doubtnut
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PHYSICS

BOOKS - AAKASH SERIES

MOTION IN A STRAIGHT LINE

PROBLEM

1. A particle is at $x = +5$ m at $t = 0$, $x = -7$ m at $t = 6$ s and $x = +2$ at $t = 10$s. Find the average velocity of the particle during the intervals

(a) $t=0$ to $t=6$s

(b)t=6s to 6=10s

(c) t=0 to t=10s .

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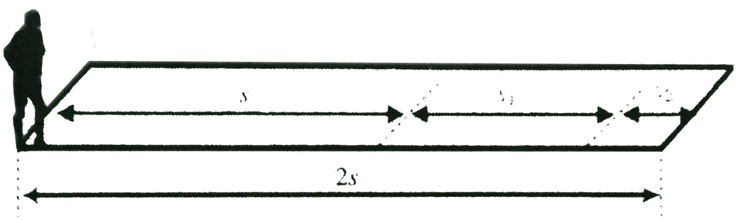
2. A man traversed half the distance with a velocity v_0. The remaining part of the distance was covered with velocity v_1. For half the time and with velocity v_2 for the other half of the time . Find the average speed of the man over the whole time of motion.



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

a. relative velocity of B with respect to A?

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

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4. The displacement x of a particle at the instant when its velocity v is given by $v = \sqrt{3x + 16}$. Find its acceleration and initial velocity

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5. If S_n=2+0.4n find initial velocity and acceleration

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6. A body starts from rest and moves with uniform acceleration of $5ms^{-2}$ for 8 seconds. From that time the acceleration ceases. Find the distance covered in 12s starting from rest.

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7. The two ends of a train moving with uniform acceleration pass a certain point with velocity u and v. Find the velocity with which the middle point of the train passes the same point.

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8. A scooter can produce a maximum acceleration of $5ms^{-2}$. Its brakes can produce a maximum retardation of 10ms^{-2}. The minimum time in which it can cover a distance of 1.5 km is ?

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9. The speed of a train is reduced from 60 km/h, to 15 km/h, while it travels a distance of 450 m. If the retardation is uniform, find how much further it will travel before coming to rest ?

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10. A bullet loses $1/20$ of its velocity in passing through a plank. What is the least number of plank required to stop the bullet .

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11. A body covers 100 cm in first 2 seconds and 128 cm in the next four seconds moving with constant acceleration. Find the velocity of the body at the end of 8 sec ?

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12. A car is moving with a velocity of 20 m/s. The driver sees a stationary truck ahead at a distance of 100 m. After some reaction time Δt the brakes are applied producing a retardation of $4m/s^2$? What is the maximum reaction time to avoid collision ?

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13. A bus starting from rest, accelerates at the rate of f through a distance S, then continues at constant speed for time t and declerates at the rate f/2 to come to rest. If the total distance travelled is 15 S then S =

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14. A driver can stop his car from the red signal at a distance of 20 m when he is driving at 36 kmph and 41.25 m when he is driving at 54 kmph. Find his reaction time.

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15. A car starts from rest and moves with uniform acceleration 'a', At the same instant from the same point a bike crosses with a uniform velocity 'u'. When and where will they meet ? What is the velocity of car with respect to the bike at the time of meeting?

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16. Two bodies start moving in the same straight line at the same instant of time from the same origin. The first body moves with a constant velocity of $40ms^{-1}$, and the second starts from rest with a constant acceleration of $4ms^{-2}$.Find the time that elapses before the second catches the first body. Find the also the greatest distance between them prior to it and time at which this occurs.

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17. Two trains one travelling at 54 kmph and the other at 72 kmph are headed towards one an other along a straight track. When they are $\frac{1}{2}$ km apart, both drivers simultaneously see the other train and apply their brakes. If each train is decelerated at the rate of $1ms^{-2}$, will there be collision ?

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18. In a car race, car A takes a time t less than car B at the finish and passes the finishing point with speed v more than that of the car B. Assuming that both the cars start from rest and travel with constant acceleration a_1 and a_2 respectively. Show that $v = \sqrt{a_1 a_2} t$.

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19. A particle moving along a straight line with initial velocity u and acceleration a continues its motion for n seconds. What is the distance covered by it in the last n^{th} second ?

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20. A bus accelerates from rest at a constant rate α for some time, after which it decelerates at a constant rate β to come to rest. If the total time elapsed is t seconds then, evaluate.

(a)the maximum velocity achieved and (b)the total distance travelled graphically.

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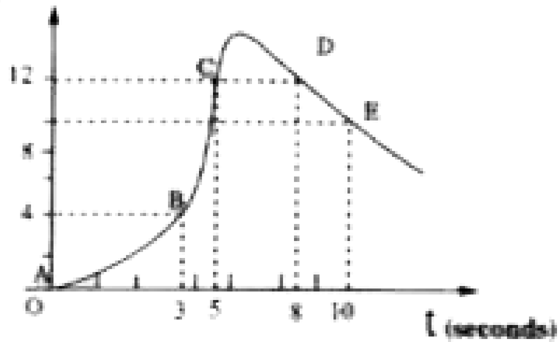
21. Figure shows the motion of a particle along a straight line. Find the average velocity of the particle during the intervals

(a)A to E , (b) B to E, (c) C to E , (d) D to E , (e) C to D .



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22. Velocity-time graph for the motion of a certain body is shown in fig.Explain the nature of this motion

.Find the initial velocity and acceleration and write the equation for the variation of displacement with time.What happens to the moving body at point B? How will the body move after this moment?

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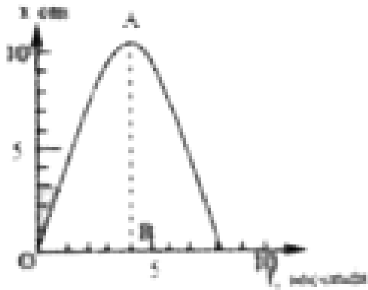
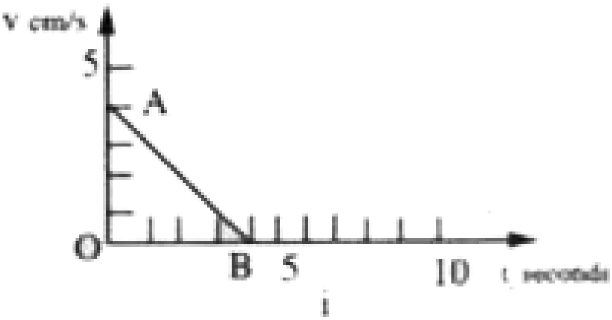
23. The graphs in (i) and (ii) show the S-t graph and V -t graph of a body. Are the motions shown in the graphs represented by OAB the same ?

