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## PHYSICS

# BOOKS - DHANPAT RAI \& CO PHYSICS 

## (HINGLISH)

## MOTION IN ONE DIMENSION

## Example

1. A car travels from $A$ to $B$ at $20 \mathrm{kmh}^{-1}$ and
form B to A at $40 \mathrm{kmh}^{-1}$. Calculate the
average speed and average velocity of the car.

## D Watch Video Solution

2. A car travels first half distance between two
places with a speed of $60 \mathrm{kmh}^{-1}$. What should be its speed for rest half of the distance so that its average speed becomes $90 \mathrm{kmh}^{-1}$ ?

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3. A body covers one-third of its journey with speed ' $u$ ' , next third with speed ' $v$ ' and the last third with speed 'w'. Calculate the average speed of the body during the entire journey.

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4. A particle traversed on third of 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 a velocity $v_{2}$ for the
remaining half of time. Assuming motion to be rectilinear, find the the mean velocity of the particle averaged over the whole time of motion.

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5. A man walks on a straight road from his
home to a market 2.5 km away with a speed of
$5 \mathrm{~km} / \mathrm{h}$. Finding the market closed, he instantly turns and walks back with a speed of
$7.5 \mathrm{~km} / \mathrm{h}$. What is the (a) magnitude of
average velocity and (b) average speed of the man, over the interval of time (i) 0 to 30 min .
(ii) 0 to 50 min (iii) 0 to 40 min ?

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6. $A$ car (A) is moving at $60 \mathrm{kmh}^{-1}$ on a straight road, is ahead of car (B) moving in the same direction at $10 \mathrm{~ms}^{-1}$. Find the velocity of (A) relative to (B) and vice versa.
7. A jet airplance travelling at the speed of $500 \mathrm{~km}^{-1}$ ejects its products of combustion at the speed of $1500 \mathrm{kmh}^{-1}$ relative to the jet plane. What is the speed of the burnt gases with respect to observer on the ground ?

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


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9. A long belt is moving horizontally with a speed of $5 \mathrm{kmh}^{-1}$. A child runs on this belt to and fro with a speed of $9 \mathrm{~km} / \mathrm{h}$ (w.r.t. bett) between his father and mother located 50 m apart on the belt. For an observer on a
stationalry plateform outsied, what is the
(a) speed of the child runningin the derection of motion of the belt, (b) speed of thechaild pruning opposite to thedirection of the belt, and (c ) time taken by the child in cases (a) and
(b) ? Which of theanswers change, if motion is viewed by one of the parents ?gt

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10. Two parallel rail tracks run north-south

Train $A$ moves north with a speed of
$54 \mathrm{kmh}^{-1}$ and train $B$ moves south with a speed of $90 \mathrm{kmh}^{-1}$. What is the
a. relative velocity of $B$ with respect to $A$ ?
b. relative of a monkey running on the roof of the train $A$ against its motion (with its velocity of $18 \mathrm{kmh}^{1}$ with respect to the train $A$ ) as observed by a man standing on the ground?

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11. Two trains 120 m and 80 m in length are running in opposite directions with velocities
$42 \mathrm{kmh}^{-1}$ and $30 \mathrm{kmh}^{-1}$. In what time they will completely cross each other?

## D Watch Video Solution

12. Two cars are moving in the same direction
with the same speed $30 \mathrm{~km} / \mathrm{hr}$. They are separated by a distance of 5 km , the speed of a
car moving in the opposite direction of it
meets these two cars at an interval of 4 minutes, will be.

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13. 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 $20 \mathrm{kmh}^{-1}$ in the direction $A$ to $B$ notices that a bus goes past him every

18 min in the direction of his motion, and every 6 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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14. A boat covers certain distance between two
spots on a river taking 4 hours going downstream and 6 hours going upstream.

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

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16. A race car accelerates on a straight road from rest to a speed of $180 \mathrm{kmh}^{-1}$ in 25 s .

Assuming uniform acceleration of the car throughout, find the distance covered in this time.

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17. A car moving along a straight highway with speed of $16 \mathrm{kmh}^{-1}$ is brought to a stop within a distance of 200 m . What is the retardation of
the car (assumed uniform), and how long does
it take for the car to stop?

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18. An electron travelling with a speed of
$5 \times 10^{3} \mathrm{~ms}^{-1}$ passes through an electric field with an acceleration of $10^{12} \mathrm{~ms}^{-2}$. (i) How
long will it take for the electron to double its speed ?(ii) What will be the distance covered by the electron in this time?
19. A driver takes 0.20 s to apply the brakes after he sees a need for it. This is called the reaction time of the driver. If he ils driving a car at a speed of $54 \mathrm{~km} / \mathrm{h}$ and the brakes cause a deceleration of $6.0 \frac{\mathrm{~m}}{\mathrm{~s}^{2}}$, find the distance travelled by the car after he sees the need to put the brakes on.

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20. A bullet travelling with a velocity of $16 \mathrm{~m} / \mathrm{s}$ penetrates a tree trunk and comes to rest in
0.4 m . Find the time taken during the retardation.

