Chapter 2. Motion in One Dimension

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Solution 1:
A body is said to be in state of rest if it does not change its position with respect to its surrounding objects with time.

Solution 2:
A vector quantity is that physical quantity which is represented by both magnitude and direction.

Solution 3:
No mass is not a vector quantity.

Solution 4:
A vector is represented by an arrow. The length of the arrow represents the magnitude of vector quantity and arrow head gives the direction of vector quantity.

Solution 5:
If a book is lying in almirah then it is at rest.

Solution 6:
A body is said to be in motion when it change its position with respect to its surrounding objects with time.

Solution 7:
Yes rest and motion are relative to each other.

Solution 8:
Out of Force and Energy, Force is a vector quantity.

Solution 9:
Examples of scalars are distance and mass.

Solution 10:
Out of these positions, (i) and (ii) positions of body lie on same straight line as direction of these two are same.

Solution 11:
A vector quantity is represented only when its magnitude and direction are specified so this quantity is a vector quantity.

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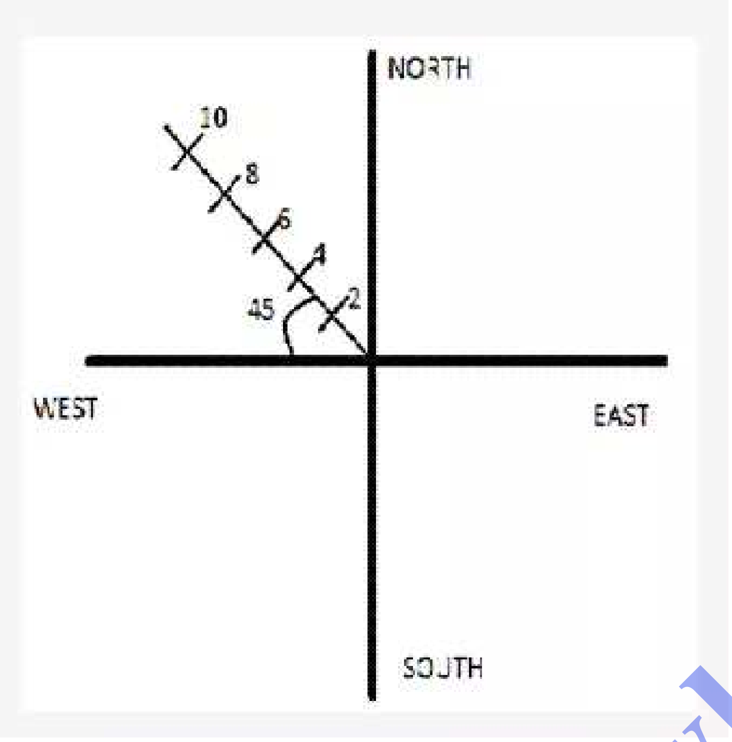
Solution 12:
Passengers sitting in a train are at rest with respect to each other.

Solution 13:
Yes we are at rest as well as motion because we are at rest with respect to a observer which is itself at rest and we are in motion with respect to a observer which is in motion.

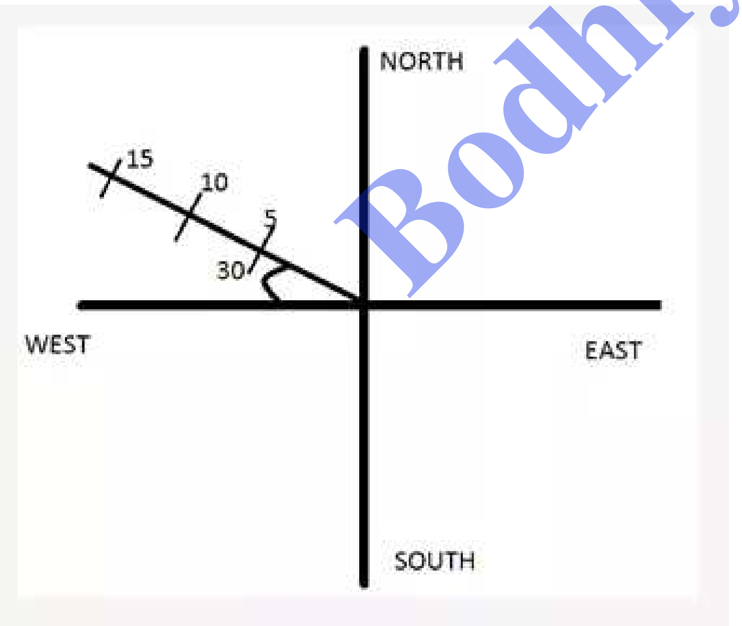
Solution 14:

The platform is in motion with respect to train. As train is moving with respect to platform so platform would also look in motion with respect to train.

Solution 15:



Solution 16:



Solution 17:

The physical quantity representing the magnitude and its direction is a vector quantity.

Solution 18:

- Yes we can add two scalars.
- Yes we can add two vectors.
- Yes we can multiply two scalars.

- No we cannot add a scalar quantity to a vector quantity.
- Yes we can subtract two scalars.
- No we cannot subtract a scalar quantity from a vector quantity. Reverse is also not true.
- Yes we can multiply vectors.

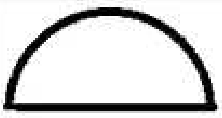
Solution 19:
The actual length of the path covered by a moving object irrespective of its direction of motion is called the distance travelled by the object.

Solution 20:
No the distance covered by a body cannot be less than the magnitude of its displacement.

Solution 21:
The displacement of a moving body is defined as the change in its position along a particular direction

Solution 22:
SI unit for measurement of distance and diplacement is metre denoted by m.

Solution 23:



In this case Distance travelled =half of the parameter of circle.
so distance travelled is $=\pi r$.
Displacement=diameter of circle
So displacement is 2r.

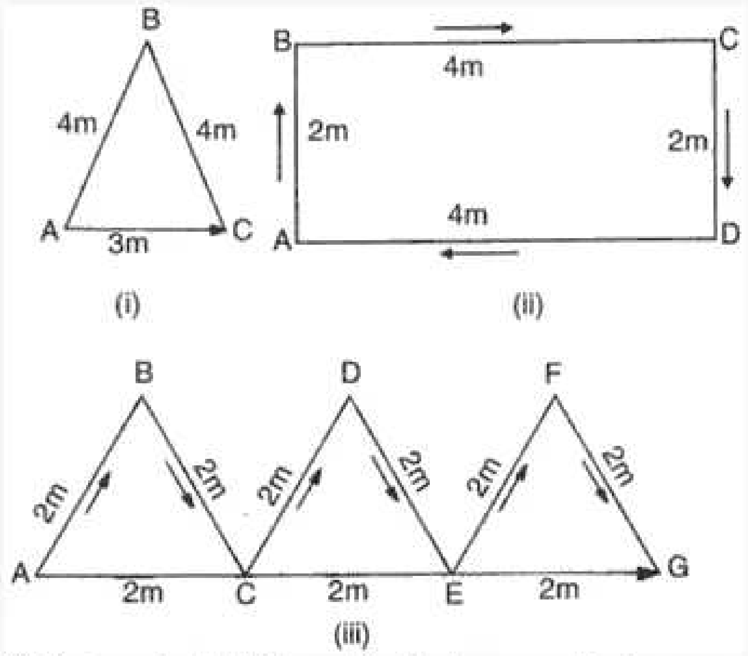
Solution 24:
Yes a body can have negative displacement.

Solution 25:
If a body is moving in a straight line then the displacement of a body is equal to the distance travelled by it.

Solution 26:

- Distance is a scalar quantity whereas displacement is a vector quantity.
- Distance is always positive but displacement can be negative,zero or positive.

Solution 27:



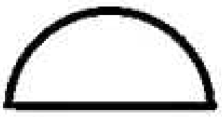
(i) Distance is 4+4=8 m while displacement is 3m.

(ii) Distance is 2+4+2+4=12m while displacement is 0m.

(iii) Distance is 2+2+2+2+2+2=12m while displacement is 2+2+2=6m.

Solution 28:

(i)



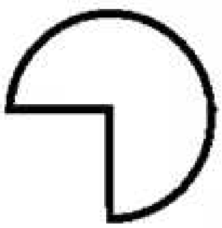
In this case Distance travelled =half of the parameter of circle.

so distance travelled is = πr.

Displacement=diameter of circle

So displacement is 2r.