(i)



(ii)



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

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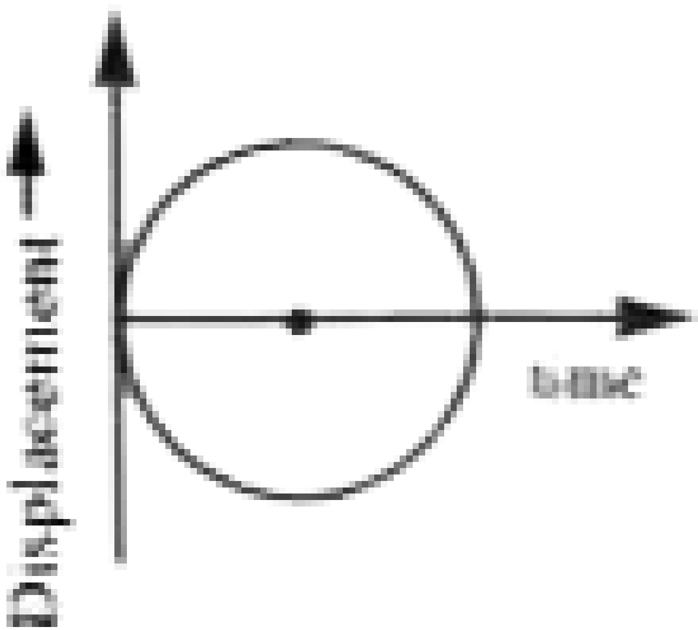
25. Figure given here shows the displacement time graph for a particle. Is it practically possible ? Explain.



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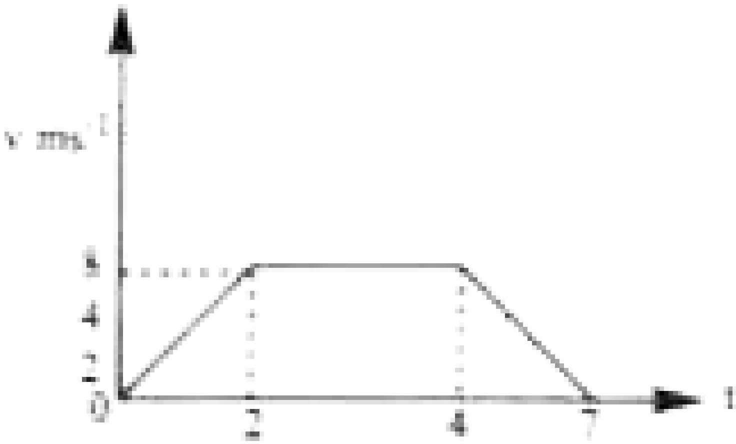
26. Figure given here shows the variation of velocity of a particle with time.



Find the following:

(i) Displacement during the time intervals.

(a) 0 to 2 sec., (b) 2 to 4 sec. and (c) 4 to 7 sec

(ii) Accelerations at

(a)$t = 1$ sec, (b) $t = 3$ sec. and (c)$t = 6$ sec.

(iii) Average acceleration

(a) between t = 0 to t = 4 sec.

(b) between t = 0 to t = 7 sec.

(iv) Average velocity during the motion.

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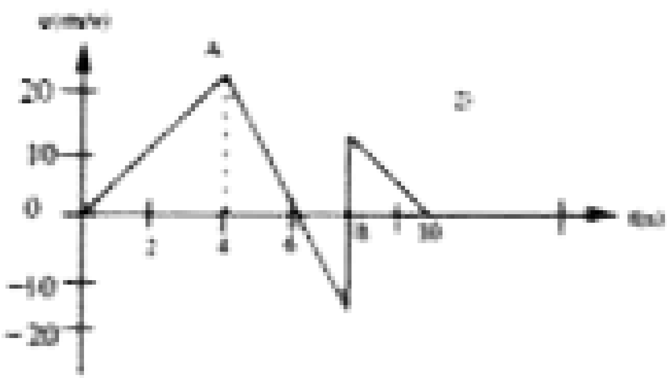
27. The velocity-time graph of a body moving in a straight line is shown in Fig. Find the displacement and distance travelled by the body in 10 sec.



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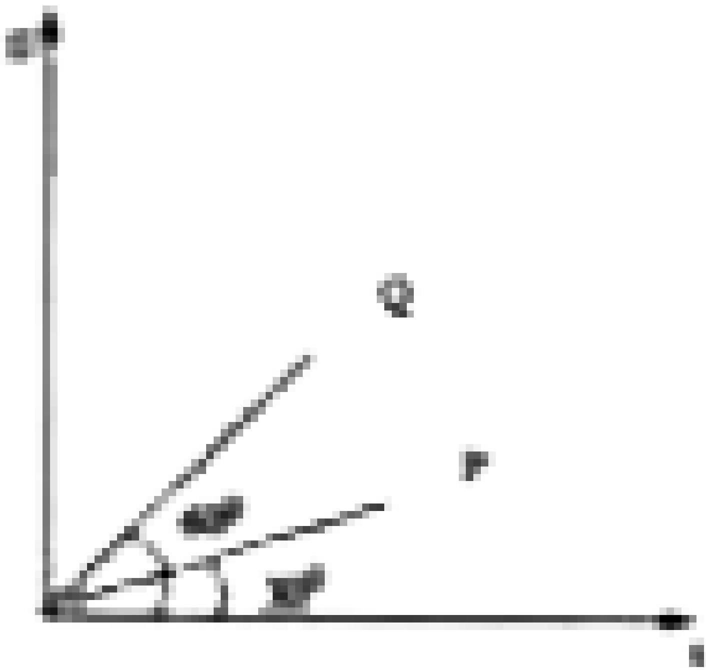
28. The displacement-time graphs of two particles P and Q are as shown in the figure. The ratio of their velocities V_P and V_Q will be



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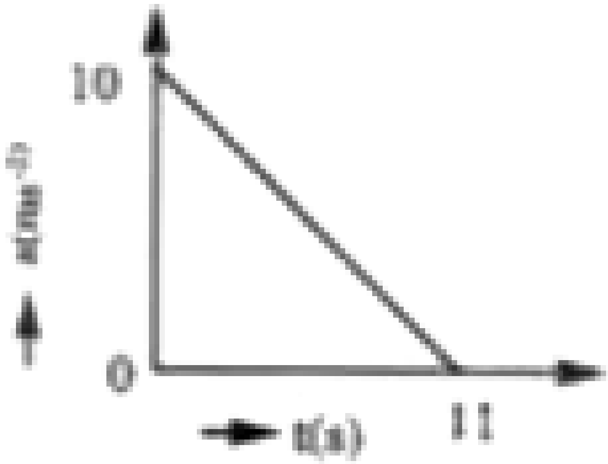
29. The a -t graph is shown in the figure. The maximum velocity attained by the body from rest will be



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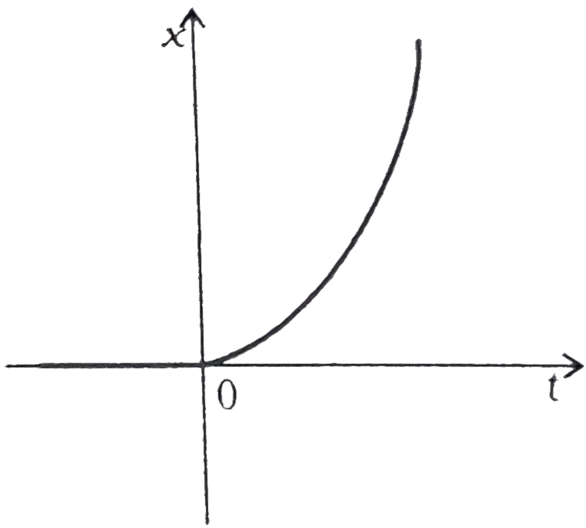
30. Figure 3.21 shows the $x - t$ plot of one-dimensional motion of a particle. Is it correct to say from the graph that the particle moves in a straight line for $t < 0$ and on a parabolic path for $t > 0$? If not, suggest a suitable physical context for this graph.