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21. Two trains $A$ and $B$ of length 400 m each are moving on two parallel tracks with a uniform speed of $72 \mathrm{kmh}^{-1}$
in the same direction with $A$ ahead of $B$.The
driver of $B$ decides to overtake $A$
and accelerates by $1 \mathrm{~m} / \mathrm{s}^{2}$.if after 50 s ,the guard of $B$ just passes the driver of $A$, what was the original distance between them?

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22. On a two lane road, car (A) is travelling with a speed of $36 \mathrm{kmh}^{-1}$. Tho car $B$ and $C$ approach car (A) in opposite directions with a speed of $54 \mathrm{kmh}^{-1}$ each. At a certain instant, when the distance ( $A B$ ) is equal to ( $A C$ ), both
being $1 k m,(B)$ decides $\rightarrow$ overtake A before
$C$ does, What minimum accelration of car (B)
is required to avoid and accident.

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23. On a foggy day two drivers spot each other
when they are just 80 meters apart. They are
travelling at $27 \mathrm{kmh}^{-1}$ and $60 \mathrm{kmh}^{-1}$, respectively. Both of them applied brakes retarding their cars at the rate of $5 m s^{-2}$

Determine whether they avoid collision or not.

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24. A hunderd metre sprinter increases her speed from rest uniformly at the rate of $1 \mathrm{~ms}^{-2}$ upto three quarters of the total run and covers the last quarter with uniform speed. How much time does she take to cover the first half and the second half of the run?

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25. A car starts from rest and accelerates
uniformly for $10 s$ to a velocity of $80 \mathrm{~ms}^{-1}$. It
then runs at a constant velocity and is finally brought to rest in $64 m$ with a constant retardation. The total distance covered by the car is $584 m$ Find the value of acceleration, retardation, and total time taken.
26. An athlete runs a distance of 1500 m in the following manner. (i) Starting from rest, he accelerates himself uniformly at $2 m s^{-2}$ till he covers a distance of 900 m . (ii) He , then runs the remaining distance of 600 m at the uniform speed developed. Calculate the time taken by the athlete to cover the two parts of the distance covered. Also find the time, when he is at the centre of the track.
27. A body starting from rest accelerates uniformly at the rate of $10 \mathrm{cms}^{-2}$ and retaeds uniformly at the rate of $20 \mathrm{cms}^{-2}$. Find the least time in which it can complete the journey of 5 km if the maximum velocity attained by the body is $72 k m h^{-1}$.

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28. A man is $\mathrm{I}=9 \mathrm{~m}$ behind the door of a train
when it starts moving with acceleration $a=$
$2 m / s^{2}$.The man runs at full speed. How far
does he have to run and after what time does
he get into the train ? What is his full speed?

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29. A body moving with uniform acceleration, covers a distance of 20 m in the $7^{\text {th }}$ second and $24 m$ in the $9^{\text {th }}$ second. How much shall it cover in $15^{\text {th }}$ second?
30. A body covers 12 m in 2 nd second and 20 m
in 4th second. How much distance will it cover in 4 seconds after the 5 th second ?

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31. Two busses $A$ and $B$ are at positions 50 m
and 100 m from the origin at time $\mathrm{t}=0$. They
start moving in the same direction
simultaneously wi8th uniform velocities of
$10 m s^{-1}$ and $5 m s^{-1}$. Determine the time and position at which A overtakes B.

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32. An object is moving along +ve $x$-axis with a uniform acceleration of $4 \mathrm{~ms}^{-2}$. At time $\mathrm{t}=0$, $\mathrm{x}=5 \mathrm{~m}$ and $v=3 m s^{-1}$.
(a) What will be the velocity and position of the object at time $\mathrm{t}=2 \mathrm{~s}$ ?

What will be the velocity and position of the object when it has a velocity of $5 m s^{-1}$ ?
33. A body is thrown vertically upwards with a velocity of $98 \mathrm{~ms}^{-1}$ Calculate (i) the maximum height reached (ii) the time taken to reach the highest point (iii) the velocity at a heighest of 196 m from the point of projection (iv) the velocity with which it returneds to the ground and (v) the time taken to reach the ground.

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34. A ball throuwn vertically upwards with a speed of $19.6 \mathrm{~ms}^{-1}$ from the top of a tower returns to the earth in 6 s . Find the height of the tower.

## D Watch Video Solution

35. A ball throuwn up is cautght by the thrower after 4s. How did it go and with what velocity was it thrown ? How far was it below the highest point 3 s after it was thrown?
36. A balloon is ascending at the rate of $9.8 \mathrm{~m} / \mathrm{s}$ and is 39.2 m above the ground when a package is dropped. (a) How long does the package take to reach the ground? (b) with what speed does it hit the ground ? $\left(g=9.8 m / s^{2}\right)$

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37. A food packet is released from a helicopter which is rising steadily at $2 \mathrm{~ms}^{-1}$, After two second (i) What is the velocity of the packet ?
(ii)How far is it below the helicopter?