(ii)

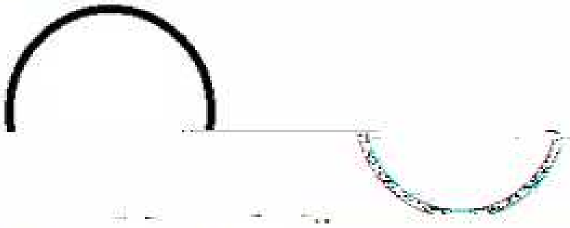


Distance travelled = (3/4) of perimeter of circle.

So distance travelled is = (3πr/2).

Displacement can be calculated as s = $\sqrt{r^2+r^2} = \sqrt{2}r$.

(iii)

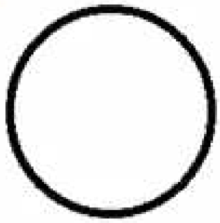


Distance travelled is =perimeter of circle.

So distance travelled is $=2\pi r$.

Displacement =0 as starting and ending point are coinciding.

(iv)

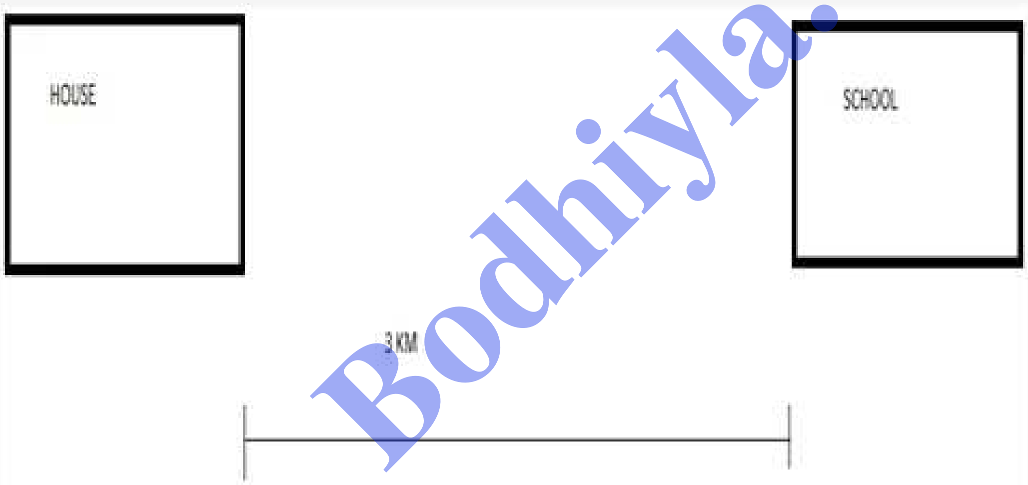


Distance travelled is two times the perimeter of cirle.

So distance travelled is $=4\pi r$.

Again displacement is =0 as starting and ending point are coinciding.

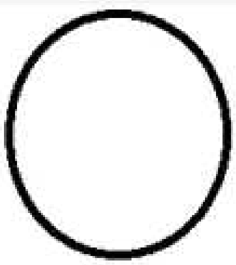
Solution 29:



(i) Distance travelled =distance between house to school + distance between school to house=3+3 =6 km.

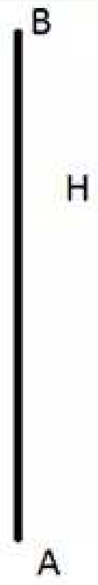
(ii) Displacement is =0 as starting and ending point are coinciding.

Solution 30:



Displacement of a satellite to make a complete round trip is= 0 as starting and ending point is coinciding.

Solution 31:



(i) Total distance travelled = distance from A to B + distance from B to A

So total distance = H +H = 2H.

(ii) Total displacement =0 as starting and ending points are coinciding.

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Solution 1:
Speed of a body can be defined as distance covered by the body in unit time.

Solution 2:
Average speed of a body can be defined as ratio of total distance covered by a body In total time.

Solution 3:
Both speed and average speed have same unit and that is ms-1.

Solution 4:
No speed and average speed of a body have different meaning.

Solution 5:
60 km/hr can be converted into m/s to compare with 15m/s.
60 km/hr = (60 x 1000)/3600 = 16.66 m/s. so speed 60 km/hr is greater.

Solution 6:
20m/s can be converted inti km/hr as
20 m/s = (20 x 3600)/1000 = 72 km/hr.

Solution 7:

36 km/hr can be converted into m/s to compare with 8.5m/s.
36 km/hr = (36 x 1000) /3600 = 10 m/s which is greater than 8.5 m/s
So 36 km/hr is greater than 8.5 m/s.

Solution 8:
SI unit of velocity is ms-1.

Solution 9:
No as their direction is different they don't have same velocity.

Solution 10:
we convert all the speeds in m/s to compare them.
36 km/hr = (36 x 1000)/3600 = 10m/s.
2 km/min = (2 x 1000)/60 = 33.3 m/s.
7 m/s = 7 m/s.
So increasing order of speed is 7m/s < 10m/s <33m/s.

Solution 11:
let total distance be S.
Boy covers distance S/2 with speed u then time taken by him to cover this distance would be T_1 =S/2u.
Again boy covers rest of the distance S/2 with speed v then time taken by him to cover this distance would be T_2 =S/2v.
So total time taken by boy to cover the distance S is T = T_1 + T_2.
Total time T= S/2 (1/u +1/v) = s(u+v)/2uv.
And average speed = S/T = 2uv/(u+v).

Solution 12:
Yes uniform speed and constant speed have same meaning.

Solution 13:
let S be the distance between P and Q.
Body covers forward journey distance S (P to Q) with speed u then time taken by him to cover this distance would be T_1 =S/u.
Again body covers backward journey distance S (Q to P) with speed v then time taken by him to cover this distance would be T_2 =S/v.
So total time taken by body to cover the distance S is T = T_1 + T_2.
Total time T= S (1/u +1/v) = s(u+v)/uv.
And average speed = 2S/T = 2uv/(u+v).

Solution 14:
As body goes from P to Q and then return back to P so the displacement of the body would be zero and hence average velocity would also be zero.

Solution 15:
let distance between P and Q is S.
Speed of car while travelling from P to Q is 20 m/s.
Let car take time T_1 to travel from P to Q then T_1= S/20.
Speed of car while travelling from Q to P is 30 m/s.
Let car take time T_2 to travel from Q to P then T_2= S/30.
Total time = T_1 + T_2 = S/20 +S/30 =S/12.
So average speed of journey = total distance/ total time = 2S/(S/12) = 24 m/s.
Average speed of journey is 24 m/s.

Solution 16:
Speed is a scalar quantity whereas velocity is a vector quantity. So speed doesn't have its direction and velocity has a particular direction.

Solution 17:
Speed and velocity of a moving body become equal when the body moves in a straight line.

Solution 18:
When the velocity of a moving body doesn't change with time then the velocity of the body is said to be constant or uniform.Yes uniform velocity and constant velocity are one and the same thing.

Solution 19:
Acceleration of a body is rate of change of its velocity with respect to the time.

Solution 20:
SI unit of acceleration is ms^{-2}.

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Solution 21:
If the acceleration of a moving body is constant in magnitude and direction then the path of the body must not be a straight line because in circular motion also acceleration of a body is constant in magnitude and always directed towards the centre.
So the path of the body may be a straight line and may be a circular one.

Solution 22:
No the relation S = v x t cannot used to find the total distance covered by a body moving with non-uniform speed.

Solution 23:
Yes area under a speed time graph in a given interval gives the total distance covered by a body.

Solution 24:
Yes the motion is uniform and the uniform speed is given by area under speed time graph divided by time interval.
So speed = 500/20 =25 m/s.

Solution 25:
Positive acceleration corresponds to situation when velocity is continuously increasing with respect to the time.

Solution 26:
Negative acceleration corresponds to situation when velocity is continuously decereasing with respect to the time.

Solution 27:
If a body falls towards earth then it would have a positive acceleration.

Solution 28:
If a body has acceleration of 8.5 ms^{-2} then it means its velocity is increasing at a rate of 8.5 ms^{-1} per second.

Solution 29:
SI unit of retardation is ms^{-2}.

Solution 30:
first convert 60 km/h in m/s.
60 km/hr =(60 x 1000)/3600 = 16.7 m/s.
This is initial velocity of car i.e u = 16.7 m/s.
As car stops in 10 seconds so final velocity is =0 m/s.
So acceleration = (v-u)/t = (0-16.7)/10 = -1.67 ms^{-2}.
Acceleration of car is = -1.67 ms^{-2}.

Solution 31:
-30 m/s is speed.

Solution 32:
Velocity corresponds to the rate of change of displacement.

Solution 33:
No the speed of a body cannot be negative.

Solution 34:
A flying bird most likely to have a non uniform velocity.

