fall through successive distance of $1m$ each will be :

A. All equal, being equal to $\sqrt{2/g}\,\mathrm{sec}\,ond$

B. In the ratio of the square roots roots of the integers `1, 2, 3,.....

C. In the ratio of the disfference in the square roots of the integers, i.e., sqrt1, (sqrt2, -sqrt1),(sqrt3-sqrt2), (sqrt4-sqrt3)`.....

D. In the ratio of the rectiprocals of the square roots of the integers, i.e., (1)/(sqrt1), (1)/(sqrt2), (1)/(sqrt(3)`,.....

Answer: C

Watch Video Solution

33. A ball is dropped into a well in which the water level is at a depth h below the top. If the speed of sound id C, then the time after which the splash is heard will be give by.

A. $h\left[\sqrt{\frac{2}{gh}}+\frac{1}{c}\right]$

B. $h\left[\sqrt{\frac{2}{gh}}+\frac{1}{c}\right]$

C. $h\left[\frac{2}{g}+\frac{1}{c}\right]$

D. $h\left[\frac{2}{g}+\frac{1}{c}\right]$

Answer: A

Watch Video Solution

34. If particled travels n equal distances with speeds $v_1, v_2, \ldots v_n$, then the average speed $\overrightarrow{v}$ of the particle will be such that .

A. $\overrightarrow{V}=\frac{v_1+v_2+\ldots\ldots+v_n}{n}$

B. $\overrightarrow{V}=\frac{nv_1v_2+v_n}{v_1+v_2+v_3+\ldots.+v_n}$

C. $\frac{1}{\overline{V}} = \frac{1}{n}\left(\frac{1}{v_1} + \frac{1}{v_2} + \ldots\ldots + \frac{1}{v_n}\right)$

D. $\overline{V} = \sqrt{v_1^2 + v_2^2 + \ldots . + \frac{1}{v_n}}$

Answer: C

Watch Video Solution

35. A ball is thrown from the top of a tower in vertically upward direction. Velocity at a point h m below the point of projection is twice of the velocity at a point h m above the point of projection. Find the maximum height reached by the ball above the top of tower.

A. $2h$

B. $3h$

C. $(5/3)h$

D. $(4/3)h$

Answer: C

Watch Video Solution

36. A juggler keeps on moving four balls in the air throwing the balls after regular intervals. When one ball leaves his hand $\left(\text{speed} = 20ms^{-1}\right)$ the positions of other balls (height in m) (Take $g = 10ms^{-2}$).

A. $10, 20, 10$

B. $15, 20, 15$

C. $4, 15, 20$

D. $5, 10, 20$

Answer: B

Watch Video Solution

37. A particle slides from rest from the topmost point of a vertical circle of radius r along a smooth chord making an angle θ with the vertical. The time of descent is .

A. Least for $\theta = 0$

B. Maximum for $\theta = 0$

C. Least for $\theta = 45$

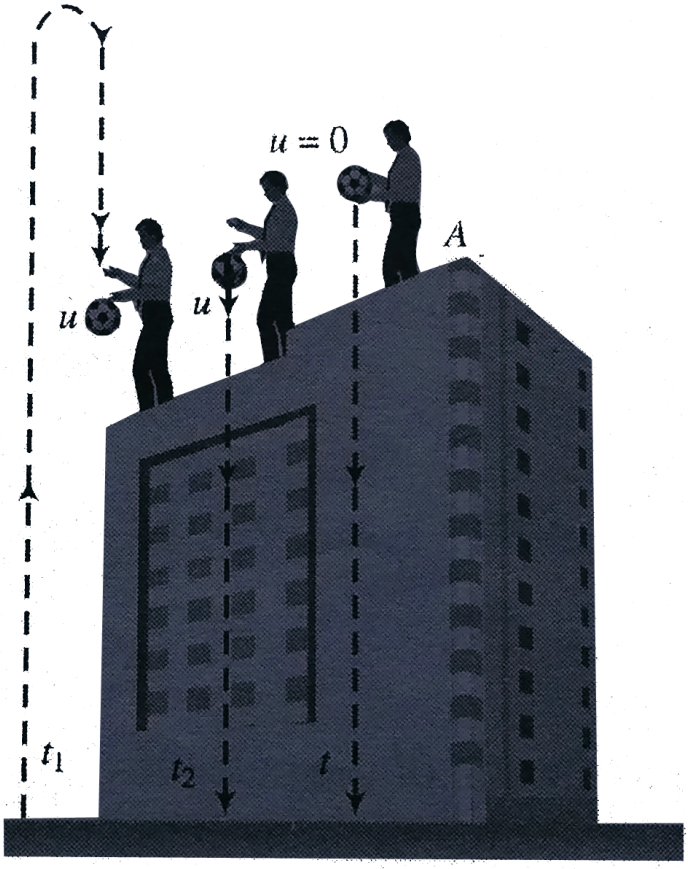
D. Independent of θ

Answer: D

Watch Video Solution

38. A body is thrown vertically upwards from A. The top of a tower . It reaches the ground in time t_1. It it is thrown vertically downwards from A with the same speed it reaches the ground in time t_2, If it is allowed to

fall freely from A. then the time it takes to reach the ground.



A. $t = \left(t_1 + \frac{t_2}{2}\right.$

B. $t = \frac{t_1 t_2}{2}$

C. $t = \sqrt{t_1 t_2}$

D. $t = \sqrt{\left(\frac{1_1}{t_2}\right.}$

Answer: C

Watch Video Solution

39. The deceleration exerienced by a moving motor blat, after its engine is cut-off is given by $dv/dt = -kv^3$, where k is constant. If v_0 is the magnitude of the velocity at cut-off, the magnitude of the velocity at a time t after the cut-off is.

A. $v_0/2$

B. v

C. $v_0 e^{-kt}$

D. $\frac{v_0}{\sqrt{2v_0^2kt+1}}$

Answer: D

Watch Video Solution

40. For motion of an object along the x-axis the velocity v dipends on the displacement x an $v = 3x^2$, then what is the acceleration at $x = 2m$.

A. $48ms^{-2}$

B. $80ms^{-2}m.$

C. $18ms^{-2}$

D. $10ms^{-2}$

Answer: B

Watch Video Solution

41. A storne is dropped from the 25 th storey of a multistored building and it reaches the ground in $5s$. In the first second, it passes through how many storey of the buliding?

A. 1

B. 2

C. 3

D. none of ther

Answer: A

Watch Video Solution

42. A body is projected upwards with a velocity u. It passes through a certain point above the ground after t_1, Find the time after which the body passes through the same point during the journey.

A. $1\left(\frac{u}{g} - t_1^2\right)$

B. $2\left(\frac{u}{g} - t_1\right)$

C. $3\left(\frac{u^2}{g} - t_1\right)$

D. $3\left(\frac{u^2}{g} - t_1\right)$

Answer: B

Watch Video Solution

43. A parachutist drops first freely form an areophone for $10s$ and then his parachut opens out. Now he descends with a net retardtion of $2.5ms^{-2}$ If the balil out of the plane at a height of $2495m$ and $g = 10ms^{-2}$, his velocity on reaching the ground will be`.

A. $5ms^{-1}$

B. $10ms^{-1}$

C. $15ms^{-1})$

D. $20ms^{-1}$

Answer: A

Watch Video Solution

44. A police party is chasing a dacoit in a jeep which is moving at a constant speed v. The dacoit is on a motor cycle. When he is at a distance

x from the jeep, he accelerates from rest at a constant rate α. Which of the following relations is true, if the police is able to catch the dacoit ?

A. $v^2 \leq \alpha x$

B. $v^2 \leq 2\alpha x$

C. $v^2 \leq 2\alpha x$

D. $v^2 \leq \alpha x$

Answer: C

Watch Video Solution

45. A train is moving at a constant speed V when its driverobserves another train in front of him on the same track and voing in the same direction with constant speed v. If the distance berween the trains is x. Trains is `x then what should be the minimum retardation of the train so as to avoed collision?.

A. $\frac{(V_+ v)^2}{x}$

B. $\frac{(V_+ v)^2}{x}$

C. c. $\frac{(V_+ v)^2}{2x}$

D. $\frac{(V_+ v)^2}{2x}$

Answer: D

Watch Video Solution

46. A moving car possesses average velocities of $5ms^{-1}$, $10ms^{-1}$, and $15ms^{-1}$, in the first, second, and third seconds, respecticely. What is the total destance coverd by the car in these $3s$.?

A. $15m$

B. 30

C. $55m$

D. `None of these

Answer: B

Watch Video Solution

47. The average velocity of a body moving with uniform acceleration after travelling a distance of $3.06m$ is $0.34ms^{-1}$. If the change in velocity of the body is $0.18ms^{-1}$ during this time, its uniform acceleration is .