Take $g=9.8 m s^{-2}$.

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38. A parrachutist bails out from an aeropane and after dropping through a distance of 40 m opens the parachute and decelerates at
$2 \mathrm{~ms}^{-2}$. If he reaches the ground with a speed of $2 \mathrm{~ms}^{-1}$, how lowg he in the air ? At what height did he bail out from the plane ?

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39. Two balls are thrown simultaneously, A
vetically upwards with a speed of $20 \mathrm{~ms}^{-1}$
from the ground, and $B$ vetically downwards from height of 40 m with the same speed and along the same line of motion. At what points do the two balls collide? Take $g=9.8 \mathrm{~ms}^{-2}$.
40. A stone falls from a cliff and travels 24.5 m in the last second before it reaches the ground at the foot of the cliff. Find the height of the cliff.

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

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42. A stone is dropped into a well $45 m$ deep.

The sound of the splash of the splash is heard
$3.13 s$ after the stone is dropped. Find the speed of sound in air. Take $g=10 m / s^{2}$.

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43. The acceleration due to gravity on a planet
is $1.96 \mathrm{~ms}^{-1}$. If it is safe to jump from a height
of 2 m on the earth, what will be the corresponding safe height on the planet?

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44. A boy standing on a stationary lift (open
from above ) throws a ball upwards with the maximum initial speed he can, equal to $49 \mathrm{~ms}^{-1}$. How much time does the ball take to
return to his hands ? If the lift starts moving up with a uniform speed of $5 m s^{-1}$ and the boy again throws the ball up with the maximum speed he can , how hoes the ball take to return to his hands ?

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45. A player throwsa a ball upwards with an initial speed of $29.4 m s^{-1}$.
(i) What is the direction of acceleration during the upwared motion of the ball?
(ii) What are the velocity and acceleration of the ball at the highest point of its motion?
(iii) Choose the $\mathrm{x}=0$ and $\mathrm{t}=0$ to be the location and time of the ball at its highest point, vertically downward direction to be the positive direction of X -axis, and give the signs of positive, velocity and acceleration of the ball during its upward, and downward motion.
(iv) To what height does the ball rise and after how long does the ball return to the player's hand?( Take $\mathrm{g}=9.8 \mathrm{~ms}^{-2}$, and neglect air resistance).
46. A stone is dropped from rest from a point 0.4 m above a window 0.5 m high. Find the time taken by the stone to pass against window.

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47. The displacement x of a particle varies with
time $t$ as
$x=4 t^{2}-15 t+25$

Find the position, velocity and acceleration of the particle at $t=0$. When will the velocity of the particle become zero? Can we call the motion of the particle as one with uniform acceleration ?

## D Watch Video Solution

48. The velocity of a paticle is given by the equation, $v=2 t^{2}+5 c m s^{-1}$. Find (i) the change in velocity of the velocity of the particle during the time interval between
$t_{1}=2 s \quad$ and $\quad t_{2}=4 s \quad$ (ii) the average acceleration during the same interval and (iii) the instantaneous acceleration at $t_{2}=4 \mathrm{~s}$.

## D Watch Video Solution

49. The distance $x$ of a particle moving in one
dimensions, under the action of a constant
force is related to time $t$ by the equation, $t=\sqrt{x}+3$, where x is in metres and t in seconds. Find the displacement of the particle when its velocity is zero.

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50. 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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51. Two straight lines drawn on the same velocity-time graph make angles $30^{\circ}$ and $60^{\circ}$ with time axis respectively, as shown in Fig.

Which line represents greater acceleration ?
What is the ratio of the two accelerations ?
(

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52. A woman starts from her home at 9.00 a.
m., walks with a speed of $5 k m h^{-1}$ on straight
road up to her office $2.5 k m$ away, stays at the office up to $5.00 p$. $m$., and returns home by an auto with a speed of $25 k m h^{-1}$. Plot the position-time graph of the woman taking home as origin.

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53. A drunkard walking in a narrow lane takes 5
steps forward and 3 steps backward, followed again by 5 steps forward and 3 steps backward, and so on. Each step is $1 m$ long and
requires 1s. Plot the x-t graph of his motion.

Determine graphically or otherwise how long
the drunkard takes to fall in a pit 9 m away from the start.


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54. Fig. 2 (b). 12 ` shows thae distance ( S ) -time (t) graphs of two trains, which start moving simultaneously in the same direetion. From the graphs, find:  (a) How much (B) is ahead of (A) when motion starts (b) What is the speed of (B) ? (c) What and where (A) will catch (B) ? \({ }^{`}\)
(d) What is the differnce in speeds of (A) and
(B) ? It

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55. Starting from rest a car moves with uniform acceleration and attains a velocity of
$72 k m h^{-1}$ in 15 s . It then moves with uniform speed for 20 s and is then brought to rest in 10
$s$ undere uniform retardation. Find total distance travelled using velocity - time graph.