Solution 35:
Let initial velocity be u.
Final velocity is v= 0 m/s.
Time taken by body to come to rest = 10 sec.
Retardation =2.5 ms^{-2}.
We know v = u +at.
Then u = v – at.
u = 0 – (-2.5 x 10) = 25 m/s.
So initial velocity of the body is 25 m/s.

Solution 36:
Equation of motion gives us the picture of motion of moving body.

Solution 37:
First equation of motion is v = u + at.
Second equation of motion is s= ut + 1/2a t^2.
Third eqution of motion is v^2 – u^2 =2as.

Solution 38:
Four variables are present in each equation of motion.

Solution 39:
Four variables are present in each equation of motion and if any of three is known to us then fourth can be easily find with the help of these equation of motion.

Solution 40:
SI unit of acceleration and retardation is ms^{-2}.

Solution 41:
Distance is the physical quantity which is equal to the area under speed-time graph.

Solution 42:
A uniformly accelerated motion is one in which speed is constantly increasing or decreasing with time while a non uniform motion is one in which speed is not constantly changing with time.

Solution 43:
No we cannot use this relation for a body moving with uniform acceleration.

Solution 44:
Slope of a graph is given as rate of change of y coordinates to the x coordinate. In speed time graph speed is on the y axis and time is on the x axis. And we define acceleration as rate of change of speed with respect to time. So slope of a speed time graph gives acceleration.

Solution 45:

- Motion of blades of an electric fan.
- Motion of moon around earth.

Solution 46:
A straight line curve on speed time graph indicates that acceleration of the body is uniform and a zigzag or curved line indicates that acceleration of a body is not uniform.

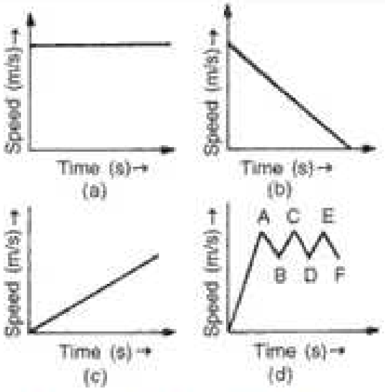
Solution 47:
Two quantities are directly proportional to each other.

Solution 48:
As we distance = speed x time.
Speed = 42 km/hr.
Time = 10 m = 1/6 hr.
Distance = 42 x 1/6 =7 km.

Solution 49:
Initial velocity u =10 ms^{-1}.
Acceleration a = 2 ms^{-2}.
Time t = 10 s.
By using first equation of motion
V = u + at.
V = 10 + 2 x 10.
V (final velocity) = 30 ms^{-1}.

Solution 50:
Initial velocity u = 10 km/hr. = (10 x 1000)/3600 = 8.33 ms^{-1}.
Final velocity = 64 km/hr = (64 x 1000)/3600 = 17.77 ms^{-1}.
Time = 10 s.
Acceleration = (v-u)/t = (17.77- 8.33)/10 = 9.44/10 = 0.94 ms^{-2}.

Solution 51:



(i) In speed time graph uniform motion is given by a straight line parallel to x axis so figure (a) denotes the uniform motion.

(ii) In speed time graph motion with increasing speed is shown by straight line with positive slope so figure (c) denotes the motion with speed increasing.

(iii) In speed time graph motion with decreasing speed is shown by straight line with negative slope so figure (b) denotes the motion with speed decreasing.

(iv) In speed time graph motion with oscillating speed is shown by zigzag line so figure (d) denotes the motion with speed oscillating.

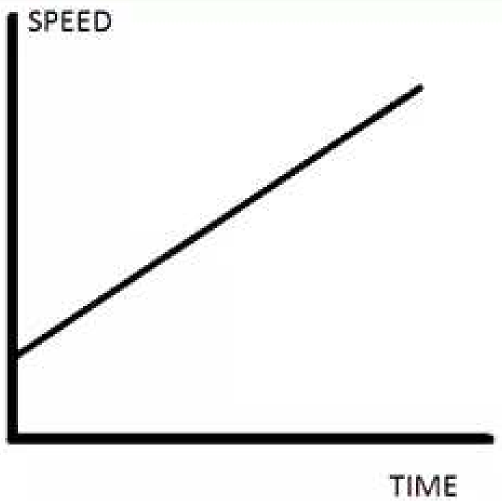
Solution 52:

No a body cannot have a speed negative.

Solution 53:

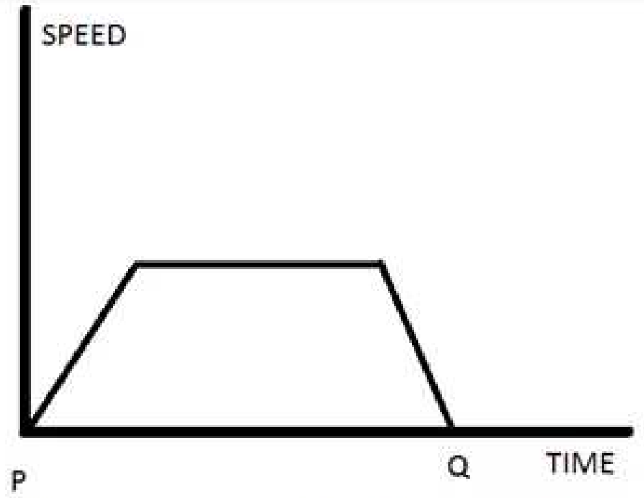
No2 distance covered by body during nth second is not more than the distance covered in n seconds.

Solution 54:



Speed time graph of a body when its initial speed is not zero and and speed increase uniformly with time.

Solution 55:



Speed time graph of a body starting from point P gradually picking up speed, then running at a uniform speed and finally slowing down to stop at some point Q.

Solution 56:

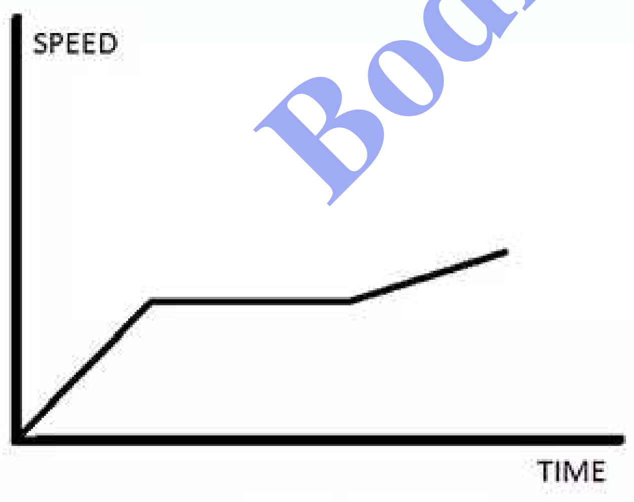
If speed time graph is moving upward then the body is accelerating and if it is starting from origin then it means the body has initial velocity =0.

Solution 57:

Speed time graph is moving upward then the body is accelerating and if it is not starting from origin then it means the body has some initial velocity.

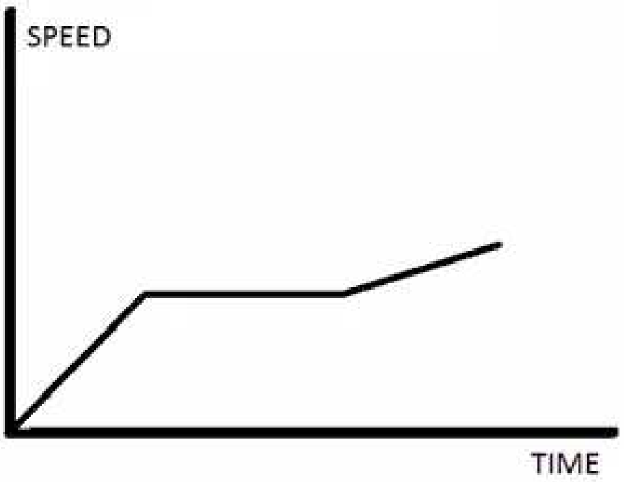
Solution 58:

(A)



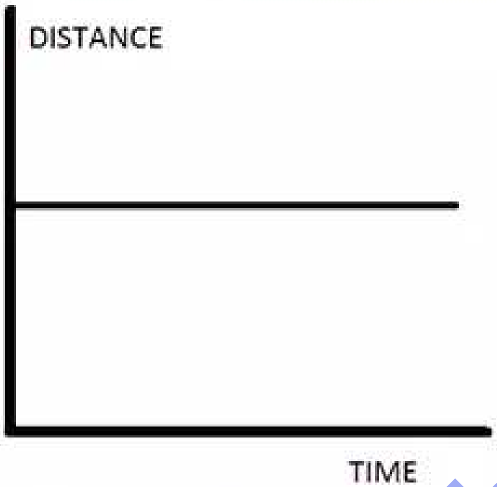
Speed time graph for a stepped motion.