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

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32. The motion of a particle along a straight line is described by the function $s = 6 + 4t^2 - t^4$ in SI units. Find the velocity, acceleration, at t = 2s, and the average velocity during 3^{rd} second.

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33. A particle moves according to the equation $t = \sqrt{x} + 3$, where will be the particle come to the rest for the first time

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34. The velocity of a particle moving in the positive direction of the X-axis varies as $V = K\sqrt{S}$ where K is a positive constant. Draw V-t graph.

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35. A point moves rectilinearly with deceleration whose modulus depends on the velocity v of the particle as $\alpha = k\sqrt{v}$, where k is a positive constant. At the initial moment the velocity of the point is equal to V_0. What distance will it take to cover that distance?

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36. A body is projected vertically up with velocity u from a tower. It reaches the ground with velocity nu.

The height of the tower is $H = \frac{u^2}{2g}(n^2 - 1)$

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37. Two bodies begin to fall freely from the same height but the second falls T second after the first. The time (after which the first body begins to fall) when the distance between the bodies equals L is:

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38. For a freely falling body, Find the ratio of the times taken to fall successive equal distances.

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39. If a freely falling body covers half of its total distance in the last second of its journey, Find its time of fall.

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

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41. A rocket is fired vertically upwards with a net acceleration of $4m/s^2$ and initial velocity zero. After $5s$ its fuel is finished and it decelerates with g. At the highest point its velocity becomes zero. Then, it accelerates downwards with acceleration g and return back to ground. Plot velocity-time and displacement -time graphs for the complete journey. Take $g=10m/s^2$.

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42. A ball is thrown upward with an ini tial velocity of 100ms^{-1}. After how much time will it return ? Draw velocity - time graph for the ball and find from the graph (i) the maximum height attained by the ball and (ii) height of the ball after 15 s. Take $g = 10ms^{-2}$

.

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43. A stone is allowed to fall from the top of a tower 300 m height and at the same time another stone is projected vertically up from the ground with a velocity $100ms^{-1}$. Find when and where the two stones meet ?

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44. Ball A dropped from the top of a building. A the same instant ball B is thrown vertically upwards from the ground. When the balls collide, they are moving in opposite directions and the speed of A is twice the speed of B. At what fraction of the height of the building did the collision occur?

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45. An object falls from a bridge which is 45 m above the water. It falls directly into a small row - boat moving with constant velocity that was 12m from the point of impact when the object was released. What was the speed of the boat ?

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46. Two balls are dropped to the ground from different heights. One ball is dropped 2s after the other, but both strike the ground at the same time 5s after the Ist is dropped.

(a) What is the difference in the heights from which they were dropped ?

(b) From what height was the first ball dropped?

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47. Drop of water fall at regular intervals from roof of a building of height (H=16 m), the first drop striking the ground at the same moment as the fifth drop falls from the roof. The distances between separate drops in air as the first drop reaches the ground are.

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48. If an object reaches a maximum vertical height of 23.0 m when thrown vertically upward on earth how high would it travel on the moon where the acceleration due to gravity is about one sixth that on the earth ? Assume that initial velocity is the same.

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49. An elevator ascends an upward acceleration of 0.2 m/s2. At the instant it upwards speed in 3m/sec a loose bolt 5 m high form the floor drops from the ceiling of the elevator.Find the time until the bolt strikes the floor and the displacement it has fallen .

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50. A body falls freely from a height of 125m $(g = 10m/s^2)$ after 2 sec gravity ceases to act Find the time taken by it to reach the ground?

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51. A parachutist drops freely from an aeroplane for 10 seconds before the parachute opens out.Then he descends with a net retardation of $2m/\sec^2$. His velocity whe he reaches the ground is 8m/sec.Find the height at which he get out of the aeroplane?

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52. A stone is dropped into a well and the sound of splash is heard after 5.3 sec. If the water is at a depth of 122.5 m from the ground, the velocity of sound in air is

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53. A body is thrown vertically up with a velocity of 100 m/s and another one is thrown 4 sec after the first one. How long after the first one is thrown will they meet?

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54. A ball is thrown vertically upward with a velocity 'u' from the balloon descending with velocity v. After what time, the ball will pass by the balloon ?

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55. A ball dropped from the 9th story of a multi - storeyed building reaches the ground in 3 second. In the first second of its free fall, it passes through storeys, where n is equal to (Take $g = 10ms^{-2}$)

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56. A stone is dropped into water from a bridge 44.1 m above the water. Another stone is thrown vertically downward 1 s later. Both strike the water simultaneously. What was the initial speed of the second stone?

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57. A ball is dropped from the top of a building .It takes 0.5 s to fall past the 3m length of a window some distance from the top of the building .If the velocity of the ball at the top and at the bottom of the window are V_T and V_B respectively then $V_T + V_B = ?$

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58. A ball is thrown vertically upwards with a velocity of $20ms^{-1}$ from the top of a multistorey building. The height of the point from where the ball is thrown is 25.0 m from the ground. (a) How high will the ball rise ? and (b) how long will it be before the ball hits the ground ? Take $g = 10ms^{-2}$.

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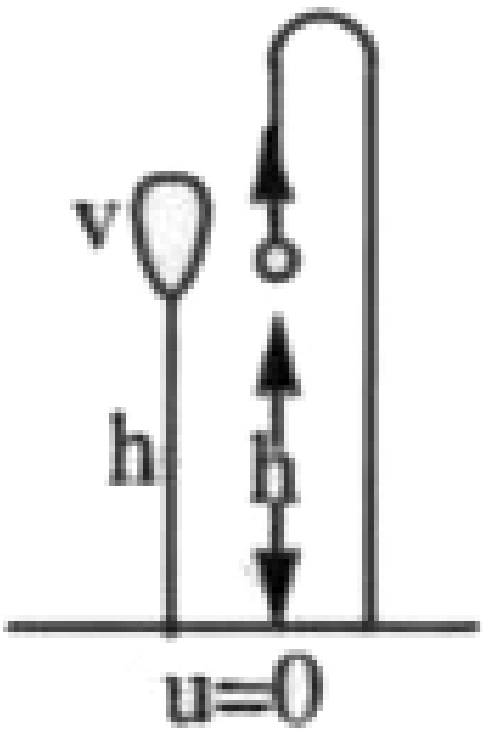
59. A balloon starts from rest from the ground and moves with uniform acceleration g/8. When it reaches a height h a ball is dropped from it. Find the time taken by the ball to reach the ground.



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EXERCISE -I

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

A. unity

B. unity or less than 1

C. unity or more

D. less than unity

Answer: B

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2. A person travelling on a straight line moves with a uniform velocity v_1 for a distance x and with a uniform velocity v_2 for the next equal distance. The average velocity v is given by

A. $v = \frac{v_1 + v_2}{2}$

B. $v = \sqrt{v_1 v_2}$

C. $\frac{2}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

D. $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

Answer: C

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3. A lift is coming from 8th floor and is just about to reach 4th floor. Taking ground floor as origin and positive direction upwards for all quantities, which one of the following is correct ?