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56. A train starting from rest accelerates uniformly for 100 s, runs at a constant speed for 5 minutes and then comes to a stop with uniform retardation in next 150 seconds. During this motion, it covers a distance of 4.25 km. Find its (i) constant speed (ii) acceleration and (iii) retardation

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57. A train moves from one station to another in two hours time. Its speed during the motion is shown in the graph Calculate

(i) Maximum acceleration during the journey.
(ii) Distance covered during the time interval from 0.75 hour to 1 hour

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58. A three wheeler starts from rest, accelerates uniformly with $1 m s^{-2}$ on a straight road for $10 s$ and then moves with uniform velocity. Plot a graph between the distance covered by the vehicle during the nth second ( $n=1,2,3, \ldots . . . .$. ) versus ( $n$ ) What do you expect the plot to be during accelerated
motion: a straight line or a parabola ?


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59. A ball is throwm upword with an initial velcoity o f $100 \mathrm{~ms}^{-1}$. After how much time will
it retun ? Draw velcoity - time graph for the ball and find from the graph (i) the maximum
height attained by the ball and (ii) height of ball after 15 s. take $\mathrm{g}=10 \mathrm{~ms}^{-2}$.

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60. A ball is dropped from a height of a height of 90 m on a floor. At each collsion with the
floor, the ball loses one - tenth of its speed.

Plot the speed -time graph of its motion between t 0 to 12 s .

## D Watch Video Solution

61. Two stones are thrown up simultaneously
from the edge of a cliff 200 m high with initial
speeds of $15 \mathrm{~ms}^{-1}$ and $30 \mathrm{~ms}^{-1}$. Verify that the graph shown in Fig. 2 ( NCT). 13 , correctly represents the time variation of the relative position of the second stone with respect to
the first. Neglect the air resistance and assume that the stones do not rebound after hitting the ground. Take $g=10 m s^{-2}$. Give equations for the linear and curved parts of the plot.


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62. the velcoity - time graph for a vehicle is
shown if fig 3.24. drow acceleration - time graph from it .


## D Watch Video Solution

1. the velcoity -time relation of an electron starting from rest is given by $v=k t$,where $h=2 m s^{-2}$.calculate the distance traversed in 3 s .

## D Watch Video Solution

2. The relation between time $t$ and displacement x is $t=\alpha x^{2}+\beta x, \quad$ where $\alpha$ and $\beta$ are constants. The retardation is
3. The deceleration exerienced by a moving motor blat, after its engine is cut-off is given by $d v / d t=-k v^{3}$, 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.

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4. 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 $t_{1} \cdot t_{2}$, and $t_{3}$ Which of the following Relations is correct?.

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5. Two trains are headed towaads each other on the same straight rrach, each vaving a speed of $30 \mathrm{kmh}^{-1}$. A bird that can fly at $60 \mathrm{kmh}^{-1}$ flies off one train when they are 60 km apart and leads firectly form the otjer train, On reaching the other train, tg flies back to the first train and so on.
(a) How many trips can the bird make from one trin to the other train befre they meet ?
(b) What is the total distance the bird travels?

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6. In a car race, $A$ takes a time of $t \mathrm{~s}$, less than
car $B$ at the finish and passes the finishing
point with a velocity $v$ more than car $B$.
Assuming that the cars start 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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7. The driver of a train moving at a speed $v_{1}$ sights another train at a disane $d$, ahead of him moving in the same direction with a slower speed $v_{2}$. He applies the brakes and gives a constant teradation $a$ to his train. Show that here will be no collision if $d>\left(v_{1}-v_{2}\right)^{2} / 2 a$.
8. A particle is moving in a straight line with constant acceleration. If $x, y$ and $z$ be the distances described by a particle during the pth, qth and rth second respectively, prove that

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9. A car accelerates from rest at a constant
rate $\alpha$ for some time, after which it decelerates at a constant rate $\beta$, 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.

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10. the velcoity of a trian incrreases at a constant rate $\alpha$ from 0 to v and then remains constant for same interval and then finally decreases to zero at constant rate $\beta$.if the total distance coverd by the the particle $x$,then
show that the total time taken will be
$t \frac{x}{v}+\frac{v}{2}\left[\frac{1}{\alpha}+\frac{1}{\beta}\right]$.

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11. A left storing from rest assends with
constants acceleration 'a', then with a constant velcoity and finally stops under a constant retardation 'a'. If the total distance assended is ' $x$ ' and the total time taken is 't',show that the time during which the left is
assending with constant vlocity is
$\sqrt{t^{2}-\frac{4 x}{a}}$

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12. A body falling freely from a given height $H$
hits an inlclined plane in its path at a height $h$.