(B)



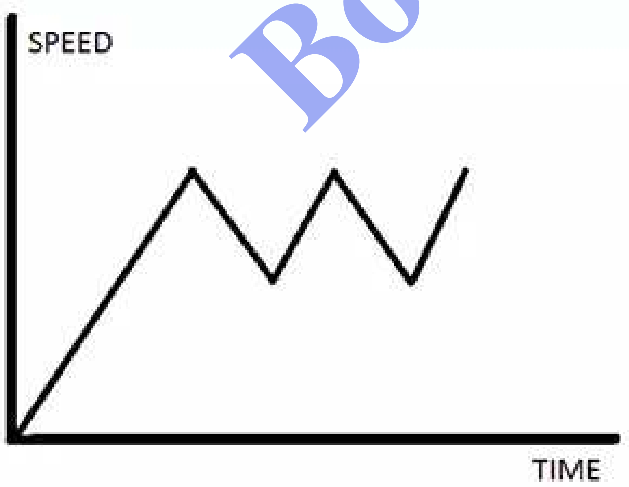
Speed time graph for a non uniform acceleration.

(C)

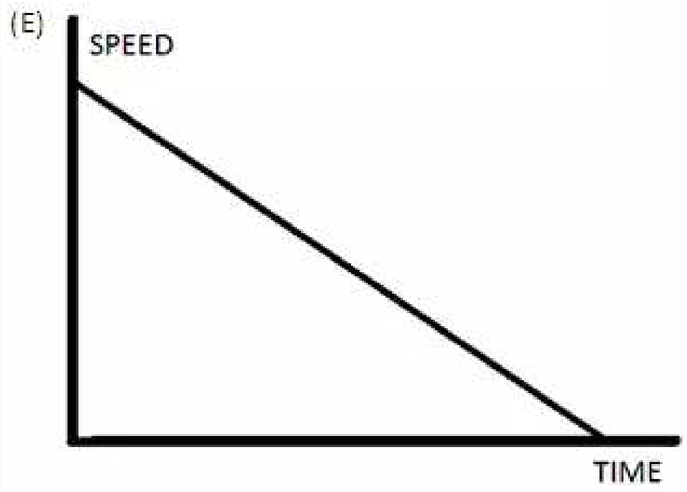


Distance time graph for a body at rest.

(D)

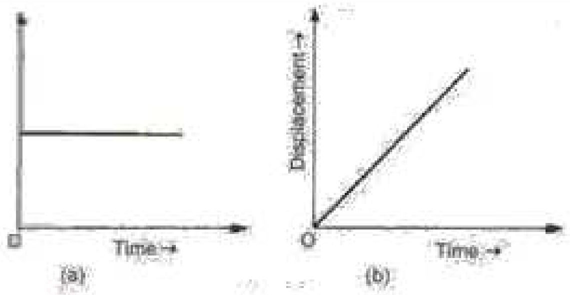


Speed time graph for a body showing fluctuating speed.



Speed time graph for a uniformly retarded motion.

Solution 59:



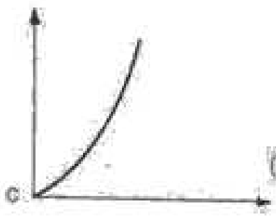
(i) If distance time graph of a body is straight line parallel to x axis then the body is said to be at rest.

(ii) If displacement time graph of a body is straight line moving upwards and starting from origin then it means body has started from and moving with a uniform velocity.

Solution 60:

(a) uniformly retarded motion

(b) non-uniform acceleration



(c) non-uniform motion

(d) uniform motion

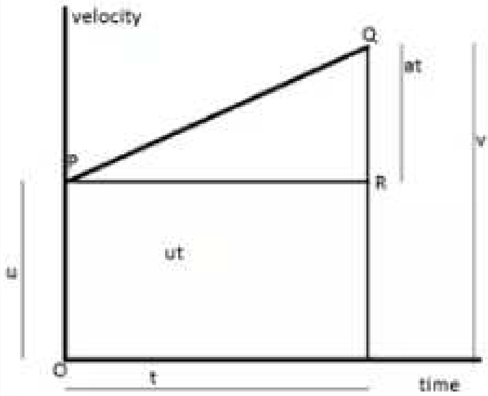
A - (d)

B - (a)

C - (b)

D - (c).

Solution 61:



This is graph plotted between velocity and time.

The initial velocity of the body is u at t=0. The velocity of the body increases at a uniform rate and this increase in velocity up to time t is depicted by a straight line PQ. The slope of line PQ gives acceleration a.

a = QR/PR.

PR = OS =t

SR = OP =u

QR = a × PR.

= a × t.

The point Q corresponds to the final velocity v after time t.

v = QR + RS

and generally we write v = u + at.

This is first equation of motion.

(ii)

The area enclosed under a velocity time curve gives the distance covered by a moving body. So total distance S covered by a uniformly accelerating body is given by area of trapezium OSQP.

S = area of trapezium OSQP.

AREA of rectangle OSRP + area of triangle PRQ.

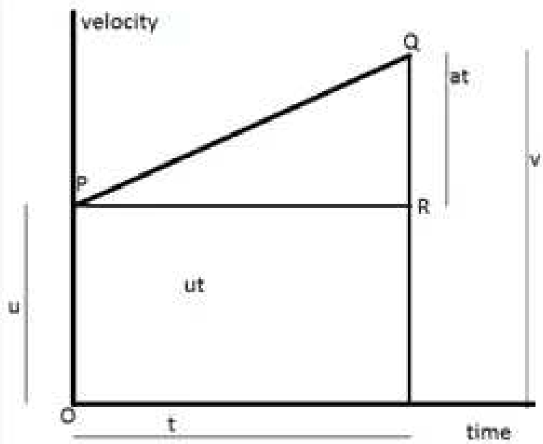
S = OP × OS + ½ PR ×QR.

S = u × t + ½ × t × at.

$S = ut + \frac{1}{2} at^2$.

This is known as second equation of motion.

Solution 62:



In figure we know

S = area of trapezium OSQP

Area of trapezium OSQP = ½ (sum of parallel sides) ×perpendicular distance between them.

$S = \frac{1}{2}(OP + SQ) \times PR.$

$PR = QR/a = (QS - RS)/a$

$PR = (v - u)/a = t$

So PR = t.

Substituting these values in expression of area of trapezium we get

$S = \frac{1}{2}(u + v) \times t$

$S = \frac{1}{2}(u + v) \times (u - v)/a.$

$2aS = v^2 - u^2.$

$v^2 - u^2 = 2aS.$

This is known as third equation of motion.

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Solution 1:
Displacement and velocity are two examples of vectors.

Solution 2:
SI unit of retardation is ms^{-2}.

Solution 3:
Velocity is the physical quantity associated with the rate of change of displacement with time.

Solution 4:

The angular velocity is defined as rate of change of angular displacement (θ) with time (t). It is denoted by (ω).

Solution 5:
There are three types of rectilinear motion Translational , vibrational and rotational.

Solution 6:
A body is said to have a uniform velocity if it covers equal displacement in equal interval of time.

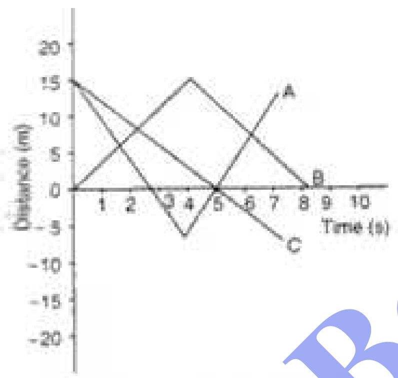
Solution 7:
Acceleration is a vector quantity.

Solution 8:
Slope of speed time graph represents acceleration.

Solution 9:
If a stone is dropped from a certain height then it undergoes non uniform velocity motion.

Solution 10:
This means the body has a positive acceleration.

Solution 11:

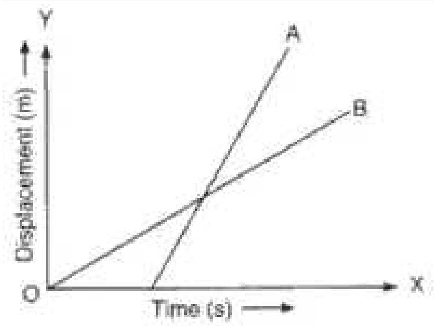


Graph (c) represents a motion with negative acceleration.