A. $0.01ms^{-2}$

B. $0.02ms^{-2}$

C. $0.013ms^{-2}$

D. $0.04ms^{-2}$

Answer: B

Watch Video Solution

48. Water drops fall from a tap on to the floor 5.0 m below at regular intervals of time. The first drop strikes the floor when the fifth drops

beings to fall. The height at which the third drop will be from ground at the instant when the first drop strikes the ground is (take $g = 10m^{-2}$)

A. $1.25m$

B. $2.15m$

C. $2.75m$

D. $3.75m$

Answer: D

Watch Video Solution

49. Drops of water fall at regular intervals from the roof of a building of height $h = 16m$. The first drop striking the ground at the same moment as the fifth drop is ready to leave from the roof. Find the distance between the successive drops.

A. $1m, 5m, 7m, 3m$

B. $1m, 3m, 5m, 7m$

C. $1m, 3m, 7m, 5m$

D. None of the above

Answer: B

Watch Video Solution

50. A point moves in a straight line so its displacement x metre at time t second is given by $x^2 = 1 + t^2$. Its acceleration in ms^{-2} at time t second is .

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

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

C. $\frac{1}{x} - \frac{t^2}{x^3}$

D. $\frac{1}{x} - \frac{1}{x^2}$

Answer: C

Watch Video Solution

51. A point moves with uniform acceleration and v_1, v_2, and v_3 denote the average velocities in the three successive intervals of time t_1. t_2, and t_3 Which of the following Relations is correct?.

A. $(v_1 - v_2) : (v_2 - v_3 = (t_1 - t_2 : (t_2 + t_3.$

B. $(v_1 - v_2) : (v_2 - v_3 = (t_2 - t_2 : (t_2 + t_3$

C. $(v_1 - v_2) : (v_2 - v_3 = (t_1 - t_2 : (t_2 + t_3$

D. $(v_1 - v_2) : (v_2 - v_3 = (t_1 - t_2 : (t_2 + t_3$

Answer: B

Watch Video Solution

52. A $2 - m$ wide truck is moving wigh a uniform speed $v_0 = 8ms^{-1}$ along a straight horizontal road. A pedestrian starts to cross the road with a uniform speed v when the truck is $4m$ away from him, The minimum value of v so that he can cross the road safely is .

A. $2.62ms^{-1}$

B. $4.6ms^{-1}$

C. $3.57ms^{-1}$

D. $1.414ms^{-1}$

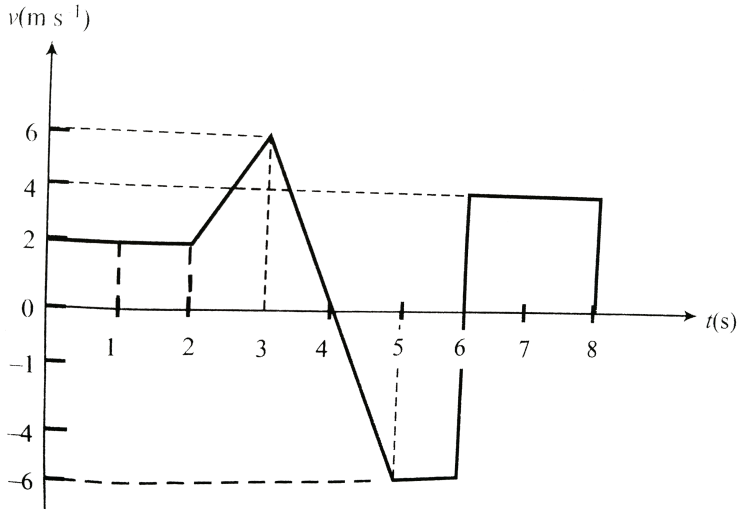
Answer: C

Watch Video Solution

Graphical Concept

1. The velocity-time graph of a body is shown in .

The displacement of the body in $8s$ is.



A. $9m$

B. $12m$

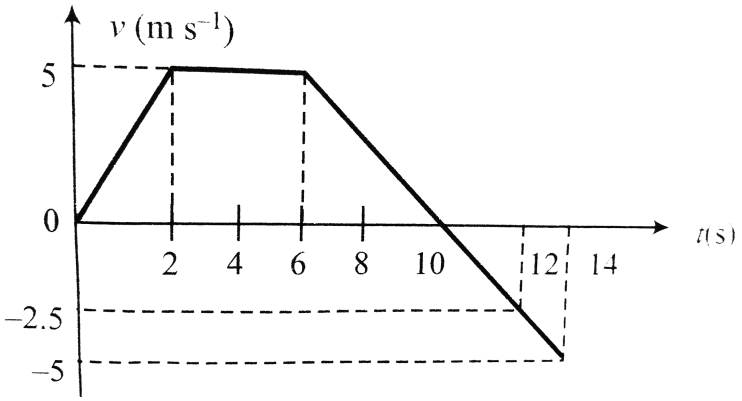
C. $10m$

D. $28m$

Answer: C

Watch Video Solution

2. The variation of velocity of a particle moving along a straight line is shown in . is



A. $37.5km$

B. $32.5m$

C. $35.0m$

D. None of these

Answer: A

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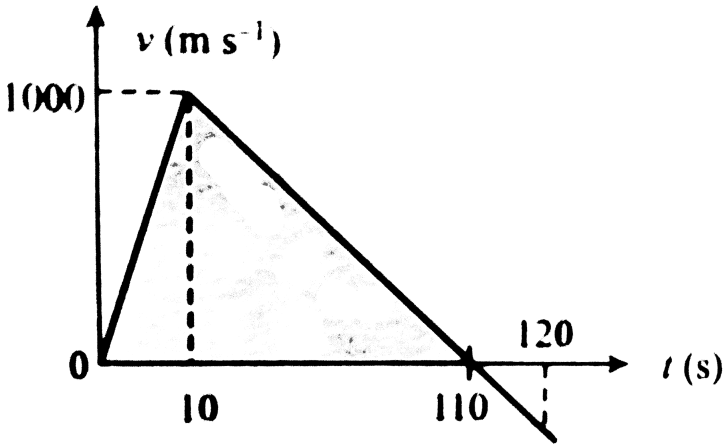
3. The follwing graph shows the variation of velocity of a rocker with time.

Then the mximum height attained by the rocket is.



A. $1.1km$

B. $5km$

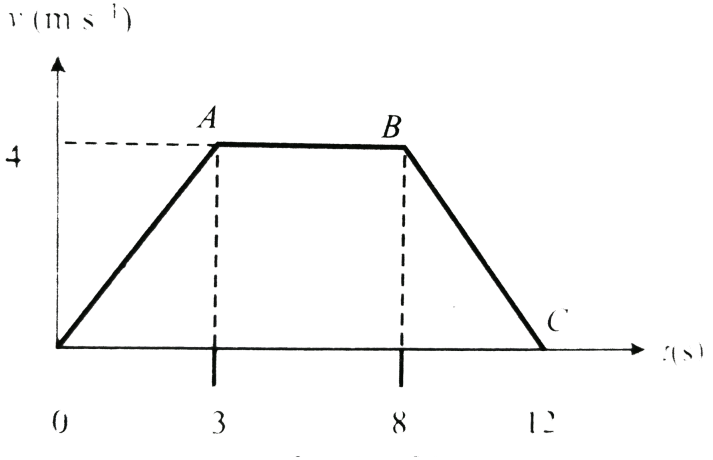
C. $55km$

D. None of these

Answer: C

Watch Video Solution

4. From athe velocity time graph, given in of a particle moving in a straight line, one can conclude that



A. Its average velocity during the $12s$ interval is $24/7ms^{-1}$.

B. Its velocity for the first $3s$ is uniform and is eual to $4ms^{-1}$.

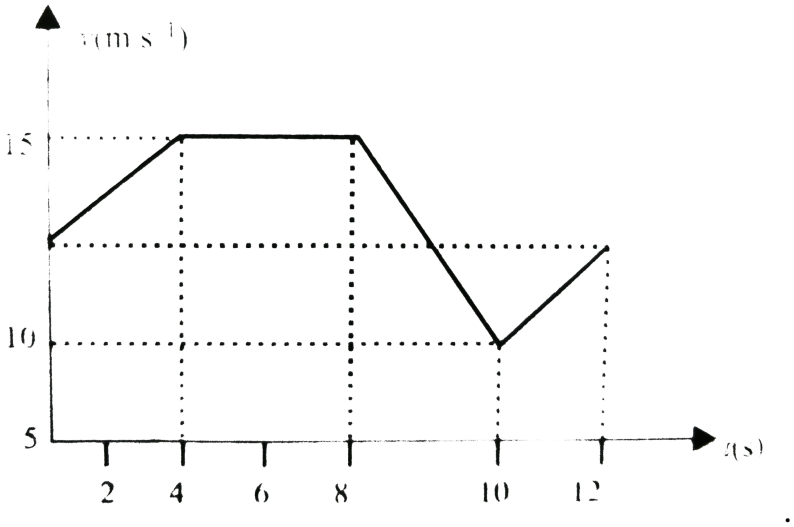
C. The body has a constant acceleration between $t = 3s$ and $t = 8s$.