As a result of this impact the direction of the
velocity of the body becomes horizontal. For what value of $h / H$, the body will take the maximum time to reach the ground.
13. A rocket is fired vertically up from the ground with a resultant vertical acceleration of $10 \mathrm{~m} / \mathrm{s}^{2}$. The fuel is finished in 1 min and it continues to move up. (a) What is the maximum height reached? (b) Afte2r how much time from then will the maximum height be reached?(Take $g=10 \mathrm{~m} / \mathrm{s}^{2}$ )

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14. A body projected vertically upwords from
the top of a tower reaches the ground in $t_{1}$ second. If it projected vertically downwards
from the some top with same velocity ,it reaches the ground in $t_{2}$ seconds. If it is just dropped from the top it reaches the ground in t second .prove that $t=\sqrt{t_{1} t_{2}}$

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15. A particle is projected vertically upwards
from a point O on the ground. It takes time $t_{1}$ to reach a point $A$ at a height h above the ground, it continues to move and takes a time
$t_{2}$ to reach the ground. Find (a) $h$, (b) the maximum height reached and (c) the velocity of the partical at the half of maximum height.
16. water drops trickle out from a nozzle and
fall on the height 4.0 m below at regular intervals. When first drop reaches the floor, the fifth drop begins to fall. Find the positive of the drops, when a drop just strikes the floor.

17. A juggle maintains four balls in motion making each in turn rise to a height of 20 m
form his hand. With velcoity does he project them and where will the other three ball be at the instant when the fourth one is just leaving the hand ? Take $\mathrm{g}=10 \mathrm{~m}^{-2}$

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18. A metal ball is allowed to fall freely on a perfectly elastic plate from a height 3 to ,At $t=$

0 the speed of the ball is zero.

Diagrammatically repersent velocity with time specifying the proper unit on $X$ and $Y$ axes .

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19. A ball is dropped from a height of 19.6 m
above the ground. It rebounds from the ground and raises itself up to the same height. Take the starting point $s$ the origin and vertically downward as the positive X -axis.

Draw approximate plots of $x$ versus $t, v$ versus
t and a versus t . Neglect the small interval during which the ball was in contact with the ground.

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## Problems For Self Practice

1. A person moves on a semi - circular track of
radius radius 42 m during a morning walk. He
starts at one end of the track and reaches the
other end. Find the distance covered and the displacment of the person .

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2. A car covers the first half of the distance between two places at a speed of $40 \mathrm{kmh}^{-1}$ and the second half at $60 \mathrm{kmh}^{-1}$ the next 15 minutes,and then with a speed of $60 \mathrm{kmh}^{-1}$ .what is the average speed of the car?

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3. A train moves with a speed of $30 \mathrm{kmh}^{-1}$ in
the first 15 minutes,with another speed of
$40 \mathrm{kmh}^{-1}$ the next 15 minutes, and then with a speed of $60 \mathrm{kmh}^{-1}$ in the last 30 minutes.

Calculate the average speed of the train of train for this journey.

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4. A body describes the first half of the total
distance with velocity $v_{1}$ and the second half and velocity $v_{2}$. Calculate the average velocity.

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5. A body travels a distance $s_{1}$ with vleocity $v_{1}$ and distance $s_{2}$ with velocity $v_{2}$ in the with velocity $v_{2}$. Calculate the average velocity.

## - Watch Video Solution

6. A car covers $1 / 4$ of the total distance with velocity of $20 \mathrm{~ms}^{-1}$,next $1 / 4$ part with the velcoity of $40 \mathrm{~ms}^{-1}$. The $20 \mathrm{~ms}^{-1}$ and last $1 / 4$
part with the velocity of $40 \mathrm{~ms}^{-1}$. Find the averafe speed of the car.

## D Watch Video Solution

7. A car along a starigth line for the first half time with speed $50 \mathrm{kmh}^{-1}$ and the second
half time with speed $60 \mathrm{kmh}^{-1}$. Find the average speed of the car.
8. A train A moves with a unifrom velocity of
$60 \mathrm{kmh}^{-1}$ another train B moves in the same direation with a unifrom velocity of $80 \mathrm{~km}^{-1}$
(a) wghat is the relactive velocity of a with respect to $B$ ? (b) what is the relative velocity of $B$ with respect to $A$ ?

## D Watch Video Solution

9. two train $A$ and $B$ are moving on parallel tracks with velocities of $60 \mathrm{kmh}^{-1}$ and
$90 \mathrm{kmh}^{\wedge}(-1)^{\wedge}$ respectively but in oppiste directions. Find (i) the relative velocity of train A.w.r.t train $B$ and (ii) the relative velocity of ground w.r.t tain A.

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10. A jet airplane travelling at the speed of
$450 \mathrm{kmh}^{-1}$ ejects the burnt gases at the speed of $1200 \mathrm{kmh}^{-1}$ relative to the jet airplane.

Find the speed of the brunt gases w.r.t a stationary observer on earth .
11. two car A and B are moving with velocities
of $60 \mathrm{kmh}^{-1}$ and $45 \mathrm{kmh}^{-1}$ respectively.
Calculate the relative velocity of A w.r.t B if (i) both cars are travelling eastwards and (ii)car A is travelling eastwards and car $B$ is travelling westwards.