Solution 12:

- No a body with constant acceleration cannot have a zero velocity.
- No a body with an acceleration in vertical direction cannot move horizontally.
- No in an accelerated motion a body cannot have a constant velocity.

Solution 13:



As slope of line A is greater than line B that means velocity of body A is greater than body B or in other words body A is moving faster.

Solution 14:

- In displacement-time graph a straight line parallel to time axis shows that body is at rest position.
- In displacement-time graph a straight line inclined to the time axis with an acute angle means body is moving with a positive velocity.

Solution 15:
No a accelerating body cannot have constant speed.

Solution 16:

- In displacement-time graph a straight line shows body is at rest if it is parallel to time axis and shows a body is moving with uniform velocity if it is inclined to x axis.
- In velocity-time graph a straight line shows body is moving with uniform constant velocity if it is parallel to x axis and shows body is moving constant acceleration of it is inclined to x axis.

Solution 17:
Average speed during different time intervals for a uniform motion is same.

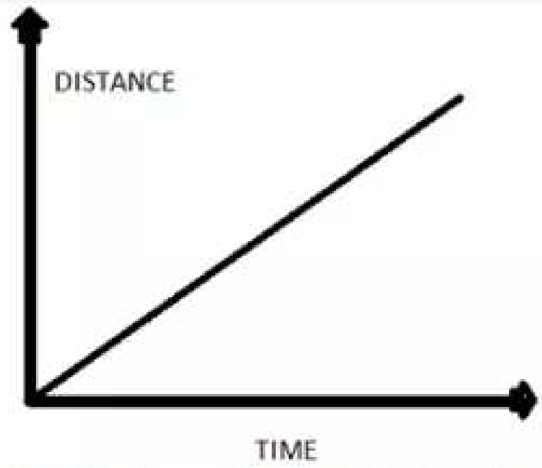
Solution 18:
Velocity of a stone thrown vertically upward at its maximum height is Zero.

Solution 19:
Velocity of a stone thrown vertically upwards decrease because acceleration due to gravity is acting on downward direction.

Solution 20:
Linear velocity would be equal to linear speed if body is moving in a straight line.

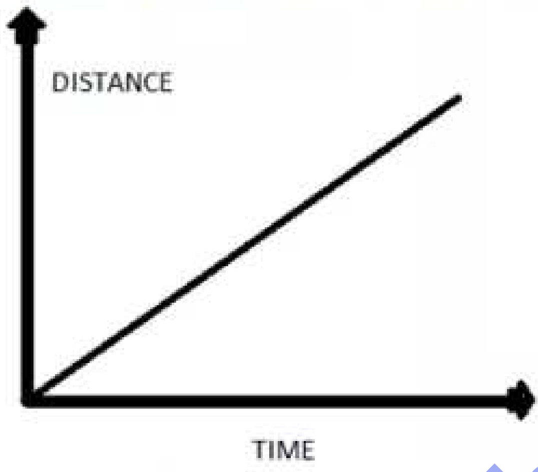
Solution 21:

(a)



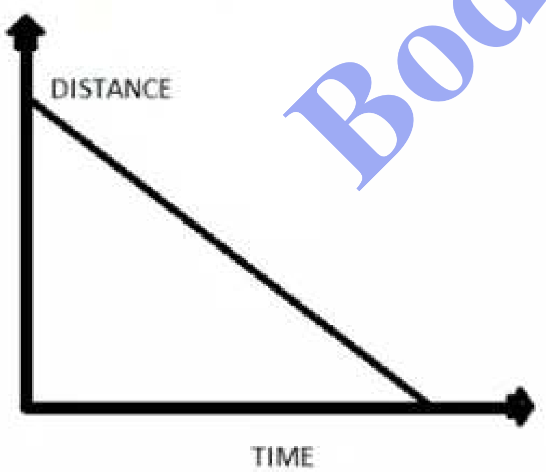
As slope of a distance time graph indicates velocity so a increasing velocity means a straight line having a positive slope with time axis.

(b)



As uniform velocity means slope of line should be constant throughout the motion so this graph also represents uniform velocity.

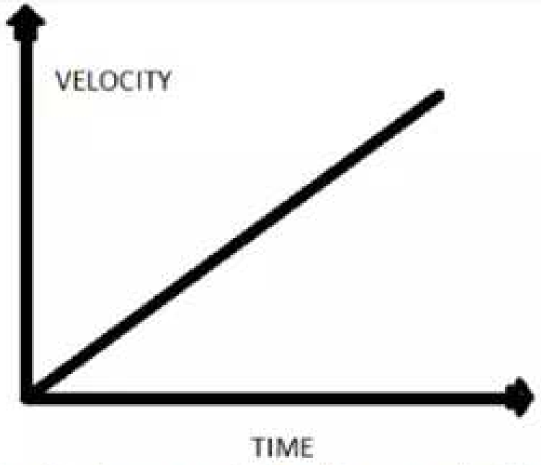
(c)



As slope of this line is negative so this represent decreasing velocity.

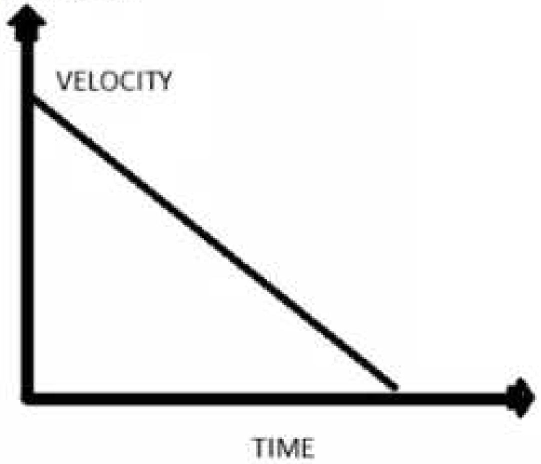
Solution 22:

(a)



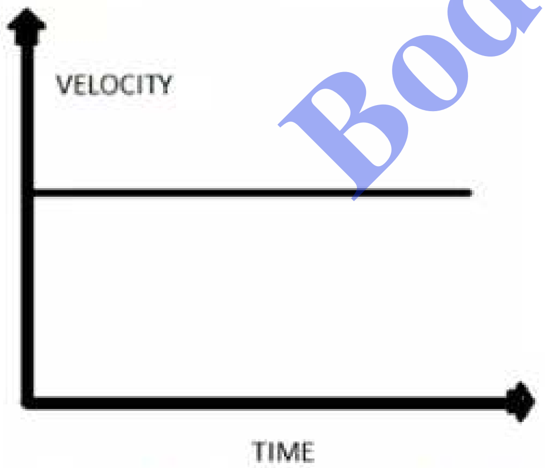
Acceleration is represented by a line on a velocity time graph with a positive slope with time axis.

(b)



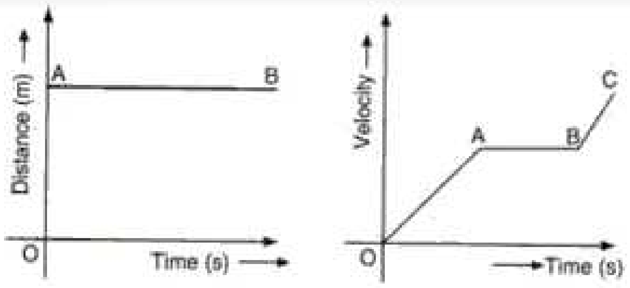
Deceleration is represented by a straight line having a negative slope with time axis.

(c)



As slope of velocity time graph gives acceleration. So motion with zero acceleration is represented by line having zero zero slope with time axis or a line parallel to the time axis.

Solution 23:



(a) (b)

(a) In distance time graph a straight line parallel to time axis represents state of motion.

(b) In this graph portion O to A represents motion with acceleration, A to B represents motion with uniform velocity, B to C represents motion with acceleration.

Solution 24:

During circular motion

- Speed remains constant.
- Velocity changes continuously.

Solution 25:

The statement is not correct , the correct statement is "the earth is moves round the sun with constant speed".

Solution 26:

As in circular motion direction changes continuously with motion so after two complete revolutions we can say that direction has changed infinite times.

Solution 27:

As after completing 3 revolution in circular motion the displacement is = 0. so the ratio of distance covered to the displacement is infinite.

Solution 28:

The graph becomes straight line with positive slope with time axis and represents almost a constant acceleration.

Solution 29:

Retardation is negative of acceleration so retardation the body is +3.4 ms^{-2}.