A. $x < 0, v < 0, a > 0$

B. $x > 0, v < 0, a < 0$

C. $x > 0, v < 0, a > 0$

D. $x > 0, v > 0, a < 0$

Answer: A

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4. Which of following statements is incorrect?

A. Path length is a scalr quantity whereas displacement is a vector quantity

B. The magnitude of displacement is always equal to the path length traversed by an object over a given time interval

C. The displacement depends only on the end points whereas path length depends on the actual path followed.

D. The path length is always positive whereas displacement can be possitive, negative and zero.

Answer: B

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5. (A) : A body can have acceleration even if its velocity is zero at a given instant of time.

(r) : A body is momentarily at rest when it reverses its direction of motion.

A. Both (Assertion) and (Reason) are true and (Reason) is the correct explanation of (Assertion)

B. Both (Assertion) and (Reason) are true and (Reason) is not the correct explanation of (Assertion)

C. (Assertion) is true but (Reason) is false

D. (Assertion) is false but (Reason) is true

Answer: A

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6. The displacement of a particle starts from rest is proportional to the square of time, then the particle travels with

A. uniform acceleration

B. uniform velocity

C. increasing acceleration

D. decreasing velocity

Answer: A

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7. (Assertion) :A body may be accelerated even when it is moving at uniform speed.

(Reason) : When direction of motion of the body is changing then body may have acceleration.

A. Both (Assertion) and (Reason) are true and (Reason) is the correct explanation of (Assertion)

B. Both (Assertion) and (Reason) are true and (Reason) is not the correct explanation of (Assertion)

C. (Assertion) is true but (Reason) is false

D. (Assertion) is false but (Reason) is true

Answer: A

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8. What determines the nature of the path followed by the particle

A. speed

B. velocity

C. acceleration

D. none of these

Answer: B

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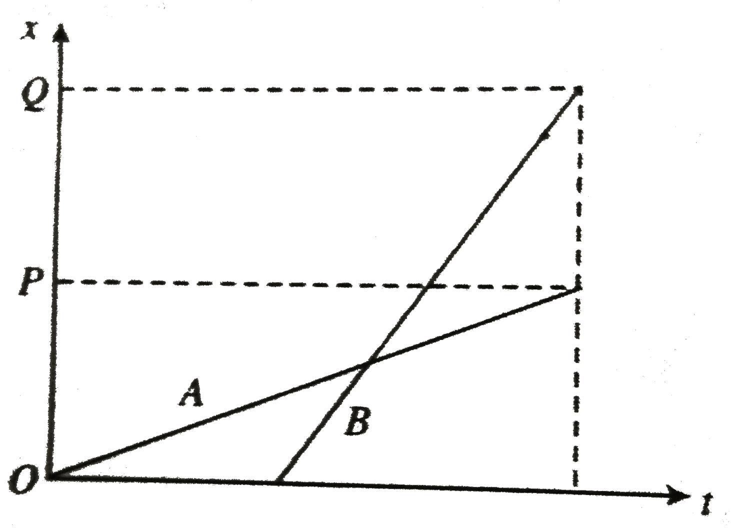
9. The position-time (x-t) graphs for two children A and B returning from their school O to their homes

P and Q, respectively, are shown in . Choose the correct entries in the brackets



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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).

A. A lives closer to the school than B.

B. A starts from the school earlier than B.

C. A walks faster than B.

D. A and B reach home at the same time.

Answer: C

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10. At time t = 0, two bodies A and B at the same point. A moves with constant velocity v and B starts from rest and moves with constant acceleration. Relative velocity of B w.r.t. A when the bodies meet each other is

A. $\frac{V}{2}$

B. $\frac{V}{3}$

C. V

D. 2V

Answer: C

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11. Two bodies of different masses are dropped similtaneously from the top of a tower .If air resistance is proportional to the mass of the body.

A. the heavier body reaches the ground earlier

B. the lighter body reaches the ground earlier

C. both reach the ground simultaneously

D. cannot be decided

Answer: A

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12. At a metro station, a girl walks up a stationary escalator in time t_1. If she remains stationary on the escalator, then the escalator take her up in time t_2. The time taken by her to walk up on the moving escalator will be

A. $(t_1 + t_2) / 2$

B. $t_1 t_2 / (t_2 - t_1)$

C. $t_1 t_2 / (t_2 + t_1)$

D. $t_1 - t_2$

Answer: C

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13. Two bodies of different masses are dropped simultaneously from the top of a tower. If air resistance is same on both of them,

A. the heavier body reaches the ground earlier

B. the lighter body reaches the ground earlier

C. both reach the ground simultaneously

D. cannot be decided

Answer: C

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14. The acceleration of a moving body can be found from

A. Area under velocity-time graph

B. Area under distance-time graph

C. Slope of the velocity-time graph

D. Slope of distance-time graph

Answer: B

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15. A body falls freely from a height 'h' its average velocity when it reaches earth is

A. $\sqrt{gh}$

B. $\sqrt{\frac{gh}{2}}$

C. $\sqrt{2gh}$

D. $g\sqrt{h}$

Answer: B

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16. For a moving body at any instant of time

A. If the body is not moving, the acceleration is necessarily zero.

B. If the body is slowing, the retardation is negative

C. If the body is slowing, the distance is negative.

D. If displacement, velocity and acceleration at that instant are known, we can find the displacement at any given time in future.

Answer: D

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17. A body falls freely from a height 'h' after two seconds if accelaration due to gravity is reversed the body

A. continues to fall down

B. falls down with retardation & goes up again with acceleration after some time

C. falls down with uniform velocity

D. raises up with acceleration

Answer: B

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18. A body falls freely from a height 'h' after two seconds if we assume that gravity disappears the body

A. continues to fall down with uniform velocity

B. falls down with acceleration

C. falls down & floats

D. falls down with declaration.

Answer: A

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19. For a freely falling body

A. the changes of position are equal in equal intervals of time

B. the changes of velocity are equal in unequal intervals of time

C. the changes of acceleration is zero in equal or unequal intervals of time

D. None

Answer: C

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20. A hydrogen balloon released on the moon from a height will

A. move up with acceleration 9.8ms^{-2}

B. move down with acceleration 9.8 ms^{-2}

C. move down with acceleration $\frac{9.8}{6}\text{ms}^{-2}$

D. neither move up nor move down

Answer: C

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21. A freely falling body traveled xm in n^{th} second distance travelled in $n-1^{th}$ second is

A. x

B. x+g

C. x-g

D. 2x+3g

Answer: C

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22. A body is projected up with a velocity 50ms^{-1} after one second if accelaration due to gravity disappears then body

A. floats in air

B. continue to move up with constant velocity

C. continue to move up with acceleration

D. goes up and falls down

Answer: B

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23. A stone is released from an elevator going up with an acceleration a. The acceleration of the stone after the release is

A. a upward

B. (g - a) upward

C. (g - a) downward

D. g downward

Answer: D

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24. From a building two balls A and B are thrown such that A is thrown upwards and B downwards with the same speed (both vertically). IF v_A and v_B are their respective velocities on reaching the ground then,

A. $v_A = v_B$ and $t_A = t_B$

B. $v_A > v_B$ and $t_A > t_B$

C. $v_A = v_B$ and $t_A > t_B$

D. $v_A < v_B$ and $t_A < t_B$

Answer: C

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25. At the maximum height of a body thrown vertically up

A. velocity is not zero but acceleration is zero

B. acceleration is not zero but velocity is zero

C. both acceleration and velocity are zero

D. both acceleration and velocity are not zero

Answer: B

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26. A body thrown vertically up with velocity u reaches the maximum height h after T seconds. Which of the following statements is true ?

