Horizontal Motion

1. Correct statement among the following is

1) When displacement is zero, distance travelled is not zero.

2) When displacement is zero, distance travelled is also zero.

3) When distance is zero, displacement is not zero.

4) Distance travelled and displacements are always equal.

2. A body starts from rest and moves with a uniform acceleration. The ratio of distance covered in the nth second to the distance covered in n seconds is

(1) $\frac{2}{n}-\frac{1}{n^2}$ (2) $\frac{1}{n^2}-\frac{1}{n}$ (3) $\frac{2}{n^2}-\frac{1}{n}$ (4) $\frac{2}{n}+\frac{1}{n^2}$

3. The numerical ratio of displacement to the distance covered is always

1) Less than one

2) Equal to one

3) Equal to or less than one

4) Equal to or greater than one

4. Which of the following four statements is false?

1) A body can have zero velocity and still be accelerated.

2) A body can have a constant velocity and still have a varying speed.

3) A body can have a constant speed and still have a varying velocity.

4) The direction of the velocity of a body can change when its acceleration is constant.

5. Choose the correct statement.

1) If a particle is in motion average speed always equals average velocity

2) Particle can travel with constant velocity and variable speed in a given.

3) If acceleration is constant speed is constant in a given direction

4) If a particle travels along a st. line average speed equals average velocity

6. If $\bar{u} = 2\bar{i} - 2\bar{j} + 3\bar{k}$ and the final velocity is $\bar{v} = 2\bar{i} - 4\bar{j} + 5\bar{k}$ and it is covered in a time of 10 sec, find the acceleration vector.

1) $\frac{3\bar{i} - 2\bar{j} + 2\bar{k}}{10}$ 2) $\frac{-3\bar{i} + \bar{j} + 2\bar{k}}{10}$ 3) $\frac{-3\bar{i} - 2\bar{j} + 2\bar{k}}{10}$ 4) $\frac{-\bar{j} + \bar{k}}{5}$

7. A particle moving with a constant acceleration describes in the last second of its motion $\frac{9}{25}$ th of the whole distance. If it starts from rest, how long is the particle in motion and through what distance does it move if it describes 6 cm in the first sec.?

1) 5s; 150 cm 2) 10 s; 150 cm 3) 15 s; 100 cm 4) 15 s ; 170 cm

8. A body moving with a uniform acceleration had velocities of 20 m/s and 30 m/s when passing the points P and Q of its path. Find the velocity midway between P and Q (in m/s)

1) $\sqrt{450}$ 2) $\sqrt{550}$ 3) $\sqrt{650}$ 4) 550

9. A bullet fired into a fixed target loses half of its velocity in penetrating 15 cm. The further distance it will penetrate before coming to rest is

1) 5 cm 2) 15 cm 3) 7.5 cm 4) 10 cm

10. For a body travelling with uniform acceleration, its final velocity is $v = \sqrt{180 - 7x}$, where x is the distance travelled by the body. Then the acceleration is

1) -8 m/s^2 2) -3.5 m/s^2 3) -7 m/s^2 4) 180 m/s^2

11. A man walks up a stationary escalator in 90sec. When this man stands on a moving escalator he goes up in 60 sec. The time taken by the man to walk up the moving escalator is

1) 30 s 2) 45 s 3) 36 s 4) 48 s

12. A particle moving with uniform retardation covers distances 18m, 14m and 10m in successive seconds. It comes to rest after travelling a further distance of

1) 50m 2) 8 m 3) 12m 4) 42 m

13. **Four persons A, B, C and D initially at the corners of a square of side of length d. If every person starts moving with same speed v such that each one faces the other always, the person will meet after time**

1) $\frac{d}{v}$ 2) $\frac{\sqrt{2}d}{v}$ 3) $\frac{d}{2v}$ 4) $\frac{d}{\sqrt{2}v}$

14. **The coordinates of a moving particle at any time 't' are given by x = αt^3 and y = βt^3. The speed of the particle at time 't' is given by**

1) $3t\sqrt{\alpha^2+\beta^2}$ 2) $3t^2\sqrt{\alpha^2+\beta^2}$ 3) $t^2\sqrt{\alpha^2+\beta^2}$ 4) $\sqrt{\alpha^2+\beta^2}$

15. **Two cars 1 & 2 starting from rest are moving with speeds V_1 and V_2 m/s $(V_1 > V_2)$. Car 2 is ahead of car '1' by 'S' meters when the driver of car '1' sees car '2'. What minimum retardation should be given to car '1' avoid collision**