Solution 30:

Bus is moving with initial velocity of u = 60 km/hr.

60 km/hr = (60 x 1000)/3600 = u = 16.66 ms^{-1}.

Reaction time = t =1/15 sec.

Distance would the bus had moved before pressing the bus would be = u x t.

S = 16.66 x 1/15 = 1.1 m.

Now if the driver is intoxiacated then reaction time would be t = 1/2 seconds.

So S becomes S = u x t = 16.66 x 1/2 = 8.33m.

Solution 31:

Time difference of 0.1 s denotes the time taken by sound to go from device to wall and back to wall. As the distance between wall and device is 15 m so total distance covered by sound is 2 x 15 m =30 m.

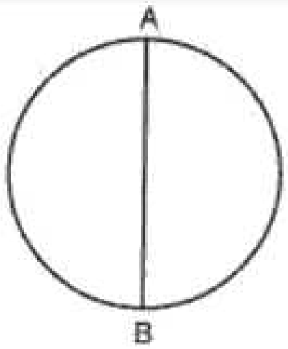
So speed of sound is = total distance covered/time taken = 30/0.1 =300 ms^{-1}.

So speed of sound is 300 ms^{-1}.

Solution 32:

Radius of orbit is 42250 km.
Distance covered by satellite to complete 1 revolution is $2\pi r$.
So distance is = 2 X 3.14 ×42250 =265330 km.
time taken by satellite to complete one revolution is 24 hr = 24×60×60=86400 sec.
so linear velocity is = distance /time = 265330/86400 ms-1 = 3.07 km s^{-1}.

Solution 33:



Circumference of track = 314 m.

We know that circumference = $2\pi r$

So $2\pi r$ = 314

R = $314/2\pi$ = 50 m

Diameter of track would be = 2 × 50 = 100 m.

Length of path AB = 100 m.

(i) Distance moved by cyclist= half the circumference of track i.e 314/2 = 157 m.

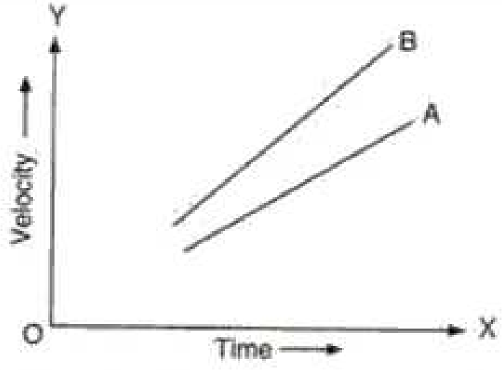
(ii) The displacement of cyclist is equal to the diameter of circle i.e AB = 100 m.

(iii) Average velocity would be equal to = 15.7 ms^{-1}.

Solution 34:

slope of velocity time graph represents acceleration of the body.

Solution 35:



As acceleration is the slope of line in velocity time graph and as B has greater slope than line A. so B has greater acceleration than A.

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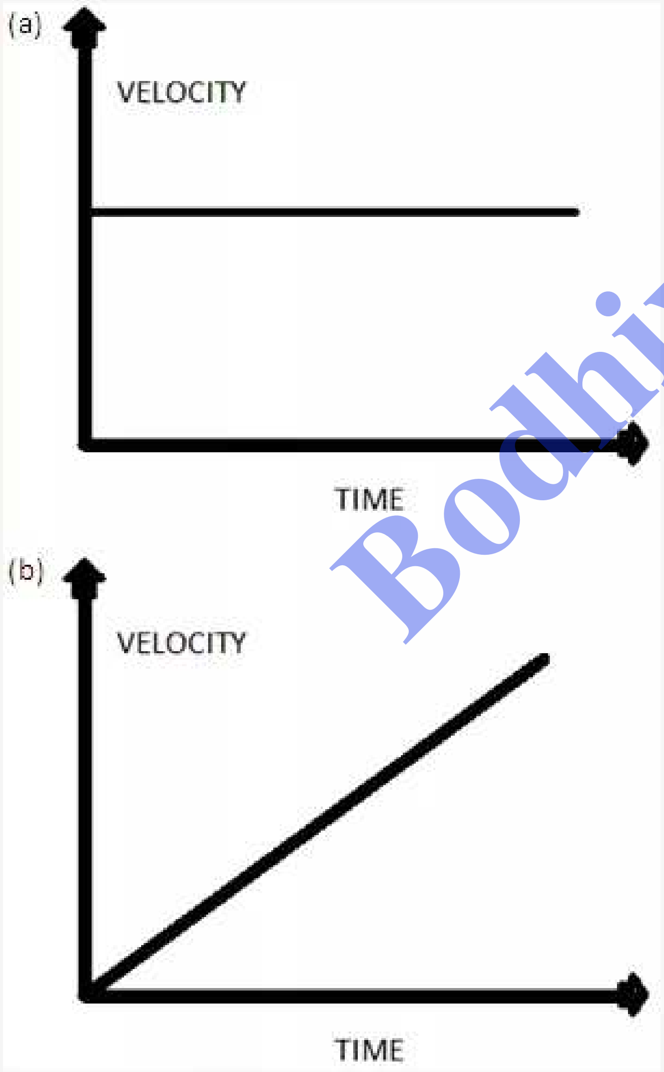
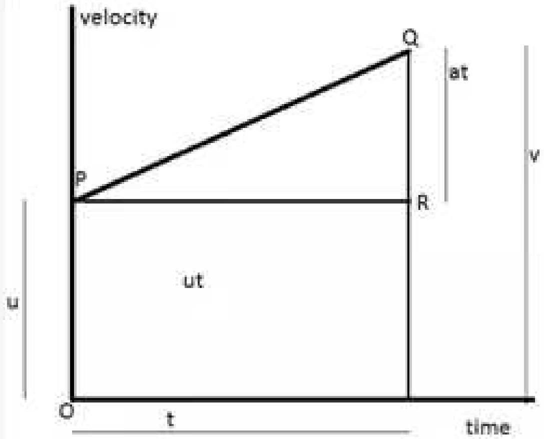
Solution 36:



Solution 37:



The area enclosed under a velocity time curve gives the distance covered by a moving body. So total distance S covered by a uniformly accelerating body is given by area of trapezium OSQP.

S = area of trapezium OSQP.

AREA of rectangle OSRP + area of triangle PRQ.

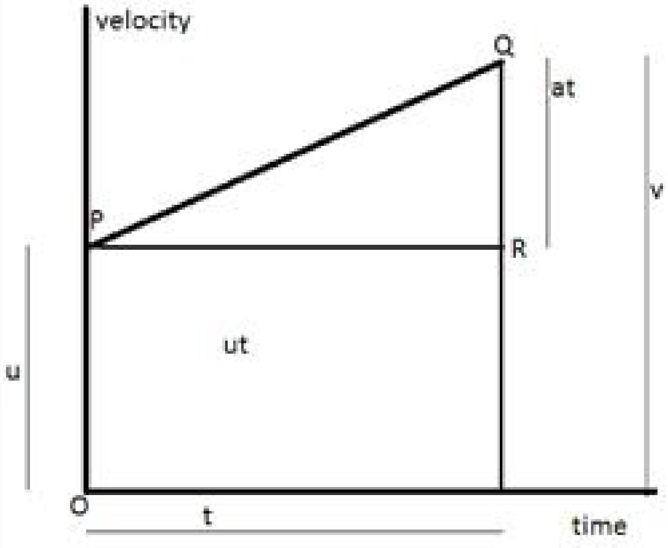
$S = OP \times OS + \frac{1}{2} PR \times QR$.

$S = u \times t + \frac{1}{2} \times t \times at$.

$S = ut + \frac{1}{2} at^2$.

This is known as second equation of motion.

Solution 38:



In figure we know

S = area of trapezium OSQP

Area of trapezium OSQP = ½ (sum of parallel sides) ×perpendicular distance between them.

S = ½ (OP + SQ) × PR.

PR = QR/a = (QS – RS) /a

PR = (v – u)/a = t

So PR = t.

Substituting these values in expression of area of trapezium we get

$S = \frac{1}{2}(u + v) \times t$

$S = \frac{1}{2}(u + v) \times (u - v)/a$.

$2aS = v^2 - u^2$.

$v^2 - u^2 = 2\,aS$.