A. At a height $\frac{h}{2}$ from the ground its velocity is $\frac{u}{2}$

B. At a time T its velocity is u

C. At a time 2T its velocity is u directed downwards

D. none of the above

Answer: C

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27. A balloon rases up with uniform velocity 'u'. A body is dropped from ballon. The time of descent for the body is given by is

A. $\sqrt{\frac{2h}{g}}$

B. $h = ut + \frac{1}{2}gt^2$

C. $h = -ut + \frac{1}{2}gt^2$

D. $-h = ut + \frac{1}{2}gt^2$

Answer: C

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28. In the above problem if body is thrown down with velocity 'u' the equation for the descent time is

A. $h = \frac{1}{2}gt^2$

B. $h = ut + \frac{1}{2}gt^2$

C. $-h = -ut + \frac{1}{2}gt^2$

D. $-h = -ut + \frac{1}{2}gt^2$

Answer: B

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29. From the top of a tower two bodies are projected with the same intital speed of 40 ms^{-1} ,first body vertically upwards and second body vertically downwards .A third body is freely released from the top of the tower.If their respective times of flights are T_1, T_2 and T_3 Identify the correct descending order of the times of flights

A. T_1, T_2, T_3

B. T_2, T_3, T_1

C. T_2, T_1, T_3

D. T_1, T_3, T_2

Answer: D

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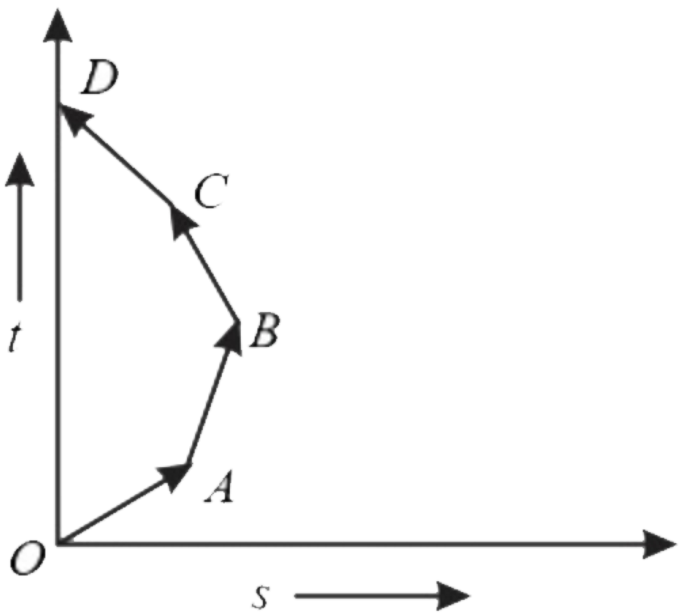
30. Which of the following options is correct for the object having a straight line motion represented by the following graph ?



A. The object moves with constantly increasing velocity from O to A then it moves with constant velocity.

B. Velocity of the object increases uniformly.

C. Average velocity is zero.

D. The graph shown is impossible.

Answer: C

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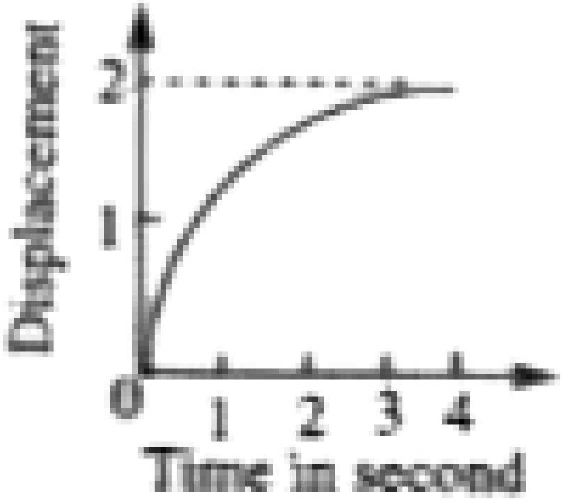
31. The displacement of a particle as a function of time is shown in the figure. The figure shows that



A. The particle starts with certain velocity but the motion is retarded and finally the particle stops

B. The velocity of the particle is constant throughout

C. The acceleration of the particle is constant throughout

D. The particle starts with constant velocity, then motion is accelerated and finally the particle moves with another constant velocity.

Answer: A

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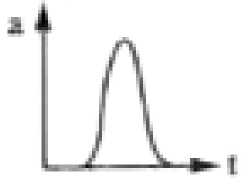
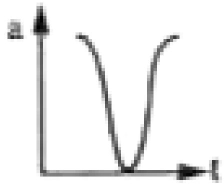
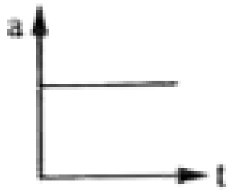
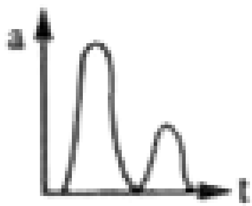
32. A uniformly moving cricket balls is hit with a bat for a very short time and is turned back. Show that variation of its acceleration with time taking the acceleration in the backward direction as positive.

A. 

B. 

C. 

D. 

Answer: A

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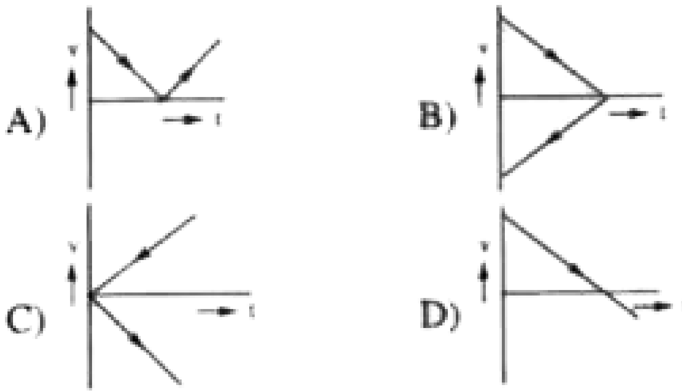
33. A ball is thrown vertically upwards. Which of the following graph/graphs represent velocity-time graph of the ball during its flight (air resistance is neglected)



A. A

B. B

C. C

D. D

Answer: B

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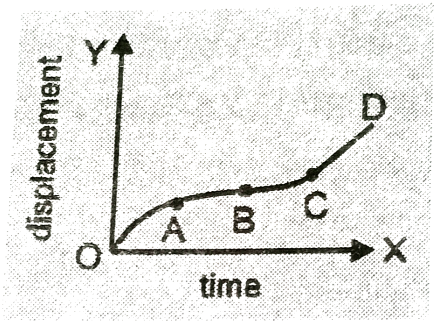
34. The graph between the displacement x and time t for a particle moving in a straigh lin ais shown in figure. During the internal OA,AB,BC and CD, the acceleration of the particle is:



	OA,	AB,	BC,	CD
(1)	+	0	+	+
(2)	–	0	+	0
(3)	+	0	–	+
(4)	–	0	–	0

A. $\begin{array}{cccc} OA & AB & BC & CD \\ + & 0 & + & + \end{array}$

B. $\begin{array}{cccc} OA & AB & BC & CD \\ - & 0 & + & 0 \end{array}$

C. $\begin{array}{cccc} OA & AB & BC & CD \\ + & 0 & - & + \end{array}$

D. $\begin{array}{cccc} OA & AB & BC & CD \\ - & 0 & - & 0 \end{array}$

Answer: B

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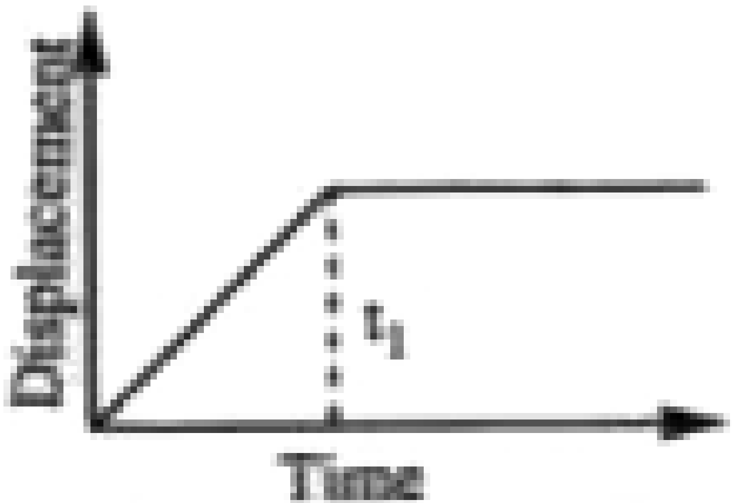
35. The x-t graph shown in figure represents



A. constant velocity

B. velocity of the body is continuously changing

C. instantaneous velocity

D. the body travels with constant speed up to time t_1 and then stops

Answer: D

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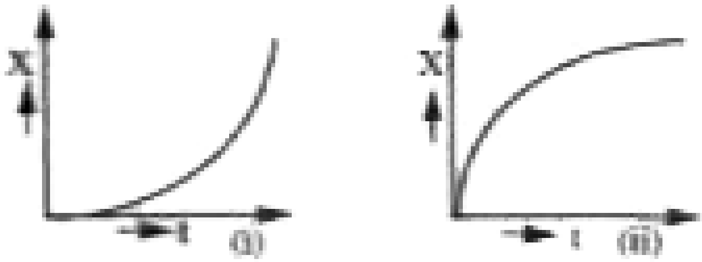
36. Figures (i) and (ii) below show the displacement - time graphs of two particles moving along the x-axis.

We can say that



A. both the particles are having uniformly accelerated motion.

B. both the particles are having a uniformly retarded motion.

C. particle (i) is having a uniformly accelerated motion while particle (ii) is having a uniformly retarded motion.

D. particle (i) is having a uniformly retarded motion while particle (ii) is having a uniformly accelerated motion.

Answer: C

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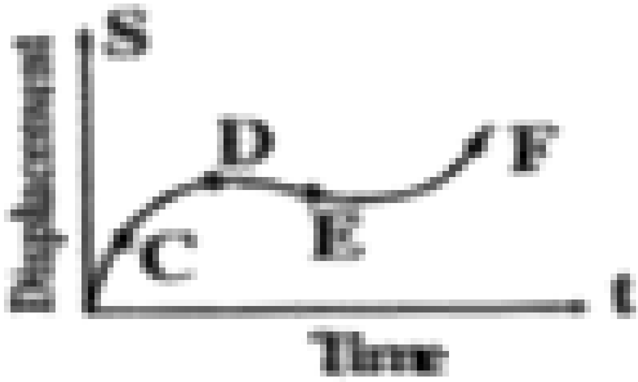
37. The displacement time graph of moving particle is shown below.



The instantaneous velocity of the particle is negative at the point.

A. D

B. F

C. C

D. E

Answer: D

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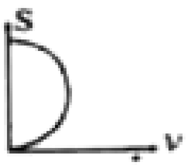
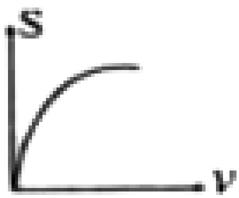
38. An object is moving with a uniform acceleration which is parallel to its instantaneous direction of motion. The displacement velocity (v) graph of this object is

A. 

B. 

C. 

D. 

Answer: C

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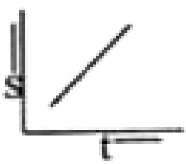
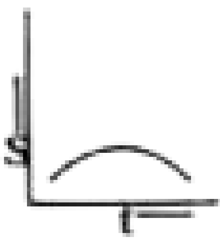
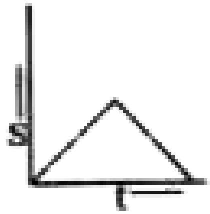
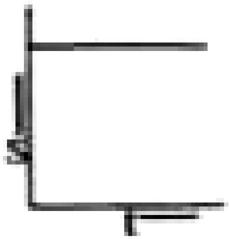
39. Which of the following graph represents uniform motion

A. 

B. 

C. 

D. 

Answer: A

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40. The area under acceleration-time graph gives

A. Distance travelled

B. Change in acceleration

C. Force acting

D. Change in velocity

Answer: D

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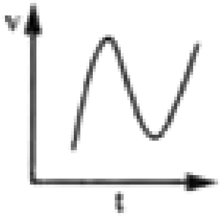
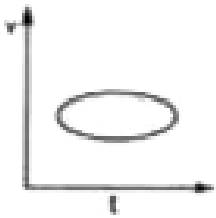
41. Which of the following velocity-time graphs shows a realistic situation for a body motion?

A. 

B. 

C. 

D. 

Answer: B

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42. Consider the motion of the tip of the minute hand of a clock. In one hour

(a) the displacement is zero

(b) the distance covered is zero

(c) the average speed is zero

(d) the average velocity is zero

A. a & b are correct

B. a, b & c are correct

C. a & d are correct

D. b,c & d are correct

Answer: C

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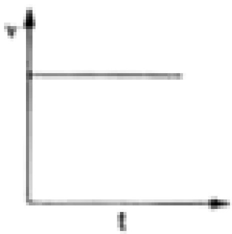
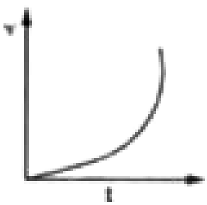
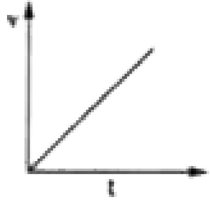
43. Which of the following velocity-time graphs represent uniform motion

A. 

B. 

C. 

D. 

Answer: A

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44. A particle moves along x-axis and its x-coordinate changes with time as $x = u(t-2) + a(t-2)^2$

A. a & b are correct

B. b & c are correct

C. a & c are correct

D. c & d are correct

Answer: D

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45. An object may have

(a) varying speed without having varying velocity

(b) varying velocity without having varying speed

(c) nonzero acceleration without having varying velocity

(d) nonzero acceleration without having varying speed.