D. The body has a uniform retardation from $t = 8s$ to $t = 12s$.

Answer: D

Watch Video Solution

5. The velovity-time graph of a particle moving in a straitht line is shown in . The acceleration of the particle at $t = 9s$ is.



A. Zero

B. $5ms^{-2}$

C. $-5ms^{-2}$

D. $-2ms^{2}$

Answer: C

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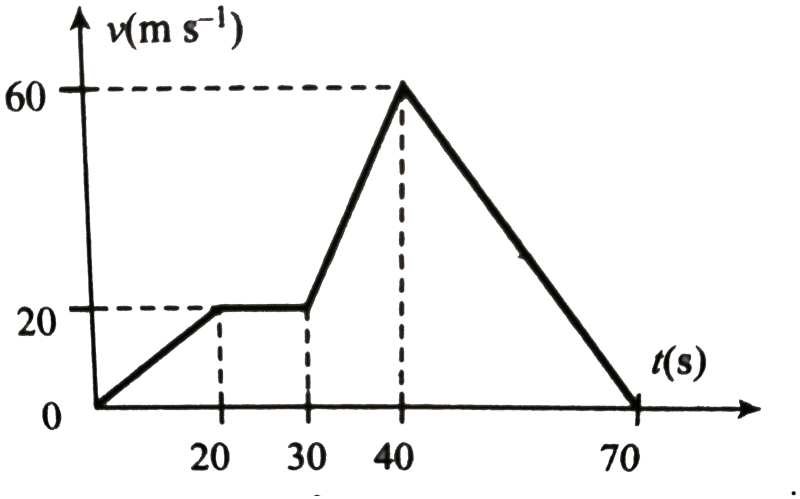
6. The velocity-time graph of a body is given in. The maximum acceleration in ms^{-1} is .



A. 4

B. 3

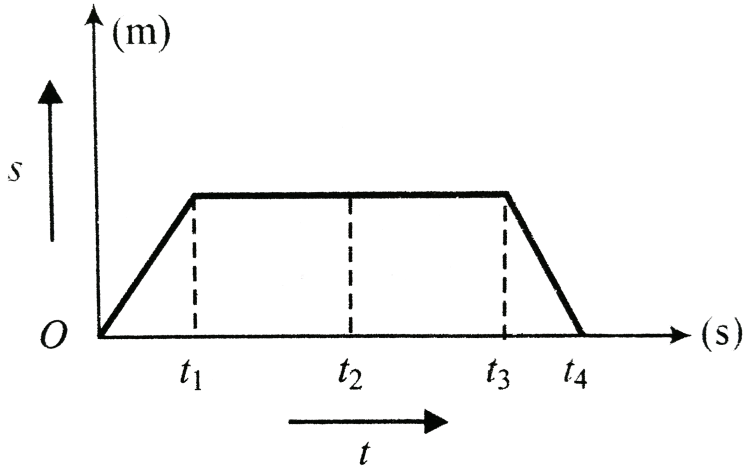
C. 2

D. 1

Answer: A

Watch Video Solution

7. The displacement-time graph of a body is shown in.



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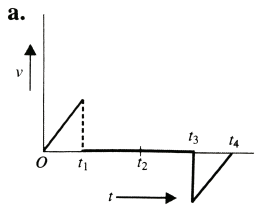
The velocity-time graph of the motion of the body will be .

A. 

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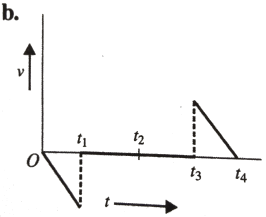
B. 

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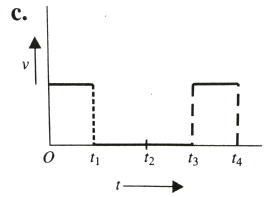
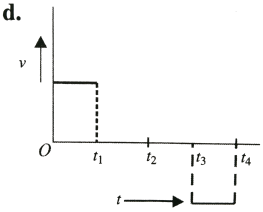
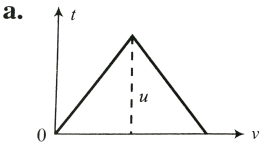
C. 

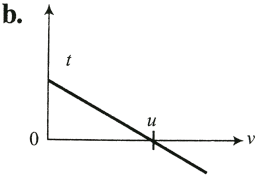
D. 

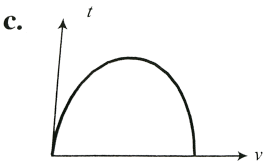
Answer: D

Watch Video Solution

8. An object thrown vertically. Thevelocity-time graph for the motion of the particle is .

A. 

B. 

C. 

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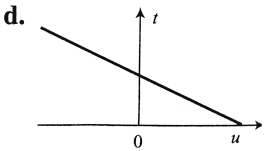
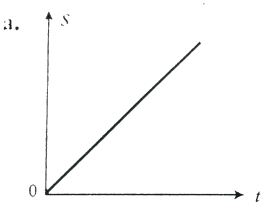
D. 

.

Answer: D

Watch Video Solution

9. From a high tower, at time $t = 0$, one stone is dropped from rest and simultaneously another stone is projected vertically up with an initial velocity .The graph of distance S between the two stones plotted against time t will be

A. 

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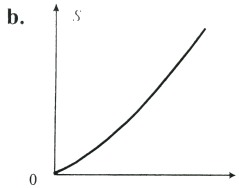
B. b. 

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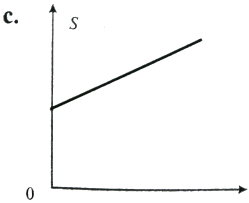
C. c. 

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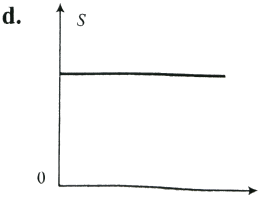
D. d. 

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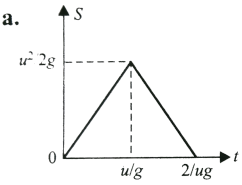
Answer: A

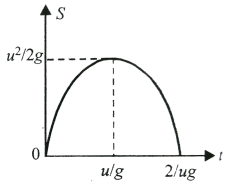
Watch Video Solution

10. An object is verically thrown upwards. The the dislacement-time graph for the motion is as shown in .

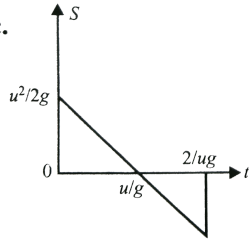
A. a.



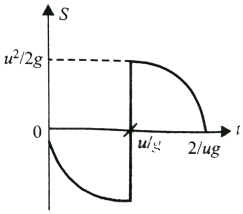
B. b.



C. c.



D. d.



Answer: B

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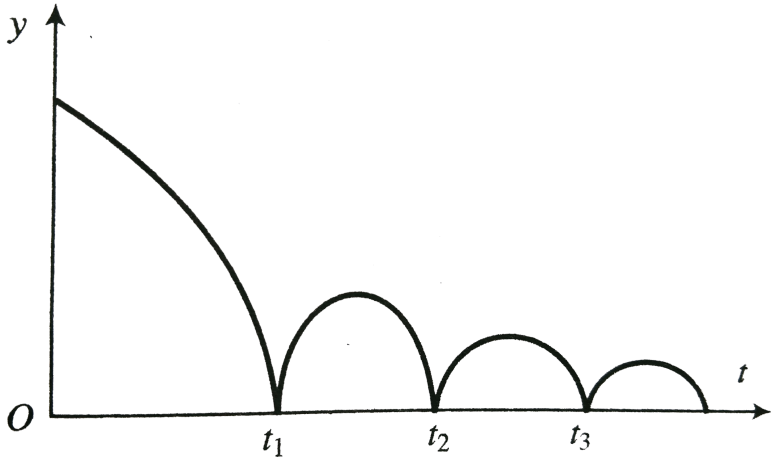
11. The graph as shown in. below descrines the motion of a ball rebounding from a horizontal surface being released from a point above the surface. Assume that the ball colledes each time with the floor inelastically. The quantity represented on the y-axis in the is the ball`s (take upward direction as positive)