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12. an open car is moving on a road with a speed of $100 \mathrm{kmh}^{-1}$. A man sitting in the car
fires a bullet from the gun in the oppositve direction. If the spedd of the bullet is $250 \mathrm{kmh}^{-1}$ relative to the car.then find its
(bullt 's ) speed with respect to an observe on the ground.

## D Watch Video Solution

13. A car A is moving with is speed of
$60 \mathrm{kmh}^{-1}$ an car B is moving with a speed of
$75 \mathrm{kmh}^{-1}$,along parallel straight paths starting paths starting from the same point.

What is the position of car A w.r.t B after 20 minutes ?

## D Watch Video Solution

14. two trains $A$ and $B$,each of length 100 m, in
length are running in opposite driection on
parallel tracks with velocities
$40 \mathrm{kmh}^{-1}$ and $32 \mathrm{kmh}^{-1}$. In what time will they completely cross each other?

## D Watch Video Solution

15. two buses start simultaneoulsly towards
each othehr from towns $A$ and $B$ which are 480
km apart. The first bus taken 8 hours to travel
form A to B while the second bus takes 12
hours to travel from $B$ to $A$. determine when
and where the buses will meet.

## Watch Video Solution

16. Two trains, each of length 100 m , are running on parallel tracks. One overtakes the other in 20 sec ond and one crosses the other in 10 sec ond. Calculate the velocities of two trains.

## - Watch Video Solution

17. A man swins in a river with and against water at the rate of $15 \mathrm{kmh}^{-1}$ and $5 k m h^{-1}$.

Find the man's speed in still water and the speed of the river.

## D Watch Video Solution

18. A motrobaot covers the distance between
the two sport on the river is 8 h and 12 h downstream and upstream respecitvley. Find the time required by the boat to cover the distance in still water.

## D Watch Video Solution

19. two men can swin in still water at the rate of $5 \mathrm{kmh}^{-1}$. One of them swims downstream throgh a distance of 2 km and another swims upstream through an equal distance. Find the difference in time taken by them, if the velocity of the flow of river is $3 \mathrm{kmh}^{-1}$.

## D Watch Video Solution

20. A body starts to slide over a horizontal surface with an initial velocity of $0.5 \mathrm{kmh}^{-1}$ .due to friction, it velocity decreases at a rate
of $0.05 \mathrm{~ms}^{-2}$.how much time will it take for body to stop ?

## D Watch Video Solution

21. An electron is emittied with a veloctiy of
$5 \times 10^{6} \mathrm{~ms}^{-1}$. It is accelerated by an electric
field in the direction of initial velocity at
$3 \times 10^{14} m s^{-2}$. If its final velocity is
$7 \times 10^{6} \mathrm{~ms}^{-1}$ calculation the distance coverd by the electron.
22. A car moving along a stainght highway with a speed of $72 \mathrm{kmh}^{-1}$ is brought to a stop within a distance of 100 m . What is the retardation of the car and how long does it takes for the car to stop ?

## D Watch Video Solution

23. on turning a corner a car driving at $36 \mathrm{kmh}^{-1}$ finds a child on the road 55 m abead. He immediately applies brakes,so as to
stop within 5 m of the child. Calculate the retardation produced and the time taken by the car to stop .

## D Watch Video Solution

24. A car A is travelling on a straight level road with a uniform speed of $60 \mathrm{~km} / \mathrm{h}$. It is followed by another car B which in moving with a speed of $70 \mathrm{~km} / \mathrm{h}$. When the distance between then
is 2.5 km , the car $B$ is given a deceleration of
$20 \frac{k m}{h^{2}}$. After how much time will B catch up with A

## D Watch Video Solution

25. A bullet going with speed $350 \mathrm{~m} / \mathrm{s}$ enters
concrete wall and penetrates a distance of 5.0
cm before coming to rest. Find the deceleration.
A.
B.
C.

## D.

Answer: $1.22 \times 10^{6} \mathrm{~ms}^{-2}$

## D Watch Video Solution

26. the reaction time for an automobile drive
os 0.6 s if the automobile can be decelerated at
$5 m s^{-2}$, calculate the total distance travelled
in coming to stop fro, an intial velocity of $30 \mathrm{kmh}^{-1}$ after a singnal is observed.

## - Watch Video Solution

27. A racer cover a distance of 400 m as follows. He first increasese his speed of first quarter of the distance and covers this distance in 10 s . after that he runs at the speed so developed. Calculate the total time taken by the racer to cover the distacne .

## - Watch Video Solution

28. A car starts from rest and accelerates
uniformly for $10 s$ to a velocity of $80 \mathrm{~ms}^{-1}$. It
then runs at a constant velocity and is finally brought to rest in $64 m$ with a constant retardation. The total distance covered by the car is $584 m$ Find the value of acceleration, retardation, and total time taken.

## - Watch Video Solution

29. two tains one travelling at $72 \mathrm{kmh}^{-1}$ and other at $90 \mathrm{kmh}^{-1}$ are heading towards one another along a strauight level track. When
they are 1.0 km apart, both the drivers simultanously see the other 's train and apply brakes which restard each train at the rate of $1.0 \mathrm{~ms}^{-2}$. determine whether the trains would collide or not.