Solution 39:

Angular displacement θ = length of arc/ radius of circle

$\theta = l/r$

$l = \theta \times r$

divide above equation with t

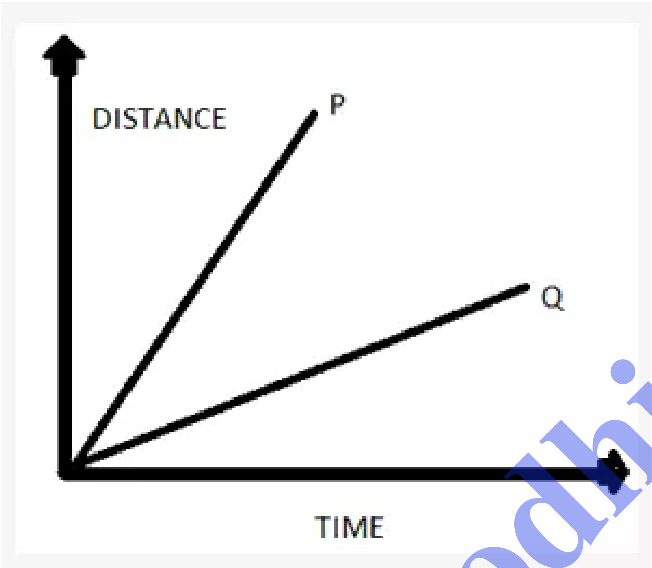
$l/t = \theta \times r/t$

now $l/t = v$ (linear speed)

$\theta/r = \omega$

so $v = \omega r$.

Solution 40:



Solution 41:

let total distance be S.

Boy covers distance S/2 with speed A then time taken by him to cover this distance would be T_1 =S/2A.

Again boy covers rest of the distance S/2 with speed B then time taken by him to cover this distance would be T_2 =S/2B.

So total time taken by boy to cover the distance S is $T = T_1 + T_2$.

Total time T= S/2 (1/A +1/B) = s(A+B)/2AB.

And average speed = S/T = 2AB/(A+B).

Solution 42:

Car travls 30 km distance with speed 60 km/hr

Time taken by car to travel this distance = 30/60 = 0.5 hr.

Car travels another distance of 30 km with speed of 20 km/hr.

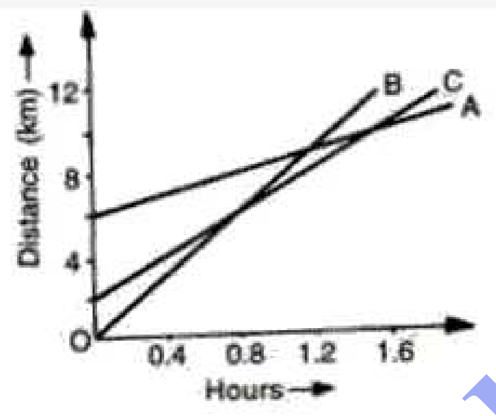
Time taken by car to travel this distance = 30/20 = 1.5 hr.

Total time taken = 1.5 + 0.5 = 2 hr.

Total distance = 30+ 30 = 60 km.
Average speed of car = 60/2 = 30 km/hr.

Solution 43:
Train travels first 40 km at speed of 30 km/hr.
Time taken by train to cover this distance is = distance/speed = 40/30 = 4/3 hr.
Let speed of train to cover next 80 km is v .
Then time taken by train to cover these 80 km is 80/v.
Total time becomes T = 4/3 +80/v = (4v + 240)/3v.
Total distance= 120 km.
Average speed = 60 km/h (given)
However average is given by = total distance /total time.
So (120 x 3 x v)/(4v +240) = 60
360 v = 240v +14400
120v = 14400
v= 14400/120 =120 km/hr.
so train has to cover those 80 km at a speed of 120 km/hr.

Solution 44:

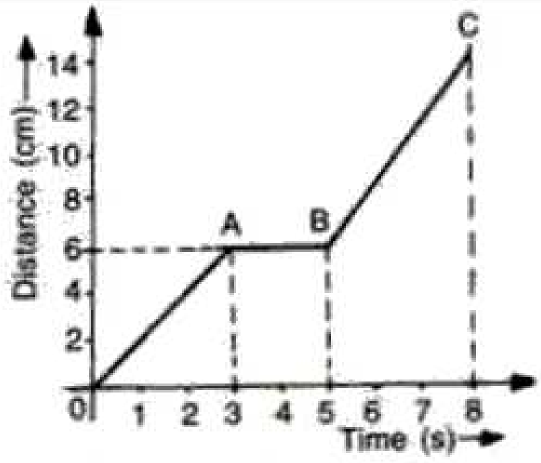


(a) B is travelling fastest among all the 3 students.

(b) C is at 8 km when B meets C.

(c) B travel 4 km between the time he passed C and A.

Solution 45:

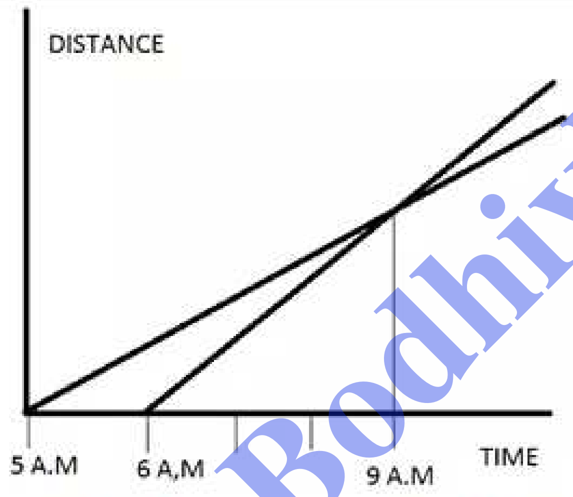


(a) Speed as it moves from 0 to a = (6 – 0)/ (3 – 0 = 2 ms^{-1}.

(b) Speed as it moves from A to B = (6 – 6)/ (5 – 3) = 0 ms^{-1}.

(c) Speed as it moves from B to C = (14 – 6)/ (8 – 5) = 8/3 = 2.66 ms^{-1}.

Solution 46:



So we can see that the two friends will meet at 9 a.m ant till then they cover a distance of u × t = u′ ×t′ = 30 ×4 = 40 × 3 =120 km

So they are 120 km away from Delhi when they meet at 9 a.m.

Solution 47:

Initial velocity of car u = 18 km/hr.
Final velocity of car v= 36 km/hr.
Time taken by body = 15 min. = 1/4 hr
Acceleration of car a = (v- u)/t = (36 – 18) x 4 = 72 kmh^{-2}.

Solution 48:

Initial speed of car u = 50 km/h.
Final speed of car v = 55 km/h.
Time taken by car to attain this speed is = 1 sec. = 1/3600 hr.
Acceleration of the car is = (55 – 50) x 3600 = 18000 kmh^{-2}.

Solution 49:

(a) 7200 km/h^2 = (7200 x 1000)/(3600 x 3600) = 5/9 ms^{-2}.

(b) 1/36 m/s^2 = (1 x 3600 x 3600)/(36 x 1000) = 3600 kmh^{-2}.

Solution 50:

initial velocity u = 20 m/s.
Acceleration = 5 m/s^2.
T = 2 s.
We know v= u + at.
v= 20 + 5 x 2= 30 m/s.

Solution 51:

acceleration of the car = 10 ms^{-2}.
Initial velocity u = 10 m/s.
Final velocity v = 30 m/s.
We v = u + at.
T = (v- u)/a
T = (30 – 10)/10 = 2 sec.
Time taken by car is 2 sec.

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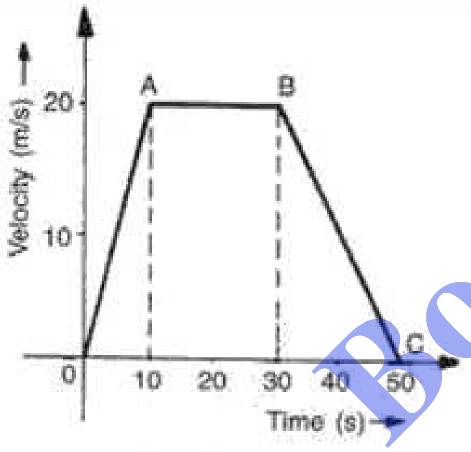
Solution 52:



(a) From 0 to 10 sec. i.e O to A motion is accelerating one. From 10 s to 30 sec. scooter is moving with uniform velocity, from 30 s to 50 sec scooter is retarding from B to C.

(b) Scooter is accelerating in the region O to A and acceleration is given by
a= (v – u)/t = (20 – 0)/10 = 2 ms^{-2}.