A. Displacement

B. Velocity

C. Acceleration

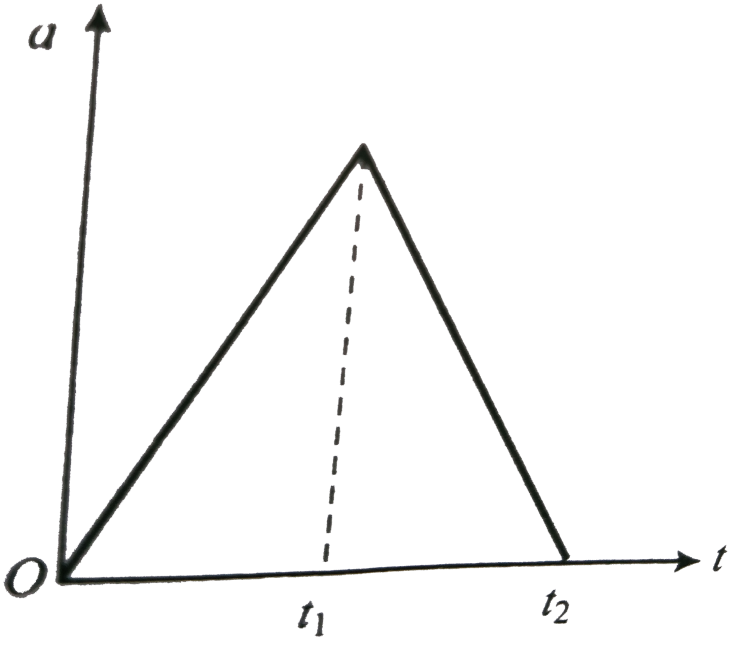
D. Momentum

Answer: A

Watch Video Solution

12. The acceleration versus time graph of a particle is shown in the figure.

The respective $v - t$ graph of the particle is .



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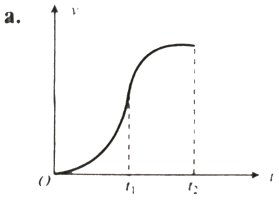
A. 

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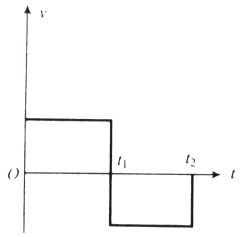
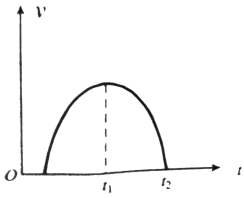
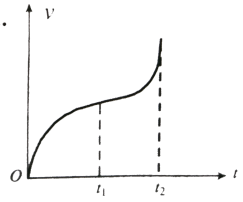
B. b.



C. c.



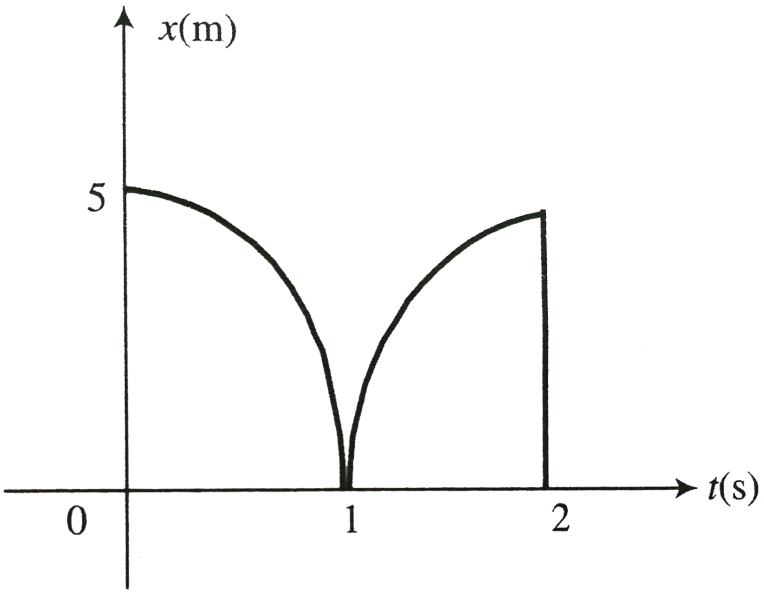
D. d.



Answer: A

Watch Video Solution

13. The displacement-time graph of a moving particle with constant acceleration is shown in. The velocity-time is given by



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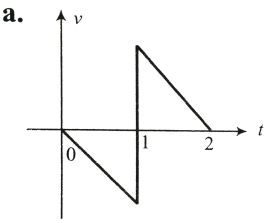
A.



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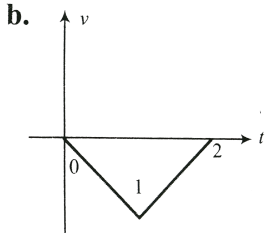
B.



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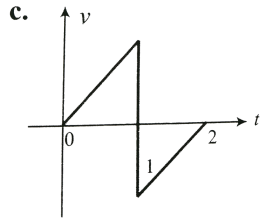
C.



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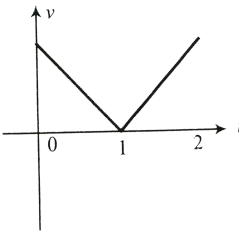
d.



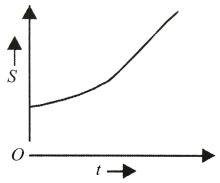
D. .

Answer: A

Watch Video Solution

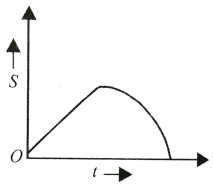
14. Two balls are dropped from the top of a hight tower with a time interval of t_0. Second , where t_0 is smaller than the time taken by the first ball to reach the ground which is perfectly inelastic. The distance S between the two balls plotted against the time lapse t from the instant of dropping the second ball, is best tepresented by.

a.



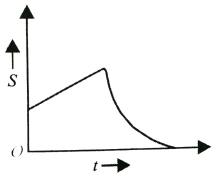
A. .

B. b.



.

C. c.



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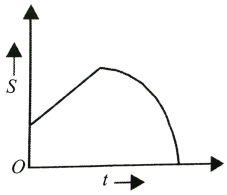
D. d.

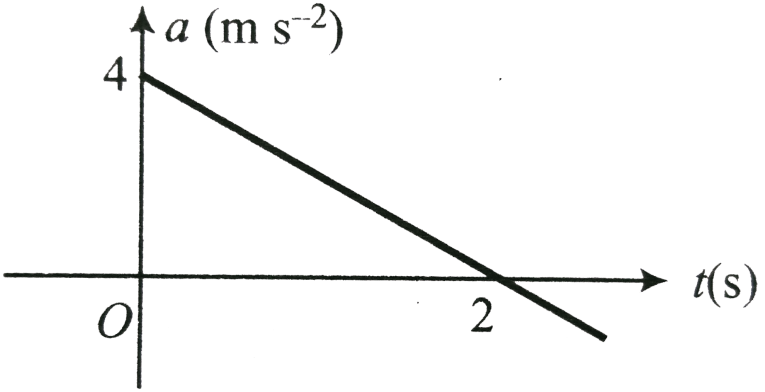


.

Answer: D

Watch Video Solution

15. The acceleration versus time graph of a particle moving in a straight line is show in figure. The velocity-time graph of the particle would be



A. A straight line

B. A parabola

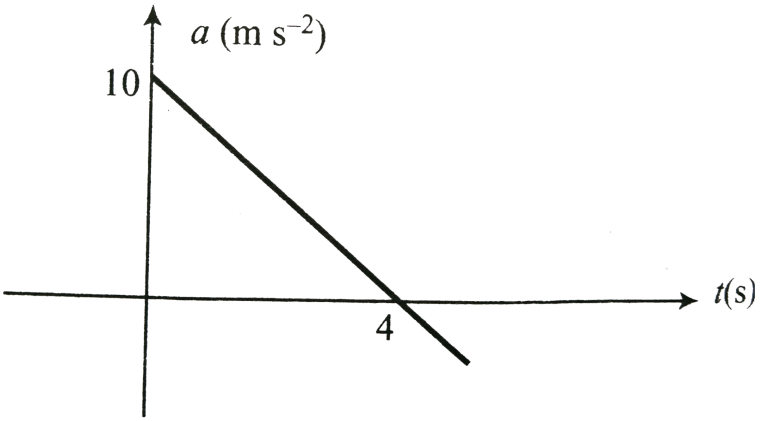
C. A circle

D. An ellipse

Answer: B

Watch Video Solution

16. The acceleration-time graph of a particle moving along a straight line is as shown in. At what time the particle acquires its initial velocity?