## Watch Video Solution

30. A burglar's car had a start with an acceleration of $2 m s^{-1}$. A police van came after 5 second and continued to chase the burglar's car with a uniform velocity of $20 \mathrm{~ms}^{-1}$. Find the time in which the police van overtakes the burglar's car .

## D Watch Video Solution

31. A ball rolls down an inclined track 2 m long

4s. Find (i) acceleration (ii) time taken to cover
the second metre of the track and (iii) speed of the vall at the bottom of the track.

## D View Text Solution

32. A drive of a mail train travelling $108 \mathrm{kmh}^{-1}$
sees a passenger train which is 250 m ahead on the same tarck. The passenger train is
travelling in the same direation as the mail train. The velocity of the passenger train is
$36^{-1}$.the driver of the mail train immediatly applies the brakes so as to produces a
constant deaceleration of $1 \mathrm{~ms}^{-2}$ wherease the passenger train continues with the constant speed (i) calculate and find wheater there will be a collision (ii) if the collision occcurs where will it take place?

## D View Text Solution

33. A bus starts from rest with a constant acceleration of $5 m s^{-1}$ overtakes andpasses
the bus. Find(i) at what distance will the bus
overtake the car ? (ii) how fast will the bus be travelling then ?

## D View Text Solution

34. A train starte from rest and moves with a constant acceleration of $2 m s^{-2}$ for half a minute. The brakes are then applied and the train comes to rest in one minute.find (i) the maximum speed attained by the train (ii) the total distance moves by the train and (ii) the
positions (s) of the train a half the maximum

## speed.

## D Watch Video Solution

35. A body covers 20 m in the 2 nd second and

40 m in the 4 th second of its motion. If its
moiton is uniformaly accelaerated, hwo much
distance will it cover in the 7 th second of its motion ?

D View Text Solution
36. A body travels a distance of 2 m in 2 seconds and 2.2 m next 4 secs. What will be the velocity of the body at the end of ' 7 th second from the start ?

## D Watch Video Solution

37. A body covers a distance of 4 m si 3 rd second and 12 m in 5 th second. If the motion $25 m s^{-1}$ and after 8 second ,it is uniformly accelerted ,how far will it travel in the next 3 second?

## - View Text Solution

38. An object is moving with a uniform acceleration. Its velocity after $5 s$ is $25 \mathrm{~ms}^{-1}$ and after $8 s$ is $34 m s^{-1}$ Find the distance travelled by the object in $10 t h$ second.

## - Watch Video Solution

39. A stone is thown vertically upwards with a
velocity of $4.9 \mathrm{~ms}^{-1}$. Calculate (i) the
maximum height reached (ii) the time taken to
reach the maximum height (iii) the velocity with which it returns to the ground and (iv) the time taken to reach the ground.

## - Watch Video Solution

40. A body is thrown vertically up from the top
fo atower with a velocity of $5 m s^{-1}$. It reaches
the gorund after 5 s . find the heigth of the tower

D View Text Solution
41. A ball thrown vertically up retruns to the thrower after 6 s . find the velocity with which it was thrown and its position after 4 s .

## D View Text Solution

42. A stone is thrown upwards from the top of tower 85 m high, reaches the ground in 5 s .
find (i) the greatest height it reaches above the ground (ii) the velocity with which it
reaches the ground and (iii) the time taken to reach the maximum height. Take $\mathrm{g}=10 \mathrm{~ms}^{-2}$ ?

## D Watch Video Solution

43. from the top of multi-storeyed building
,39.2 m tall , a boy projects a stone vertically upward with an initial velocity of $9.8 m s^{-1}$
such that it finally drops to the ground
when will the stone reach the ground? (ii) whn
will it pass through the point of projection ?
(iii) what will be its velocity before striking the ground ? take $\mathrm{g}=10 \mathrm{~ms}^{-2}$

## D Watch Video Solution

44. A rocket is fired vertically up from the ground with a resultant vertical acceleration of $10 \mathrm{~m} / \mathrm{s}^{2}$. The fuel is finished in 1 min and it continues to move up. (a) What is the maximum height reached? (b) Afte2r how much time from then will the maximum height be reached?(Take $g=10 \mathrm{~m} / \mathrm{s}^{2}$ )

## Watch Video Solution

45. A ballon is assconding at the rate of $14 \mathrm{~ms}^{-1}$ at a height of 98 m above the ground when velocity does it reach the ground ? Take $\mathrm{g} 9.8 m s^{-2}$.

## - Watch Video Solution

46. A stone is dropped from a ballon rising
upwards with a velocity of $16 m s^{-1}$. The stone
reached the ground in 4s. Calculate the height of the ballon when the stone was dropped.

## D Watch Video Solution

47. A stone is dropped from the top of a tower

200 m high. At the same time, another stone is
projected vertically upwards from the ground with a velocity of $40 \mathrm{~m} / \mathrm{s}$. Calcuate when and where the two stones will mest.