1) $\frac{V_1-V_2}{S}$ 2) $\frac{V_1+V_2}{S}$ 3) $\frac{(V_1+V_2)^2}{2S}$ 4) $\frac{(V_1-V_2)^2}{2S}$

16. **The relation $3t=\sqrt{3x}+6$ describes the displacement of a particle in one direction where x is in meters and t in sec. The displacement, when velocity is zero, is**

1) 24 meters 2) 12 meters 3) 5 meters 4) Zero

17. **A car accelerates from rest at a constant rate α for some time, after which it decelerates at a constant rate β and comes to rest. If the total time elapsed is t, then the maximum velocity acquired by the car is**

1) $\left(\frac{\alpha^2+\beta^2}{\alpha\beta}\right)t$ 2) $\left(\frac{\alpha^2-\beta^2}{\alpha\beta}\right)t$ 3) $\frac{\alpha\beta t}{\alpha+\beta}$ 4) $\frac{(\alpha+\beta)t}{\alpha\beta}$

18. **The distance travelled by a body is proportional to the square of time. The body is moving with**

(1) Uniform acceleration (2) Uniform velocity

(3) Variable acceleration (4) All of the above

19. **The velocity of a body moving along a straight line with uniform deceleration reduces by $\frac{3}{4}$ of its initial velocity. The total time of motion of the body is**

(1) $\frac{3u}{4a}$ (2) $\frac{4a}{3u}$ (3) 3u x 4a (4) zero

20. **A bullet moving with a velocity of 200 cm/s penetrates a wooden block and comes to rest after traversing 4 cm inside it. What velocity is needed for traversing a distance of 6 cm in the same block?**

(1) 104.3 cm/s (2) 136.2 cm/s (3) 244.9 cm/s (4) 272.7 cm/s

21. **A body starting from rest and moving with a constant acceleration, a body covers a certain distance in time t. It covers the second half of the distance in time.**

(1) $t\left(1-\frac{1}{\sqrt{3}}\right)$ (2) $t\left(1-\frac{1}{\sqrt{2}}\right)$ (3) $\frac{t}{\sqrt{3}}$ (4) $\frac{t}{\sqrt{2}}$

22. **A body starts from rest with a uniform acceleration. If its velocity after n seconds is v, then its displacement in the last two seconds is**

(1) $\frac{2v(n+1)}{n}$ (2) $\frac{v(n+1)}{n}$ (3) $\frac{v(n-1)}{n}$ (4) $\frac{2v(n-1)}{n}$

23. **A body travels 200 cm in the first two seconds and 220 cm in the next 4 seconds. What is the initial velocity of the body?**

(1) 15 cm/s (2) 115 cm/s (3) 215 cm/s (4) 315 cm/s

24. **A particle moves with constant acceleration such that its average velocities during time intervals t_1, t_2 and t_3 are v_1, v_2 and v_3 respectively. The ratio $(v_1 - v_2) : (v_2 - v_3)$ will be**

(1) $t_1 - t_2 : t_2 + t_3$ (2) $t_1 + t_2 : t_2 + t_3$ (3) $t_1 / t_2 : t_2 - t_3$ (4) $t_1 + t_2 : t_2 - t_3$

25. A body moves 6 m North. 8 m East and 10m vertically upwards, what is its resultant displacement from initial position?

(1) $10\sqrt{2}m$ (2) $10m$ (3) $\frac{10}{\sqrt{2}}m$ (4) $10 \times 2m$

26. A person moves 30 m North and then 20 m towards East and finally $30\sqrt{2}$ m in South-West direction. The displacement of the person from the origin will be

(1) 10 m along North (2) 10 m long South (3)10 m along West (4) Zero

27. A wheel of radius 1 meter rolls forward half a revolution on a horizontal ground. The magnitude of the displacement of the point of the wheel initially in contact with the ground is

(1) 2π (2) $\sqrt{2}\pi$ (3) $\sqrt{\pi^2 + 4}$ (4) π

28. One car moving on a straight road covers one third of the distance with 20 km/hr and the rest with 60 km/hr. The average speed is

(1) 40 km/hr (2) 80 km/hr (3) $46\frac{2}{3}$ km/hr (4)36 km/hr

29. A 150 m long train is moving with a uniform velocity of 45 km/h. The time taken by the train to cross a bridge of length 850 meters is