A. $12s$

B. $5s$

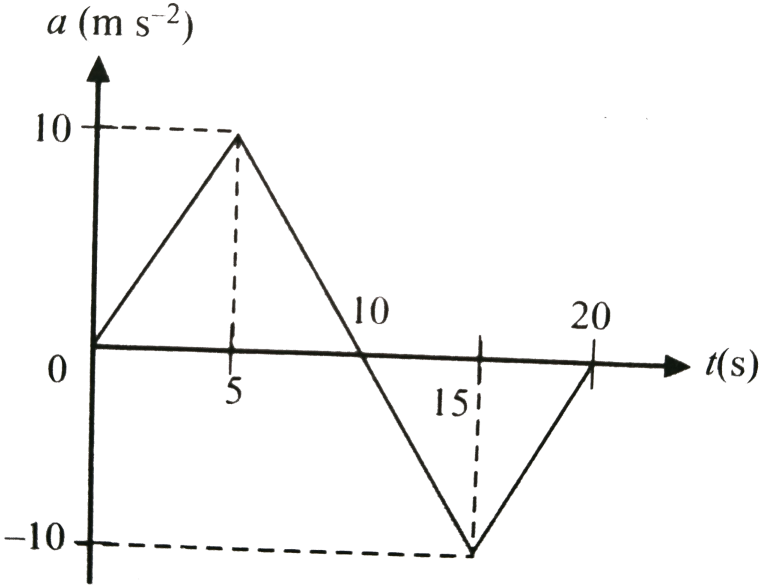
C. $8s$

D. $16s$

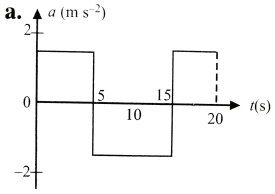
Answer: C

Watch Video Solution

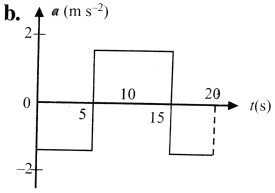
17. Plot the acceleration-time graph of the welocity-time graph given in.



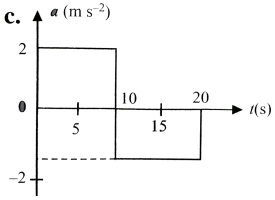
A.

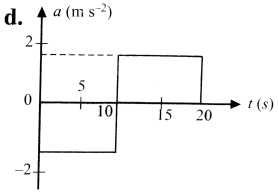


B.



C.



D. 

.

Answer: A

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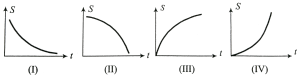
Graphical cancept

1. The acceleration will be positive in .



A. (I) and (III)

B. (I) and (IV)

C. (II) and (IV)

D. None of these

Answer: B

View Text Solution

Multiple Correct

1. Cleck up the incorrect statements in the following :

A. A body having a constant velocty still can have varying speed.

B. A body having a constant speed can have varying velocity.

C. A body having constant speed can have an acceleration.

D. If body having accleration are in the same direction, then distance is equal to displacement.

Answer: A

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2. A block slides down a smooth inclined placne when released from the top, while another falls freely from the same point. Which of the following is/are correct ?

A. Sliding block will reach the ground first

B. Freely falling block will reach the ground first.

C. Both the blocks will reach the ground with different speeds

D. Both the block will reach the ground with same speed .

Answer: B::D

Watch Video Solution

3. A car accelerates from rest at a constant rate of $2ms^{-2}$ for some time. The it retatds at a constant rate of $4ms^{-2}$ and comes to rest. It remains in motion for $6s$.

A. Its maximum speed is $8ms^{-1}$

B. Its maximum speed is $6ms^{-1}$

C. It travelled a total distance of $24m$

D. It travelled a total distance of $18m$

Answer: A::C

Watch Video Solution

4. At $t = 0$, an arrow is fired vertically upwards with a speed of $100ms^{-1}$. A second arrow is fired vertically upwads with the same speed at $t = 5s$. Then .

A. The two arrows will be at the same height above the $t = 20s$,

B. The two arrows will reach back their starting points at $t = 20s$ and at $t = 25s$.

C. The ratio of the speeds of the first and second arrow at$t = 20s$ will be $2:1$.

D. The maximum height attained by either arrow will be $1000m$,

Answer: A::B::C

Watch Video Solution

5. Two bodies of masses (m_1) and (m_2) are droppded from heiths h_1 and h_2, respectively. They reach the ground after time t_1 and t_2 and strike the ground with v_1 and v_2, respectively Choose the correct relations from the following.

A. $\frac{t_1}{t_2} = \sqrt{\frac{h_1}{h_2}}$

B. $\frac{t_1}{t_2} = \sqrt{\frac{h_2}{h_1}}$

C. $\frac{v_1}{v_2} = \sqrt{\frac{h_1}{h_2}}$

D. $\frac{v_1}{v_2} = \frac{h_2}{h_1}$

Answer: A::C

Watch Video Solution

6. 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 verticall down with the same speed. Then .

A. Both A and B will reach the ground simultaneously

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

C. Both the balls will ground with same velocity.

D. Both the balls will hit the ground with different velocity.

Answer: A::C

Watch Video Solution

7. A body starts from rest and then moves with uniform acceleration. Then.

A. Its displacement is directly proportional to square of time

B. Its displacement is inversely proportion to the square of the time.

C. It may move along a circle.

D. It always moves in a straight line.

Answer: A::D

Watch Video Solution

8. Which of the following statements is/are correct ?

A. If the velcity of a body changes, it must have some acceleration.

B. If the speed of a body change, it must have some acceleration.

C. If the body has acceleration, its speed must change.

D. If the body has acceleration. Its speed may change.

Answer: A::B::D

Watch Video Solution

9. The body will speed up if .

A. Velocity and acceleration are in the same direction.

B. Velocity and acceleration are in opposite directions.

C. Velocity and acceleration are in perpendicular direction.

D. Velocity and acceleration are acting at acute angle w.r.t. each other.

Answer: A::D

Watch Video Solution

10. Average acceleration is in the direction of .

A. Initial velocity

B. Findl velocity

C. Change in velocity

D. Final velocity if initial velcotu is zero.

Answer: C::D

Watch Video Solution

11. A particle is projected vertically upward with velocity u from a point A, when it returns to the point of projection .

A. Its average speed is $u/2$.

B. Its average velocity is zero.

C. Its displacement is zero.

D. Its average speed is u.

Answer: A::B::C

Watch Video Solution

12. A particle moves along a straight line its velocity dipends on time as $v = 4t - t^2$. Then for first $5s$:

A. Average velcotu is $25/3ms^{-1}$

B. Average speed is $10ms^{-1}$.

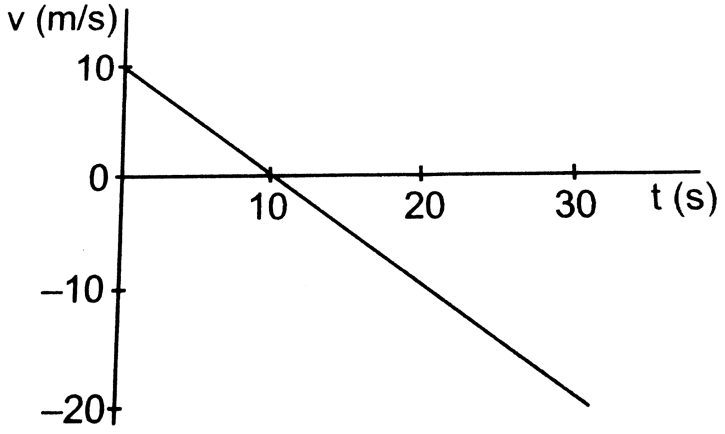
C. Average velcotu is $5/3ms^{-1}$

D. Acceleration is $4ms^{-2}$ at $t = o$

Answer: C::D

Watch Video Solution

13. The velocity time plot for a particle moving on straight line is shown in the figure.



A. The particle has a constant acceleration..

B. Theparticle has vever turned around.

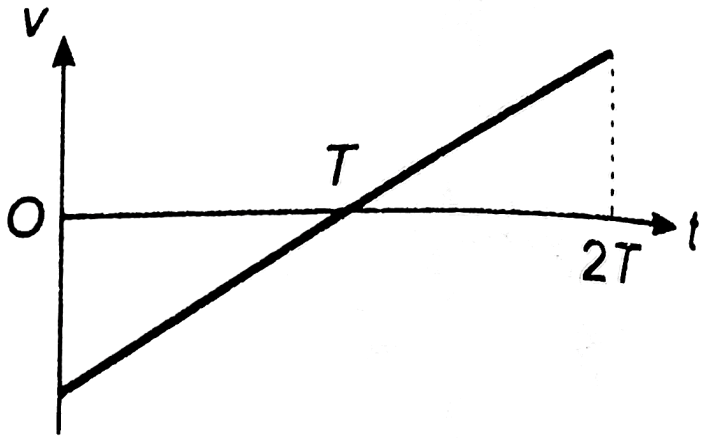
C. The particle has zero displacement .