A. a, b & c are correct

B. b & d are correct

C. a, b & d are correct

D. a & d are correct

Answer: B

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46. Mark the correct statements for a particle go ing on a straight line:

(a) If the velocity and acceleration have opposite sign, the object is slowing down.

(b) If the position and velocity have opposite sign, the particle is moving towards the origin.

(c) If the velocity is zero at an instant, the acceleration should also be zero at that instant.

(d) If the velocity is zero for a time interval, the acceleration is zero at any instant within the time interval.

A. a, b & c are correct

B. b & d are correct

C. a, b & d are correct

D. all are correct

Answer: C

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47. The velocity of a particle is zero at $t = 0$.

(a) The acceleration at $t = 0$ must be zero.

(b) The acceleration at $t = 0$ may be zero.

(c) If the acceleration is zero from $t = 0$ to $t = 10 s$, the speed is also zero in this interval.

(d) If the speed is zero from $t = 0$ to $t = 10$ s the acceleration is also zero in this interval.

A. a, b & d are correct

B. b,c & d are correct

C. a, c & d are correct

D. a, b & c are correct

Answer: B

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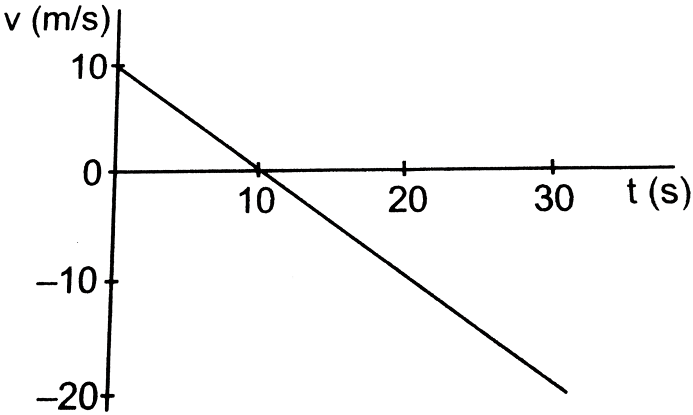
48. The velocity time plot for a particle moving on straight line is shown in the figure.



A. a & b are correct

B. b & c are correct

C. c & d are correct

D. a & d are correct

Answer: D

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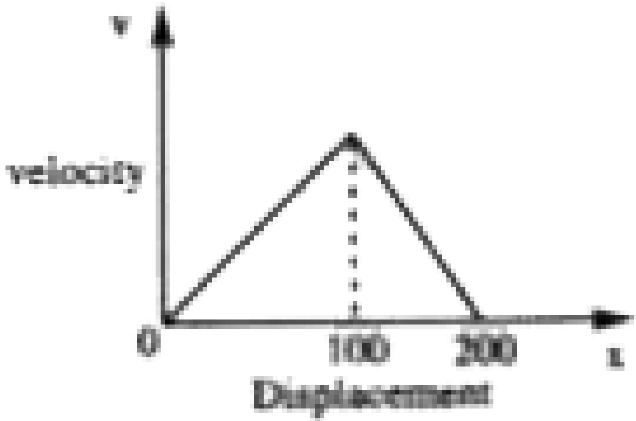
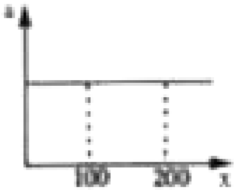
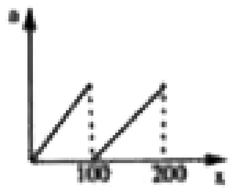
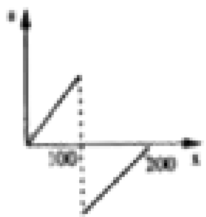
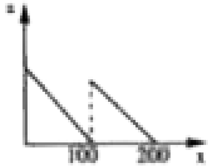
49. Velocity (v) versus displacement (x) plot of a body moving along a straight line is as shown in the graph. The corresponding plot of acceleration (a) as a function of displacement (x) is



A. 

B. 

C. 

D. 

Answer: C

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50. Following are four different relation about displacement,velocity and acceleration for the motion of a particle in general.Choose the incorrect one (S).

a) $V_{av} = \frac{1}{2}[v(t_1) + v(t_2)]$

b)$V_{av} = \frac{r(t_2) - r(t_2)}{t_2 - t_1}$

c)r=$\frac{1}{2}(v(t_2) - v(t_1)(t_2 - t_1)$

d)$a_{av} = \frac{v(t_2) - v(t_1)}{t_2 - t_1}$

A. a and b

B. a and d

C. b and c

D. a and c

Answer: D

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51. For an object moving with uniform acceleration, travelling 50m in 5th sec, 70m in 7th sec.

(a)Its initial velocity is 5 m/s

(b) Its acceleration is $20\text{m}/\text{s}^2$

(c)Its travels 100 m in 9th sec

(d) Its average velocity during 9th sec is 90 m/s

A. a is true

B. a & d are true

C. a & b are true

D. a & c are true

Answer: B

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52. A body projected vertically with a velocity 'u' from the ground. Its velocity (a)At half of maximum height u/2

b) At $3/4^{th}$ of maximum height $\frac{u}{\sqrt{2}}$

(c) At $1/3^{rd}$ of maximum height $\sqrt{\frac{2}{3}}u$

(d) At $1/4^{th}$ of maximum height $\frac{\sqrt{3}}{2}u$

A. a and b correct

B. b is correct

C. c and d correct

D. a is correct

Answer: C

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53. Read the following statements and choose the correct answer.

(a) For a freely falling body the average velocity is proportional to square root of height of fall.

(b) For a freely falling body the displacements in successive equal time intervals are in the ratio 1:4:9:....

(c) For a vertically projected body the displacement during last second of time of flight changes with velocity of projection.

(d) For a body projected from the top of the tower the displacement of the body is negative when the body crosses the point of projection

A. a,c,d are true

B. Both a,b are true

C. b and c are true

D. c and d are true

Answer: A

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54. Height of the body from the ground can be calculated by using the formula $h = -ut + (1/2)(gt^2)$ in

(a) A body projected vertically with velocity 'u' from the top of tower, reaches the ground in 't' sec.

(b) A body dropped from a balloon moving up with uniform velocity, reaches the ground in 't' sec

(c) A body dropped from a helicopter moving up with uniform velocity, reaches the ground in 't' sec

(d) A body projected vertically from the ground reaches the ground in 't' sec.

A. a, b and c are correct

B. a, b, c and d are correct

C. a is only correct

D. b and d are correct

Answer: A

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55. A balloon from rest accelerates uniformly upward with 'a' ms^{-2}, for t seconds of time. A stone is released from the balloon. Now, read the following statements to pick the right ones.

(a) The stone's initial velocity is zero, relative to balloon

(b) The stone's initial velocity is nonzero, relative to earth

(c) The time taken to reach the ground from the balloon's frame of reference is inversely proportional to $\sqrt{(a+g)}$

(d) The time take to reach the ground from earth's frame of reference is directly proportional to $\sqrt{(a+g)}$

A. a,b,c

B. a,c,d

C. a,b,d

D. a,c

Answer: A

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56. In one dimensional motion, instantaneous speed v satisfies $(0 \leq v < v_0)$ then

A. The displacement in time T must always take nonnegative values.

B. The displacement x in time T satisfies $-V_0T < x < V_0T$.

C. The acceleration is always an nonnegative number

D. The motion has no turning points.

Answer: B

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57. A particle starts from point A moves along a straight line path with an acceleration given by a = p - qx where p, q are connected and x is distance from point A . The particle stops at point B. The maximum velocity of the particle is

A. $\frac{p}{q}$

B. $\frac{p}{\sqrt{q}}$

C. $\frac{q}{p}$

D. $\frac{\sqrt{q}}{p}$

Answer: B

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58. Assertion: Always $\left|\frac{d\vec{v}}{dt}\right| = \frac{d}{dt}\left|\vec{v}\right|$, where $\vec{v}$ has its usual meaning.