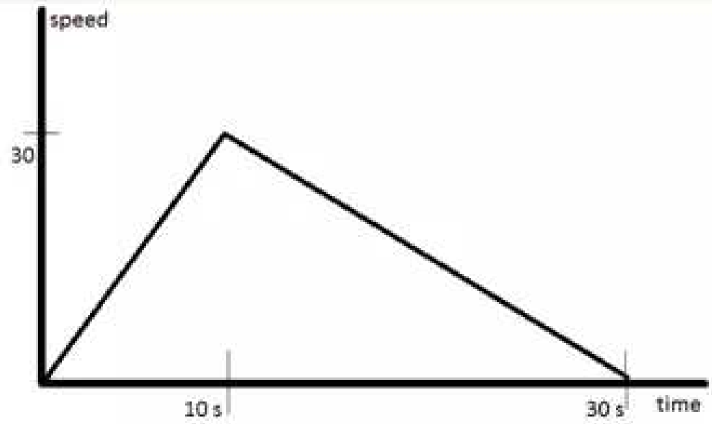
(c) Scooter is decelerating in the region B to C.
a= (v – u) /t = (0 – 20)/20 = -1 ms^{-2}.

(d) The distance travelled in 10 sec is S_1 = ½ ×20 ×10 = 100m
Distance travelled in 10s to 30s is S_2 = 20 × (30 – 10) = 20 × 20 = 400 m

Distance travelled in 30 s to 50s is S_3 = ½ ×20 ×(50 – 30) = 200m.

Total distance covered by scooter is = 100m + 400m + 200m =700m.

Solution 53:



(a) Acceleration a = (v – u)/t = (30 – 0)/10 = 3 ms^{-2}.

(b) Deceleration a = (v – u)/t = (0 – 30)/ 20 = -1.5 ms^{-2}.

(c) Distance travelled = area under speed time graph = ½ × 30 × 30 = 450 m.

Solution 54:

Let total distance be S.

Body covers distance S/2 with speed 40 ms^{-1} then time taken by him to cover this distance would be T_1 =S/2 x 40.

Again body covers rest of the distance S/2 with speed 60 ms-1 then time taken by him to cover this distance would be T_2 =S/2 x 60.

So total time taken by body to cover the distance S is T = T_1 + T_2.

Total time T= S/2 (1/40 +1/60) = s(40+60)/2 x 40 x 60 = s/48.

And average speed = S/T = 48 ms^{-1}.

So average speed is 48 ms^{-1}.

Solution 55:

As displacement for the motion from A to B and B to A is zero so the average velocity of the body would be zero.

Solution 56:

Initial velocity of body u = 0.5 ms^{-1}.

Final velocity of the body v = 0 ms^{-1} as body comes to rest finally.

Retardation of body = 0.05 ms^{-2}.

We know that v = u + at.

0 = 0.5 – 0.05t

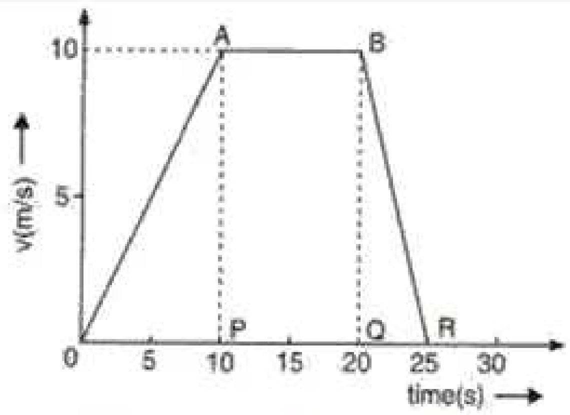
T = 0.5/0.05 = 10 sec.

Solution 57:
Initial speed of train = 90 km/hr
Speed of train imn m/s = (90 x 1000)/3600 = 25 m/s.
Retardation of the train = 2.5 ms^{-2}.
Final speed of train at platform = 0 m/s.
We know that $v^2 - u^2 = 2as$.
0 – 25 x 25 = 2 x (-2.5) x S
S = 625/5 = 125 m.
So driver should apply the brakes 125 m before the platform.

Solution 58:
Train travels first 30 km at speed of 30 km/hr.
Time taken by train to cover this distance is = distance/speed = 30/30 = 1 hr.
Let speed of train to cover next 90 km is v .
Then time taken by train to cover these 90 km is 90/v.
Total time becomes T = 1 +90/v = (v + 90)/v.
Total distance= 120 km.
Average speed = 60 km/h (given)
However average is given by = total distance /total time.
So (120 x v)/(v +90) = 60
120 v = 60v +5400
60v = 5400
v= 5400/60 =90 km/hr.
so train has to cover those 90 km at a speed of 90 km/hr.

Solution 59:
speed of train = 30 km/hr.
Speed in m/s = (30 x 1000)/3600 = 50/6 m/s.
Lenth of train = 50 m.
Let lenth of bridge be s metre.
Train has to cover total distance of 50+s to cross that bridge.
Time taken by train to cover this distance = 36 sec.
So as time taken = total distance /total time taken.
36 = (50 +s) x 6/ 50.
1800 = 300 + 6s
6s = 1500.
S = 1500/6 = 250m
Length of bridge is 250 m.

Solution 60:



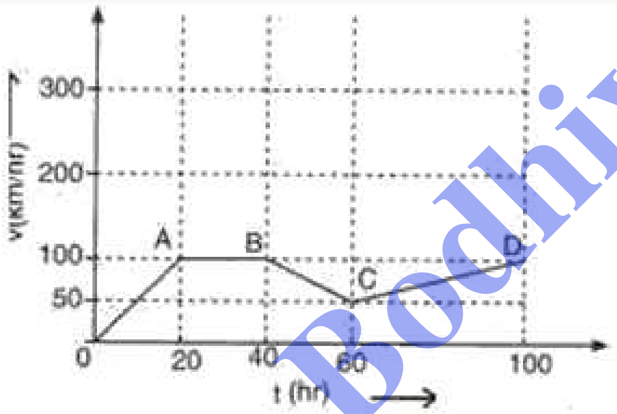
As we know that acceleration is given by slope of velocity time graph so we have to calculate the slope of graph of each stage of motion.

Acceleration during O to P $= (10 - 0)/(10 - 0) = 1\ ms^{-2}$

Acceleration during P to Q $= (10 - 10)/(20 - 10) = 0\ ms^{-2}$

Acceleration during Q to R $= (0 - 10)/(25 - 20) = -2\ ms^{-2}$.

Solution 61:



(i) Body is travelling with uniform velocity from point A to B i.e for $(40 - 20) = 20$ hr.

(ii) Acceleration along AB $= (100 - 100)/(40 - 20) = 0\ ms^{-2}$

Retardation along CD $= (100 - 50)/(100 - 60) = 50/40 = 1.25\ ms^{-2}$.

(iii) Distance travelled in last 40 hour would be equal to area under graph during that time $= 50 \times (100 - 60) + \frac{1}{2} \times (100 - 60) \times (100 - 50)$.

$S = 2000 + 1000 = 3000$ km.

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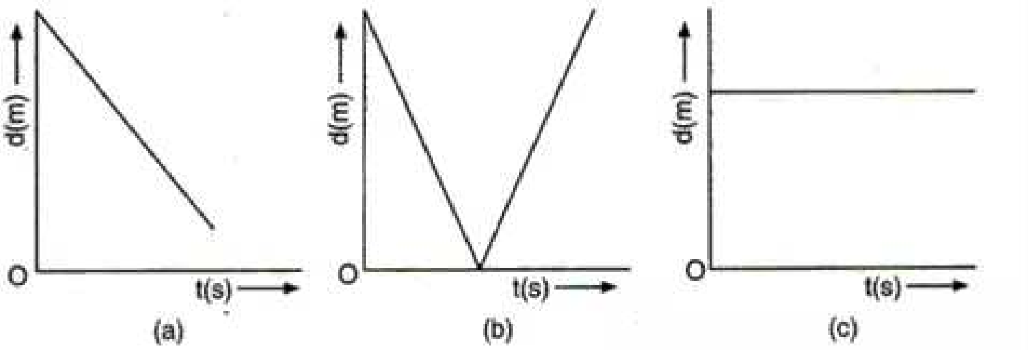
Solution 62:



(i) Body is showing decreasing velocity that is retardation.
(ii) Initially body is showing retarded motion and then a accelerating one.
(iii) The body is in state of rest.

Solution 63:

(i) No vehicle is moving with uniform velocity.
(ii) Vehicle B is moving with constant acceleration.
(iii) At 6 seconds both vehicles would meet.
(iv) Velocity of both the vehicles is 60 m/s when they meet.
(v) Vehicle B is ahead at the end of 7th sec and by 70 m.