D. The average speed in the interval $0$to $10s$ is the same as the average speed in the interval $10s \to 20s$.

Answer: A::D

Watch Video Solution

14. The figure shows the velocity (v) of a particle plotted against time (t).



A. The particle changes its direction of motion at some point.

B. The displacement of the particle remains constant.

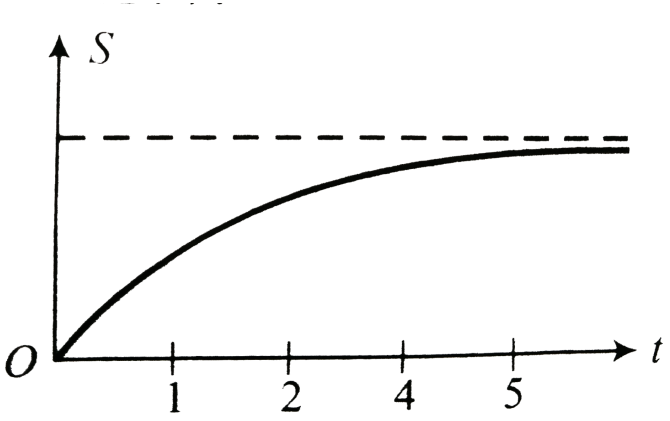
C. The displacement of the particle is zero.

D. The initial and dinal speeds of the particle are the same.

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

Watch Video Solution

15. The displacement of a particle as a function of time is shown in . It indicates



A. ainvelocity, but the motion is retarded and finally the particle stops.

B. The velocity of the particle dereases.

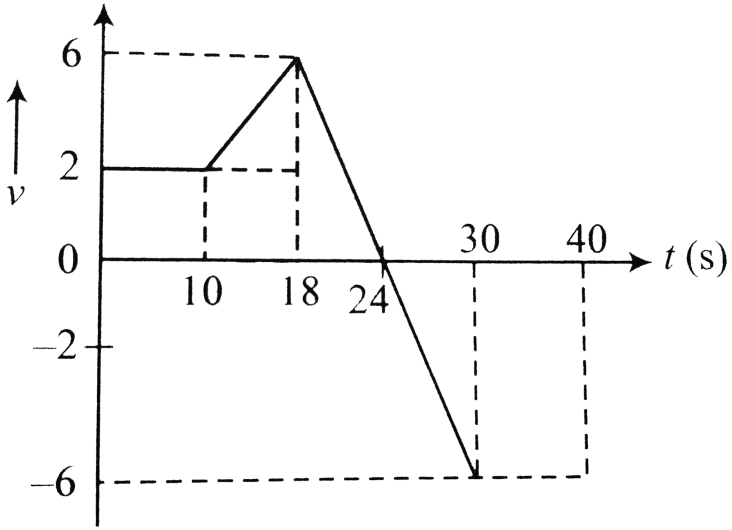
C. The accleration of the particle is in opposits direction to the velocty.

D. The particle stares with a constant velocity, the motion is accelerated and finaly pparticle moves with another constant velocity.

Answer: A::B::C

Watch Video Solution

16. A particle moves in a straight line with the velcity as shown in. At $t = 0, x = 16m,$



A. The maximum value of theposition coordinate of the particle is $54m$

.

B. The maximum value of theposition coordinate of the particle is $36m$

.

C. The particle is at the position of $36m$ at $t = 18s$.

D. The particle is at the position of $36m$ at $t = 30$s.

Answer: A::C::D

Watch Video Solution

Assertion-reasoning

1. Statement I: The displacement of a body may be zero, though its distance can be finite.

Statement II: If the bodt moves such that finally it arrives at the initial point, then displacement is zero while distance is finite.

A. Statement I is true, Statement II is true, Statement II is a correct explanation for Statement I.

B. Statemnt I is true, Statement II is true, Statement II is true, Statement II is false.

C. Statement I is true, Statement II is false.

D. Statement I is false, Statement II is true.

Answer: A

Watch Video Solution

2. Statement I: Distance and displacement are different physical quantities.

Statement II : Distance and displacement have same dismension.

A. Statement I is true, Statement II is true, Statement II is a correct explanation for Statement I.

B. Statemnt I is true, Statement II is true, Statement II is true, Statement II is false.

C. Statement I is true, Statement II is false.

D. Statement I is false, Statement II is true.

Answer: B

Watch Video Solution

3. Statement I: The average velocity of the body may be equal to its instantaneous velocity.

Statement II: For a given time interval of a given motion, average veocity is single valued while average speed can have many values.

A. Statement I is true, Statement II is true, Statement II is a correct explanation for Statement I.

B. Statemnt I is true, Statement II is true, Statement II is true, Statement II is false.

C. Statement I is true, Statement II is false.

D. Statement I is false, Statement II is true.

Answer: C

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4. Statement I: A body can have acceleration even if its velcity is zero at a given instant .

Statement II: A body is momentarily at rest when it reverses its direction of velocity.

A. Statement I is true, Statement II is true, Statement II is a correct explanation for Statement I.

B. Statemnt I is true, Statement II is true, Statement II is true, Statement II is false.

C. Statement I is true, Statement II is false.

D. Statement I is false, Statement II is true.

Answer: A

Watch Video Solution

5. Statement I: An object can possess acceleration even at a time when it has uniform speed

statement II: It is possible when the direction of momtion keeps changing.

A. Statement I is true, Statement II is true, Statement II is a correct explanation for Statement I.

B. Statemnt I is true, Statement II is true, Statement II is true, Statement II is false.

C. Statement I is true, Statement II is false.

D. Statement I is false, Statement II is true.

Answer: A

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Linked Comprehension

1. The dispacement of a body is given by $4s = M + 2Nt^4$, where M and N are constants.

The velocity of the body at any instant is .

A. $\frac{M + 2Nt^4}{4}$

B. $2N$

C. $\frac{M + 2N}{4}$

D. $2Nt^3$

Answer: D

Watch Video Solution

2. The dispacement of a body is given by $4s = M + 2Nt^4$, where M and N are constants.

The velocity of the body at the end of $1s$ from the start is .

A. $2N$

B. $\frac{M + 2N}{4}$

C. $2(M_N)$

D. $\frac{2M + N}{4}$

Answer: A

Watch Video Solution

3. A body is dropped from the top of the tower and falls freely.

The distance coverd by it after n seconds is derctlyproportional to .

A. n^2

B. n

C. $2n - 1$

D. $2n^2 - 1$

Answer: A

Watch Video Solution

4. A body is dropped from the top of the tower and falls freely.

The distance coverd in the nth second is proportilnal to .

A. n^2

B. n

C. $2n - 1$

D. $2n^2 - 1$

Answer: C

Watch Video Solution

5. A body is dropped from the top of the tower and falls freely.

The velocity of the body after n seconds is proportional to .

A. n^2

B. n

C. $2n - 1$

D. $2n^2 - 1$

Answer: B

Watch Video Solution

6. A car accelerates from rest at a constant rate α for some time, after which it decelerates at a constant rate β, to come to rest. If the total time elapsed is t seconds. Then evalute (a) the maximum velocity reached and (b) the total distance travelled.

A. $\frac{alph\beta}{2(\alpha+\beta)}t$

B. (alpha beta)/(alpha+beta) t`

C. $\frac{2alph\beta}{alph+\beta}t$

D. $\frac{4\alpha\beta}{\alpha+\beta}t$

Answer: B

Watch Video Solution

7. A car accelerates from rest at a constant rate α for some time, after which it decelerates at a constant rate β, to come to rest. If the total time elapsed is t seconds. Then evalute (a) the maximum velocity reached and (b) the total distance travelled.

A. $\frac{\alpha\beta t^2}{4(\alpha+\beta)}$

B. $\frac{\alpha\beta t^2}{2(\alpha+\beta)}$

C. $\frac{\alpha\beta t^2}{\alpha+\beta}$

D. $\frac{4\alpha\beta t^2}{\alpha+\beta}$

Answer: B

Watch Video Solution

8. A body is moving with uniform velocity of $8ms^{-1}$. When the body just crossed another body, the second one starts and moves with uniform acceleration of $4ms^{-2}$. The time after which two bodies meet will be :

A. $2s$

B. $4s$

C. $6s$

D. $8s$

Answer: B

Watch Video Solution

9. A body is moving with uniform velocity of $8ms^{-1}$. When the body just crosses another body, the second one starts and moves with uniform acceleration of $4ms^{-2}$.

The distance comered by the second body when they meet is .

A. $8m$

B. $16m$

C. $24m$

D. $32m$

Answer: D

Watch Video Solution

10. A body is allowed to fall from a height of $10m$. If the time taken for the first $50m$ is t_1 and for the remaining $50s$,is t_2.

Which is correct?

A. $t_1 = t_2$

B. $t_1 \leq t_2$

C. $t_1 < t_2$

D. $t_1 . t_2$

Answer: B

Watch Video Solution

11. A body is allowed to fall from a height of $10m$. If the time taken for the first $50m$ is t_1 and for the remaining $50s$,is t_2.