(1)56 sec (2) 68 sec (3)80 sec (4) 92 sec

30. The displacement x of a particle along a straight line at time t is given by $x = a_0 + a_1 t + a_2 t^2$. The acceleration of the particle is

(1) a_0 (2) a_1 (3) $2a_2$ (4) a_2

31. An electron starting from rest has a velocity that increases linearly with the time that is $v = kt$, where $k = 2m/\sec^2$. The distance travelled in the first 3 seconds will be

(1) 9 m (2) 16 m (3) 27 m (4) 36 m

32. A body is moving from rest under constant acceleration and let S_1 be the displacement in the first $(p-1)$ sec and S_2 be the displacement in the first $p\ \text{sec}$. The displacement in $(p^2-p+1)^{th}$ sec. will be

(1) S_1+S_2 (2) S_1S_2 (3) S_1-S_2 (4) S_1/S_2

33. A body starts from the origin and moves along the X-axis such that the velocity at any instant is given by $(4t^3-2t)$, where t is in sec and velocity in m/s. What is the acceleration of the particle, when it is 2 m from the origin?

(1) $28\ m/s^2$ (2) $22\ m/s^2$

(3) $12\ m/s^2$ (4) $10\ m/s^2$

34. An alpha particle enters a hollow tube of 4 m length with an initial speed of 1 km/s. It is accelerated in the tube and comes out of it with a speed of 9 km/s. The time for which it remains inside the tube is

(1) 8×10^{-3} s (2) $80\times10^{-3}\ s$

(3) $800\times10^{-3}\ s$ (4) $8\times10^{-4}\ s$

35. An elevator car, whose floor to ceiling distance is equal to 2.7 m, starts ascending with constant acceleration of 1.2 ms^{-2}. 2 sec after the start, a bolt begins fallings from the ceiling of the car. The free fall time of the bolt is

(1) $\sqrt{0.54}\ s$ (2) $\sqrt{6}\ s$

(3) 0.7 s (4) 1 s

36. Two trains travelling on the same track are approaching each other with equal speeds of 40 m/s. The drivers of the trains begin to decelerate simultaneously when they are just 2.0 km apart. Assuming the decelerations to be uniform and equal, the value of the deceleration to barely avoid collision should be

(1) 11.8 m/s^2 (2) 11.0 m/s^2

(3) 2.1 m/s^2 (4) 0.8 m/s^2

37. A particle moves along a straight line such that its displacement at any time t is given by $S = t^3 - 6t^2 + 3t + 4$ meters.The velocity when the acceleration is zero is

(1) $3ms^{-1}$ (2) $-12ms^{-1}$

(3) $42ms^{-1}$ (4) $-9ms^{-1}$

38. The x and y coordinates of a particle at any time t are given by $x = 7t + 4t^2$ and $y = 5t$, where x and y are in meter and t in seconds. The acceleration of particle at $t = 5$ s is

(1) Zero (2) $8\ m/s^2$

(3) 20 m/s^2 (4) 40 m/s^2

39. Two cars A and B at rest at same point initially. If A starts with uniform velocity of 40 m/sec and B starts in the same direction with constant acceleration of $4m/s^2$, then B will catch A after how much time

(1) 10 sec (2) 20 sec

(3) 30 sec (4) 35 sec

40. The relation $3t = \sqrt{3x} + 6$ describes the displacement of a particle in one direction where x is in meters and t in sec. The displacement, when velocity is zero, is

(1) 24 meters (2) 12 meters

(3) 5 meters (4) Zero

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

(1) 0.01 ms^{-2} (2) 0.02 ms^{-2}

(3) 0.03 ms^{-2} (4) 0.04 ms^{-2}

42. Equation of displacement for any particle is $s = 3t^3 + 7t^2 + 14t + 8m$. Its acceleration at time $t = 1$ sec is

(1) 10 m/s^2 (2) 16 m/s^2

(3) 25 m/s^2 (4) 32 m/s^2

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

(1) 4.0 m/s (2) 5.0 m/s

(3) 5.5 m/s (4) 4.8 m/s

44. The acceleration of a particle is increasing linearly with time t as bt . The particle starts from the origin with an initial velocity v_0 . The distance travelled by the particle in time t will be