## D Watch Video Solution

48. A body is dropped from the top a towar

150 m , and sumultaneously, another body is dropped from rest from rest from a point 100 m above the gorund. What is their differnece in height after they have fallan (i) 2 s (ii) 3s.how does the difference in height vary with time ? take g $10 \mathrm{~ms}^{-2}$

## D View Text Solution

49. A body falling freely under gravity passes
two points 30 m apart in 1 s . find from what
point above the upper point it began to fall?
Take g $9.8^{-2}$

## D View Text Solution

50. A stone is dropped from the top of tall tower and one second later another stone is dropped from a balcany 20 m below the top. If both the stones reach the ground at the same instant, determine the height of the tower .take $g=10 m s^{-2}$
51. A parachutist after bailing out falls 50 m ,whitout friction. When the parachute opens he decelerates downwards at $2 m s^{-2}$. He reaches the ground with a speed of $3 m s^{-1}$.

How long was the parachustintist in air ? At wht height did he ball out ?

## D View Text Solution

52. A body falling freely from rest from the top of a tower describes 60.1 m in the last second
of its fall. Find the height of the tower.

## D View Text Solution

53. A stone is dropped from a balloon at an altitude of '300 m'. How ling will the stone take to reach the ground of (a) the balloon is ascending with a velocity of ' 5 ',ms^(-1). (b) the balloon is descending with a velocity of ' 5 $m s^{\wedge}(-1)^{\prime}(c)$ the balloon is stationary ?
54. four balls are dropped from the top of a tower at intervals of one - one secnod. The frist ball reaches the ground after 4 s of dropping. What are the distance between first and second , second and third, third and fourth balls at this instant?

## - View Text Solution

55. A particle moves along $X$-axis in such a way
that its coordinate X varies with time t
$x=\left(2-5 t+6 t^{2}\right) m$. The initial velocity of the particle is
A.
B.
C.
D.

Answer: - 5unit
( Watch Video Solution
56. The displacement of a particle along the $x$ axis is given by $x=3+8 t+7 t^{2}$. Obtain its velocity and acceleration at $t=2 s$.

## - Watch Video Solution

57. the distance traversed by a particle moving
along a stranigt line is given by
$x=180 t+50 t^{2}$ metre .find
the initial velcoity of the particle.
(ii) the acceleration of the particle .
58. 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

59. An insect crawling up a wall crawls 3 cm
upwords in the first minute but then slides
3 cm downwards in the next minute. It again
crawls up 5 cm upwards in the third mintue
but again slides 3 cm downwards in the fourth minute. How long will the insect take to reach
a carrives in the wall at a height of 25 cm from
its starting point ? how does thr position time graph of the insect look like ?
60. a driver of a car travelling at $52 \mathrm{~km} / \mathrm{h}$ applies the brakes and acceleration uniformly in the opposite direction. The car stops in $5 s$.

Another driver going at $34 \mathrm{~km} / \mathrm{h}$ in another car applies his brakes slowly and stops in $10 s$.

On the same graph paper, plot the speed versus time graphs for the two cars. Which of the two cars travelled farther after the brakes were applied ?

## D Watch Video Solution

61. starting form rest a cars moves with unifrom acceleration and attians a velocity of $20 \mathrm{~ms}^{-1}$ and 4 s . It then moves what a unifrom velocity of $20 \mathrm{~ms}^{-1}$ for 6 s . The brakes are applied and the car is brought to rest in

10s under unifrom retardation . Draw the velocity group for the motion. using theis graph , find (i) the acceleration of the car during the frist 4 s (ii) ua retardation during the last 10 s and (iii) the total distance traveled by the car .
62. fig 3.36 showns the velocity time graph of a rocket projeted upwards. Assuming the firction is neglibel a dtermine from this graph
(i) the time for which fuel bruns (ii) accending and descerding part of the rocket and maximum height atteined by the rocket .


## D View Text Solution

63. A motor car, starting from rest, moves with
uniform acceleration and attains a velocity of
$8 m s^{-1}$ in 8 s . It then move with uniform
velocity and finally brought to rest in 32 m
under uniform retardation. The total distance
covered by the car is 646 m . Find (i) the acceleration (ii) the retardation and (iii) the total time taken.
64. The velocity-time graph of an object moving along a straight line is as shown in Fig.
3.37. Find the net distance covered by the object in time interval between $\mathrm{t}=0$ to $\mathrm{t}=10 \mathrm{~s}$.

Also find the displacement in time 0 to 10 s .

65. As soon as a car just starts from rest in a certain direction, a scooter moving with a uniform speed overtake the car. Their velocitytime graphs are shown in Fig. 3.38. Calculate (i)
the difference between the distance travelled by the car and

the scooter in 15 s (ii) the time when the car
will catch up the scooter and (iii) the distance of car and scooter from the starting point at that instant.

## D Watch Video Solution

66. Fig. 3.39 shows the acceleration - time graph for a particle in rectilinear motion. Find
the average acceleration in first 20 s.