The ratio t_1 and t_2. Is nearly .

A. $5:2$

B. $3:1$

C. $3:2$

D. $5:3$

Answer: A

Watch Video Solution

12. A body is allowed to fall from a height of $10m$. If the time taken for the first $50m$ is t_1 and for the remaining $50s$,is t_2.

The ratio of time to reach the ground and to reach first half of the distance is .

A. $\sqrt{3}:1$

B. $\sqrt{2}:1$

C. $5:2$

D. $1:\sqrt{3}$

Answer: B

Watch Video Solution

13. A body is dropped from a balloon moving up with a velocity of $4ms^{-2}$ when the balloon is at a height of $12.5m$ from the ground.

The height of the body after $5s$ from the ground is $\left(g = 9.8ms^{-2}\right)$.

A. $8m$

B. $12m$

C. $18m$

D. $24m$

Answer: C

Watch Video Solution

14. A body is dropped from a balloon meving up wigh a velocity of $4ms^{-2}$ when the balloon is at a height of 12.5 m from the ground.

The distance of separation between of separation between the body and the balloon after 5 is.

A. $122.5m$

B. $100.5m$

C. $132.5m$

D. $112.5m$

Answer: A

Watch Video Solution

15. A bus starts moving with acceleration $2ms^{-2}$. A cyclist $96m$ behind the bus starts simultaneously towards the bus at a constant speed of $20m/s$. After what time will he be able to overtake the bus ?

A. $4s$

B. $8s$

C. $12s$

D. $16s$

Answer: B

Watch Video Solution

16. A bus starts moving with acceleration $2ms^{-2}$. A cyclist $96m$ behind the nus starts simultaneously towards the bus at a constant speed of $20ms^{-1}$

After some time the bus will be left behind. If bus continues moving with the same acceelration, after what time from the begining, the bus will overtake the cyclist ?

A. $10s$

B. $12s$

C. $14s$

D. $16s$

Answer: B

Watch Video Solution

17. A car is moving towards south with a speed of $20ms^{-1}$. A motorcycst is moving towards east with a speed of $15ms^{-1}$. At a crttain instant, the motorcyclistis due south of the car and is at a distance of $50m$from the car.

The shortest distance between the motorcyclist and the car is.

A. $20m$

B. $10m$

C. $40m$

D. $30m$

Answer: d

Watch Video Solution

18. A car is moving towards south with a speed of $20ms^{-1}$. A motorcycst is moving towards east with a speed of $15s^{-1}$. At a certtain instant, the motorcyclistis due south of the car and is at a distance of $50m$ from the car.

The time after which they are closest to each other.

A. $1/3s$

B. b. 8//3 s`

C. $1/5s$

D. $8/5s$

Answer: d

Watch Video Solution

19. Two particles A and B are initially $40m$ apart, A is behind B. Particle A is moving with uniform velocity of $10ms^{-1}$ toward B. Particle B starts moving away from A with constant acceleration of $2ms^{-1}$.

The time which there is a minimum distance between the two is .

A. $2s$

B. $4s$

C. $5s$

D. $6s$

Answer: C

Watch Video Solution

20. Two particles A and B are initially $40m$apart, A is behind B. Particle A is moving with uniform velocity of $10ms^{-1}$ towared B. Particle B starts moving away from A with constant acceleration of $2ms^{-1}$.

The minimum distance between the two is .

A. $20m$

B. $15m$

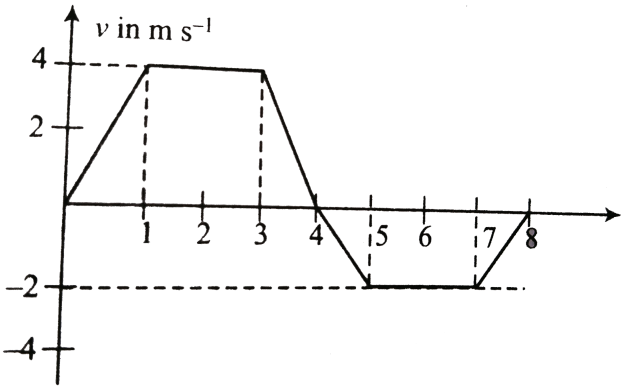
C. $25m$

D. $30m$

Answer: b

Watch Video Solution

21. The velocity-time graph of a particle in straight line motion is velocity-time graph of a particle in straight line motion is shown in. The particle starts its motion from origin.



The distance of the particle from the origin after $8s$ is .

A. $18m$

B. $16m$

C. $8m$

D. $6m$

Answer: A

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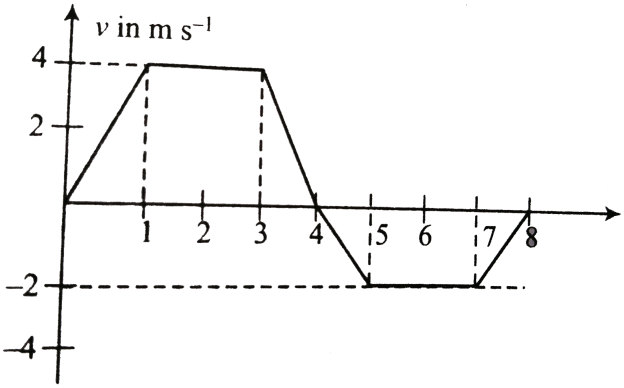
22. The velocity-time graph of a particle in straight line motion is veloity-time graph of a particle in straight line motion is shown in. The particle

starts its motion from origin.



The distance of the particle from the origin after $8s$ is .

A. $18m$

B. $16m$

C. $8m$

D. $6m$

Answer: d

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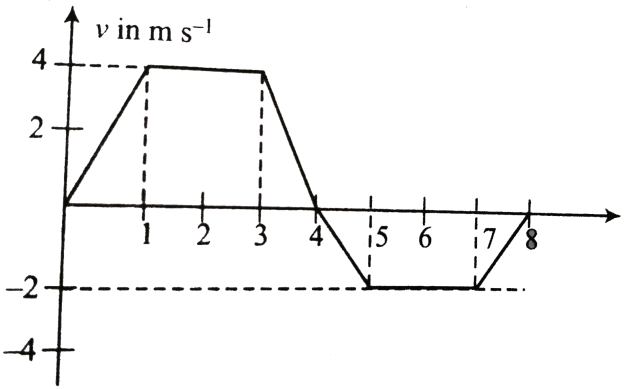
23. The velocity-time graph of a particle in straight line motion is veloity-time graph of a particle in straight line motion is shown in. The particle starts its motion from origin.



Find the average acceleration from $2s$ to $6s$.

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

B. $-3/2ms^{-2}$

C. $2ms^{-2}$

D. $3/2ms^{-2}$

Answer: B

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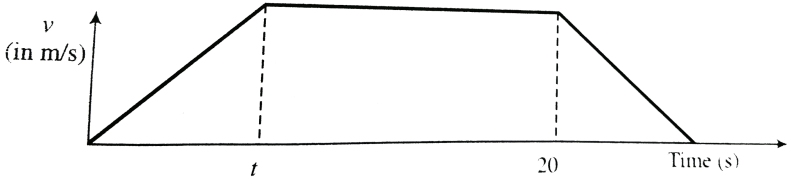
24. The velocity-time graph of a particle moving along a straight line is shown is . The rate of acceleration and deceleration is constant and it is equal to $5ms^{-2}$. If the a average velocity during the motion is $20ms^{-1}$,

Then 

.

The value of t is.

A. $5s$

B. $10s$

C. $20s$

D. $5\sqrt{2}s$

Answer: a

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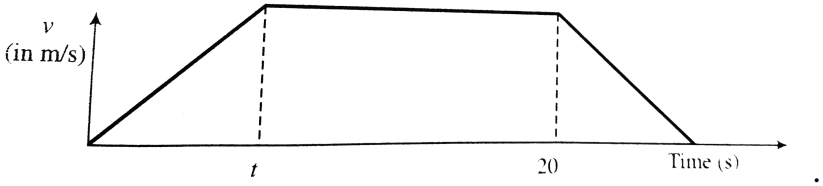
25. The velocity-time graph of a particle moving along a straight line is shown is Fig. The rate of acceleration and deceleration is constant and it is equal to $5ms^{-2}$. If the a average velocity during the motion is $20ms^{-1}$, Then



The maximum velocity of the particle is

A. $20ms^{-1}$

B. $25ms^{-1}$

C. $30ms^{-1}$

D. $40ms^{-1}$

Answer: B

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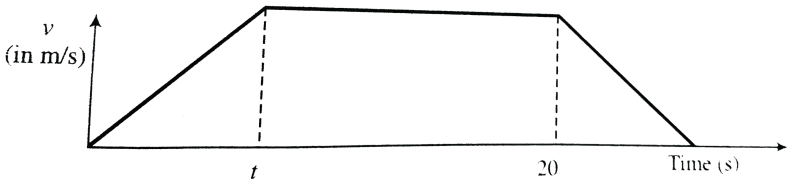
26. The velocity-time graph of a particle moving along a straight line is shown is Fing. The rate of acceleration and deceleration is constant and it is equal to $5ms^{-2}$. If the a average velocity during the motion is $20ms^{-1}$,

Then 

.