(1) $v_0 t + \frac{1}{3}bt^2$ (2) $v_0 t + \frac{1}{3}bt^3$

(3) $v_0 t + \frac{1}{6}bt^3$ (4) $v_0 t + \frac{1}{2}bt^2$

Key

1) 1	2) 1	3) 1	4) 2	5) 4	6) 4	7) 1	8) 3
9) 1	10) 2	11) 3	12) 2	13) 1	14) 2	15) 4	16) 2
17) 3	18) 1	19) 1	20)	21) 2	22) 4	23) 2	24) 2
25) 1	26) 3	27) 3	28)4	29) 3	30) 3	31)1	32) 2
33) 2	34) 4	35)3	36) 4	37) 4	38) 2	39)2	40) 4
41) 2	42)4	43)1	44)3				

Hints

6. $\vec{V}=\vec{u}+\vec{a}t$

$$\vec{a}=\frac{\vec{V}-\vec{u}}{t}=\frac{2\vec{i}-4\vec{j}+5\vec{k}-2\vec{i}+2\vec{j}-3\vec{k}}{10}$$

$$\vec{a}=\frac{2\vec{k}-2\vec{j}}{10}=\frac{\vec{k}-\vec{j}}{5}$$

7. $\frac{2n-1}{n^2}=\frac{9}{25}$ n = 5

$6=\frac{1}{2}a\times1^2$ a = 12

$\therefore S=\frac{1}{2}\times12\times5^2=150\text{m}$

8. $V=\sqrt{\frac{u^2+v^2}{2}}=\sqrt{\frac{400+900}{2}}=\sqrt{650}$

9. $\frac{\left(\frac{u}{2}\right)^2-u^2=-2a,\ 15}{0-\left(\frac{u}{2}\right)^2=-2a.\ x}\quad\frac{\frac{1}{4}-1}{-\frac{1}{4}}=\frac{15}{x}$ x = 5 cm

10. $V^2=180-7x$ $2a=-7$ $a=-3.5\ \text{m/s}^2$

11. $t=\frac{t_1t_2}{t_1+t_2}=\frac{90\times60}{150}=36\ \text{s}$

12. During uniform retardation in successive seconds

9x, 7x, 5 x, 3x, 1x

4x = 8 x = 2 in last seconds

s = 3x + x = 4x

s = 4(2) = 8m

13. $t=\frac{d/\sqrt{2}}{V/\sqrt{2}}=\frac{d}{v}$

14. $x=\alpha t^3$ $y=\beta t^3$

$$V_x = \frac{dx}{dt} = 3\alpha t^2 \qquad V_y = \frac{dy}{dt} = 3\beta t^2$$

$$V = \sqrt{V_x^2 + V_y^2} = 3t^2\sqrt{\alpha^2 + \beta^2}$$

15. $a = \frac{V_{rel}^2}{2s} = \frac{(V_1 - V_2)^2}{2S}$

16. $3t = \sqrt{3x} + 6$

$\sqrt{3x} = 3t - 6$

$3x = 9t^2 - 36t + 36$

$x = 3t^2 - 12t + 12$

$\upsilon = 6t - 12$

At V = 0t = 2

At t = 0 S = 12

At t = 2 S = 0

Displaced = 12m

17. $V_{\max} = \alpha t_1 = \beta t_2$

$t_1 = \frac{V_{\max}}{\alpha}\ t_2 = \frac{V_{\max}}{\beta}$

$t = t_1 + t_2$

$t = \frac{V_{\max}}{\alpha} + \frac{V_{\max}}{\beta}$

$V_{\max} = \left(\frac{\alpha\beta}{\alpha + \beta}\right)t$

18. $s \propto t^2$

$s = ct^2$ (c is constant of proportionality)

$\frac{ds}{dt}$ =2tc and $\frac{d^2s}{dt^2}$ = 2 c, constant

19. V = u - at $\Rightarrow \frac{3u}{4}$ = at , t = $\frac{3u}{4a}$

20. $U^2 = 2as \quad U \text{ a} \sqrt{s}$

$$\frac{U_1}{U_2} = \sqrt{\frac{s_1}{s_2}} \qquad \Rightarrow \frac{200}{u_2} = \sqrt{\frac{4}{6}}$$