The distace travelled with uniform velcoty is .

A. `375 m

B. $125m$

C. $300m$

D. $450m$

Answer: a

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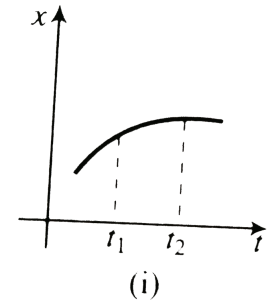
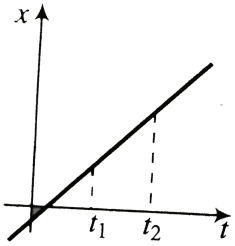
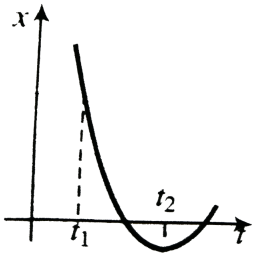
27. Sundy the four graphs given below. Answer the follwing questions on the basis of these graphs.



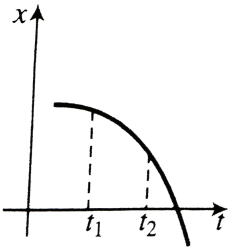
(i)



(ii)



(iii)



(iv)

In which of the graghs, the particle has more magnitude of velocity at t_2,

A. (i), (ii) and (iv)

B. (i) and (iii)

C. (ii) and (iii)

D. None of the above

Answer: b

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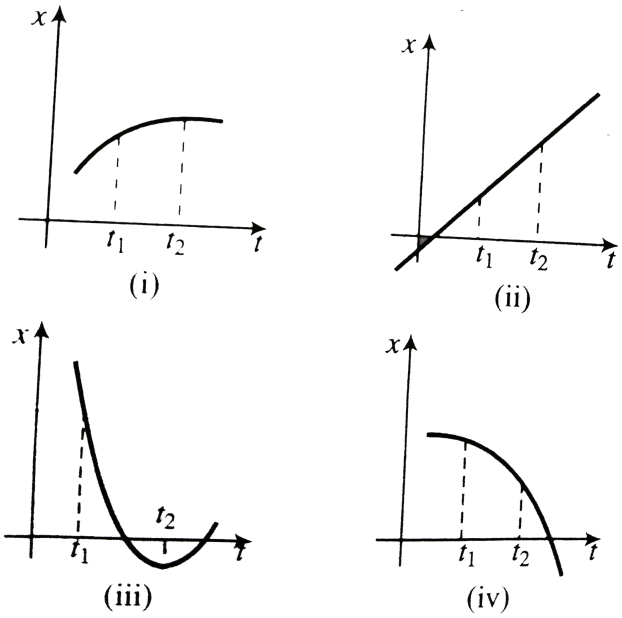
28. Sundy the four graphs given below. Answer the follwing questions on the basis of these graphs.



Acceleration of the particle is positive.

A. In graph (i)

B. In graph (ii)

C. In graph (iii)

D. In graph (iv)

Answer: c

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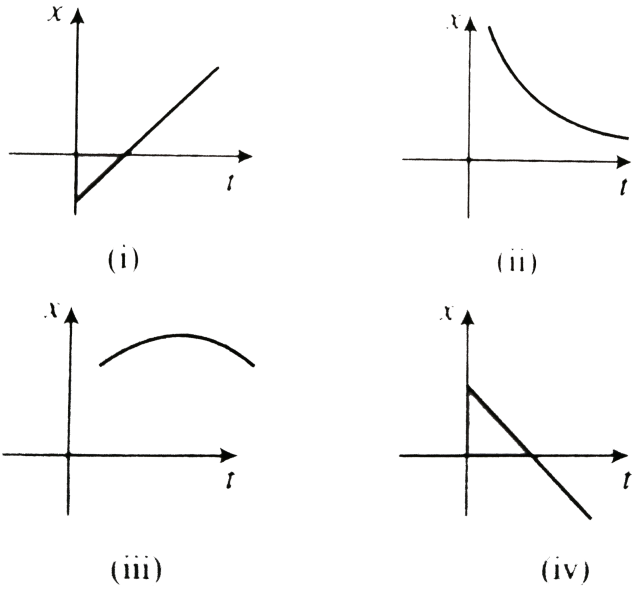
29. Study the following graph:



The particle is moving with constant speed .

A. In graph (i) and (iii)

B. In graph (i) and (iv)

C. In graph (i) and (ii)

D. In graph (i)

Answer: b

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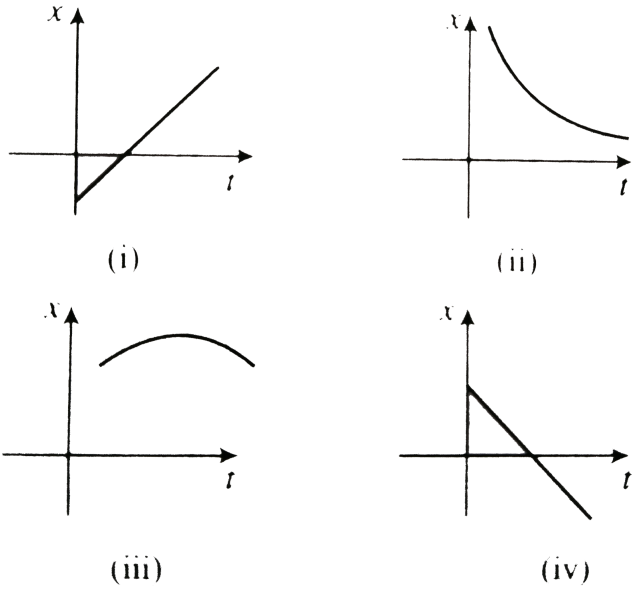
30. Study the following graph:



The particle has negative acceleration.

A. In graph (i)

B. In graph (ii)

C. In graph (iii)

D. In graph (iv)

Answer: c

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Integer

1. Form a lift moving upwards with a uniform acceleration $a = 2ms^{-2}, manthrousaballverticallyupwardswithavelcoityv=$ $12ms^{-1}$ relative to the lift. The ball comes back to the man after a time t. Find the value of t in seconds.

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2. A train starts from station A with uniform acceleration a_1. For some distance and then groes with uniform retardation a_2 for some more distance to come to rest at station B. The distance between stations A and B is $4km$ and the train takes $1/5h$ compete this journey. If accelerations are in km per mimute unit, then show that $\frac{1}{a_1}+\frac{1}{a_2}=x$. Find the value of x.

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3. In a car race, car A takes $4s$ less than can B at the finish and passes the finishing point with a velcity v more than the car B . Assumung that the cars start form restand travel with constant accleration $a_1=4ms^{-2}$ and $a_2=1ms^{-2}$ respectively, find the velocity of v in m s^{-1}.

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4. A cat, on seeing a rat at a distance $d=5m$, starts velocity $u=5ms^{-1}$ and moves with acceleration $\alpha=2.5ms^{-2}$ in order to catch it, while the

rate with acceleration β starts from rest. For what value of β will the overtake the rat?. (in ms^{-2}).

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5. A balloon reses rest on the ground with constant accleeration $1ms^{-2}$. A stone is dropped when balloon has risen to a height of $39.2m$. Find the time taken by the stone to teach the ground.

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6. A body is thrown up with a velocity $1000ms^{-1}$. It travels $5m$ in the last second of its journey. If the same body is thrown up with a velocity $200ms^{-1}$. How much distance (in metre) will it travel in the last second (g= 10 m s^(-2))?.

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7. In quick succession, a large number of balls are throun up vertically in such a way that the next ball is thrown up when the previous ball is at the maximum height. If the maximum height is $5m$, then find the mumber of the thrown up per second (g=10 m s^(-2)).

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8. A police is chasing a culprit going n a motorbike. The motorbike crosses a turning at a speed of 72 km/h.

The jeep follows it at a speed of 90 km/h, crossing the turning tenseconds later than the bike. Assuming that they travel at constant speeds, how far (in km) from the turning will the jeep catch up with the bike?

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9. On a two lane road, car A is travelling with a speed of $36kmh^{-1}$, Two cars B and C approach car A in opposite directions with a speed of

$54kmh^{-1}$. At a certain instant, when the distance AB is equal to AC, both 1 km B decided to overtake A before C does. What minimum acceleration of car B is required to avoid and accident?

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