$$u_2 = \frac{200\sqrt{6}}{2} = 244.9 \text{ cm/sec}$$

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

$$\frac{S}{2} = \frac{1}{2} at_1^2 \quad t_1 = \frac{t}{\sqrt{2}}$$

Time for second half distance

$$t_2 = t - t_1 = t\left(1 - \frac{1}{\sqrt{2}}\right)$$

22. V = an

$$S_n = \frac{1}{2} an^2$$

$$S_{n-2} = \frac{1}{2} a (n-2)^2$$

$$S_n - S_{n-2} = \frac{1}{2} a (n^2 - n^2 - 4 + 4n)$$

$$= 2a (n-1) = \frac{2v(n-1)}{n}$$

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

200 = 2u + 2a

420 = 6u + 18a

On solving, we get

$$1380 = 12 \text{ u} \Rightarrow u = \frac{1380}{12} = 115 \text{ cm/s}$$

24. Acceleration = $\frac{change\ in \text{ velocity}}{total \text{ time takne}}$ = constant

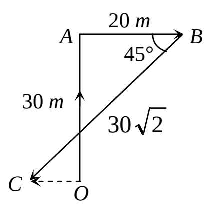
$$\frac{v_1 - v_2}{t_1 + t_2} = \frac{v_2 - v_3}{t_2 + t_3}$$

$$\frac{v_1 - v_2}{v_2 - v_3} = \frac{t_1 + t_2}{t_2 + t_3}$$

25 $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k} \quad \therefore r = \sqrt{x^2 + y^2 + z^2}$

$r = \sqrt{6^2 + 8^2 + 10^2} = 10\sqrt{2}\ m$

26. From figure, $\overrightarrow{OA} = 0\ \vec{i} + 30\ \vec{j}$, $\overrightarrow{AB} = 20\ \vec{i} + 0\ \vec{j}$

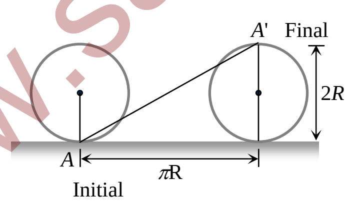


$\overrightarrow{BC} = -30\sqrt{2}\ cos45^o\vec{i} - 30\sqrt{2}\ \sin 45^o\vec{j} = -30\ \vec{i} - 30\ \vec{j}$

$\therefore$ Net displacement, $\overrightarrow{OC} = \overrightarrow{OA} + \overrightarrow{AB} + \overrightarrow{BC} = -10\ \vec{i} + 0\ \vec{j}$

$|\overrightarrow{OC}| = 10\ m.$

27. Horizontal distance covered by the wheel in half revolution = πR.



So the displacement of the point which was initially in contact with ground =

AA' = $\sqrt{(\pi R)^2 + (2R)^2}$

$= R\sqrt{\pi^2 + 4} = \sqrt{\pi^2 + 4}$ $\quad$ $(As\ R = 1m)$

28. Average speed $= \frac{\text{Total distance}}{\text{Total time}} = \frac{x}{t_1 + t_2}$

$$= \frac{x}{\frac{x/3}{v_1} + \frac{2x/3}{v_2}} = \frac{1}{\frac{1}{3\times 20} + \frac{2}{3\times 60}} = 36\ km/hr$$

29. Total distance to be covered for crossing the bridge

= length of train + length of bridge

$= 150\,m + 850\,m = 1000\,m$

$$\text{Time} = \frac{\text{Distance}}{\text{Velocity}} = \frac{1000}{45\times\frac{5}{18}} = 80\ sec$$

30. Acceleration $= \frac{d^2x}{dt^2} = 2a_2$

31. $S = \int_0^3 v\,dt = \int_0^3 kt\,dt = \left[\frac{1}{2}kt^2\right]_0^3 = \frac{1}{2}\times 2\times 9 = 9m$

32. From $S = ut + \frac{1}{2}a\,t^2$

$S_1 = \frac{1}{2}a(P-1)^2$ and $S_2 = \frac{1}{2}a\,P^2$ $\quad [As\ u = 0]$

From $S_n = u + \frac{a}{2}(2n-1)$

$$S_{(P^2-P+1)^{th}} = \frac{a}{2}\left[2(P^2-P+1)-1\right] = \frac{a}{2}\left[2P^2-2P+1\right]$$

It is clear that $S_{(P^2-P+1)^{th}} = S_1 + S_2$

33. $v = 4t^3 - 2t$

$\therefore\ a = \frac{dv}{dt} = 12t^2 - 2$

And $x = \int_0^t v\,dt = \int_0^t (4t^3 - 2t)\,dt = t^4 - t^2$

When particle is at 2m from the origin $t^4 - t^2 = 2$

$\Rightarrow t^4 - t^2 - 2 = 0 \quad (t^2-2)(t^2+1) = 0 \Rightarrow t = \sqrt{2}$ sec

Acceleration at $t = \sqrt{2}$ sec given by,

$a = 12t^2 - 2 = 12\times 2 - 2 = 22\ m/s^2$

34. $v^2 = u^2 + 2as \Rightarrow (9000)^2 - (1000)^2 = 2 \times a \times 4$

$\Rightarrow a = 10^7 m/s^2$ Now $t = \frac{v-u}{a}$

$\Rightarrow t = \frac{9000 - 1000}{10^7} = 8 \times 10^{-4}$ sec

35. $t = \sqrt{\frac{2h}{(g+a)}} = \sqrt{\frac{2 \times 2.7}{(9.8+1.2)}} = \sqrt{\frac{5.4}{11}} = \sqrt{0.49} = 0.7$ sec

As $u = 0$ and lift is moving upward with acceleration

36. Both trains will travel a distance of 1 km before to come in rest. In this case by using $v^2 = u^2 + 2as$

$\Rightarrow 0 = (40)^2 + 2a \times 1000 \Rightarrow a = -0.8\ m/s^2$

37. $v = \frac{ds}{dt} = 3t^2 - 12t + 3$ and $a = \frac{dv}{dt} = 6t - 12$

For $a = 0$, we have $t = 2$ and at $t = 2, v = -9\ ms^{-1}$

38. $a = \sqrt{a_x^2 + a_y^2} = \left[\left(\frac{d^2x}{dt^2}\right)^2 + \left(\frac{d^2y}{dt^2}\right)^2\right]^{\frac{1}{2}}$

Here $\frac{d^2y}{dt^2} = 0$. Hence $a = \frac{d^2x}{dt^2} = 8 m/s^2$

39. Let A and B will meet after time t sec. it means the distance travelled by both will be equal.

$S_A = ut = 40t$ and $S_B = \frac{1}{2}at^2 = \frac{1}{2} \times 4 \times t^2$

$S_A = S_B \Rightarrow 40t = \frac{1}{2}4t^2 \Rightarrow t = 20$ Sec

40. $3t = \sqrt{3x} + 6 \Rightarrow 3x = (3t-6)^2$

$\Rightarrow x = 3t^2 - 12t + 12$

$v = \frac{dx}{dt} = 6t - 12$, for $v = 0, t = 2$ sec

$x = 3(2)^2 - 12 \times 2 + 12 = 0$

41. $\text{Time} = \frac{\text{Distance}}{\text{Average velocity}} = \frac{3.06}{0.34} = 9$ sec

Acceleration $= \frac{\text{Change in velocity}}{\text{Time}} = \frac{0.18}{9} = 0.02\ m/s^2$

42. $s = 3t^3 + 7t^2 + 14t + 8\ m$

$a = \frac{d^2s}{dt^2} = 18t + 14$ at $t = 1\ \text{sec} \Rightarrow a = 32 m/s^2$

43. If t_1 and $2t_2$ are the time taken by particle to cover first and second half distance respectively.

$t_1 = \frac{x/2}{3} = \frac{x}{6}$ …(i)

$x_1 = 4.5\ t_2$ and $x_2 = 7.5\ t_2$

So, $x_1 + x_2 = \frac{x}{2} \Rightarrow 4.5t_2 + 7.5t_2 = \frac{x}{2}$

$t_2 = \frac{x}{24}$ …(ii)

Total time $t = t_1 + 2t_2 = \frac{x}{6} + \frac{x}{12} = \frac{x}{4}$

So, average speed $= 4\ m/sec$.

44. $\frac{dv}{dt} = bt \Rightarrow dv = bt\ dt \Rightarrow v = \frac{bt^2}{2} + K_1$

At $t = 0, v = v_0 \Rightarrow K_1 = v_0$

We get $v = \frac{1}{2}bt^2 + v_0$

Again $\frac{dx}{dt} = \frac{1}{2}bt^2 + v_0 \Rightarrow x = \frac{1}{2}\frac{bt^3}{3} + v_0 t + K_2$

At $t = 0,\ x = 0 \Rightarrow K_2 = 0$

$\therefore x = \frac{1}{6}bt^3 + v_0 t$