(Reason): Acceleration is rate of change of velocity.

A. Both (Assertion) and (Reason) are true and (Reason) is the correct explanation of (Assertion)

B. Both (Assertion) and (Reason) are true and (Reason) is not the correct explanation of (Assertion)

C. (Assertion) is true but (Reason) is false

D. (Assertion) is false but (Reason) is true

Answer: D

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EXERCISE -II

1. A person travels along a straight road for half the distance with velocity V_1 and the remaining half distance with velocity V_2 the average velocity is given by

A. $v_1 v_2$

B. $\left(\frac{v_2}{v_1}\right)^2$

C. $\frac{v_1 + v_2}{2}$

D. $\frac{2v_1v_2}{v_1 + v_2}$

Answer: D

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2. If a cyclist takes one minute to complete half revolution on a circular path 120 m radius. What is the average velocity?

A. 1 m/s

B. 2 m/s

C. 3 m/s

D. 4 m/s

Answer: D

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3. A person travels along a straight road for the half time with a velocity V_1 and the next half time with a velocity V_2. The mean velocity V of the man is

A. $\frac{2}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

B. $v = \frac{v_1 + v_2}{2}$

C. $v = \sqrt{v_1 v_2}$

D. $v=\sqrt{\frac{v_1}{v_2}}$

Answer: B

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4. If a car covers 2/5th of the total distance with v_1 speed and 3/5th distance with v_2 then average speed is

A. $\frac{1}{2}\sqrt{v_1 v_2}$

B. $\frac{v_1+v_2}{2}$

C. $\frac{2v_1 v_2}{v_1+v_2}$

D. $\frac{5v_1 v_2}{3v_1+2v_2}$

Answer: D

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5. A motor vehicle travelled the first third of a distance s at a speed of v_1=10 kmph, the second third at a speed of v_2=20 kmph and the last third at a speed of v_3=60 kmph. Determine the mean speed of the vehicle over the entire distance s.

A. 15 kmph

B. 12 kmph

C. 10 kmph

D. 18 kmph

Answer: D

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6. A motorist drives north for 35.0 minutes at 85.0 km/h and then stops for 15.0 minutes. He next continues north, travelling 130 km in 2.00 hours. What is his total displacement

A. 85km

B. 179.6 km

C. 20km

D. 140 km

Answer: B

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7. A splash is heard 3.91 after a stone is dropped into a well of 67.6 m deep. The speed of sound in air is

A. 346m/s

B. 320m/s

C. 330m/s

D. 338m/s

Answer: D

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8. A person walks along a straight road from his house to a market 2.5kms away with a speed of 5 km/hr and instantly turns back and reaches his house with a speed of 7.5 kms/hr. The average speed of the person during the time interval 0 to 50 minutes is (in m/sec)

A. $4\frac{2}{3}$

B. $\frac{5}{3}$

C. $\frac{5}{6}$

D. $\frac{1}{3}$

Answer: B

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9. 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 1 s. Plot the x-t graph of his motion. Determine graphically and otherwise how long the drunkard takes to fall in a pit 13 m away from the start.

A. 21s

B. 29s

C. 31s

D. 37 s

Answer: B

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10. A particle moving with a constant acceleration describes in the last second of its motion 9/25th 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.?

A. 5 s, 150 cm

B. 10 s, 150 cm

C. 15 s, 100 cm

D. None

Answer: A

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11. A car moving with constant acceleration covers the distance between two points 180 m apart in 6 sec. Its speed as it passes the second point is 45 m/s. What is its acceleration and its speed at the first point

A. $-5\text{m}/\text{s}^2, 15\text{m}/\text{s}$

B. $-15\text{m}/\text{s}^2, 5\text{m}/\text{s}$

C. $-5\text{m}/\text{s}^2, -15\text{m}/\text{s}$

D. $5\text{m}/\text{s}^2, 15\text{m}/\text{s}$

Answer: D

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12. A car moving with a speed of $50kmh^{-1}$ can be stopped by brakes after atleast 6 m. If the same car is moving at a speed of $100 km h^{-1}$ the minimum stopping distance is

A. 12 m

B. 18 m

C. 24 m

D. 6 m

Answer: C

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13. A particle starts moving from rest with uniform acceleration. It travels a distance x in the first 2 sec and a distance y in the next 2 sec. Then

A. y=x

B. y=2x

C. y=3x

D. y=4x

Answer: C

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14. The reaction time for an automobile driver is 0.7 sec. If the automobile can be decelerated at $5 \mathrm{m/s}^2$ calculate the total distance travelled in coming to stop from an initial velocity of 8.33 m/s after a signal is observed.

A. 12.77 m

B. 14.82 m

C. 16.83 m

D. 19.65 m

Answer: A

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15. If the particle is moving along a straight line given by the relation $x = 2 - 3t + 4t^3$ where s is in cms., and t in sec. Its average velocity during the third sec is

A. 73 cm/s

B. 80 cm/s

C. 85 cm/s

D. 90 cm/s

Answer: A

Watch Video Solution

16. A bullet fired into a fixed target loses half of its velocity in penetrating 15 cm. How much further it will penetrate before coming to rest?

A. 5 cm

B. 15 cm

C. 7.5 cm

D. 10 cm

Answer: A

Watch Video Solution

17. 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

A. $-8m/s^2$

B. $-3.5m/s^2$

C. $-7m/s^2$

D. $180m/s^2$

Answer: B

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18. A bus starts from rest with a constnat acceleration of $5m/s^2$. At the same time a car travelling with a constnat velocity 50 m/s overtakes and passes the bus. How fast is the bus travelling when they are side by side ?

A. 10 m/s

B. 50 m/s

C. 100 m/s

D. none

Answer: C

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19. A person walks up a stalled escalator in 90 s. When just standing on the same moving escalator, he is carried in 60 s. The time it would take him to walk up the moving escalator will be

A. 30 s

B. 45 s

C. 36 s

D. 48 s

Answer: C

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20. Two trains are each 50 m long moving parallel towards each other at speeds $10ms^{-1}$ and $15ms^{-1}$ respectively, at what time will they pass each other ?

A. 8s

B. 4 s

C. 2 s

D. 6 s

Answer: B

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21. A car moving on a straight road accelerates from a speed of 4.1 m/s to a speed of 6.9 m/s in 5.0 s. What was its average acceleration?

A. 0.56 m/s^2

B. 1.56 m/s^2

C. 5.6 m/s^2

D. 1.2 m/s^2

Answer: A

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22. A body starting with a velocity 'v' returns to its initial position after 't' second with the same speed, along the same line. Acceleration of the particle is

A. $\frac{-2v}{t}$

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

C. $\frac{v}{2t}$

D. $\frac{t}{2v}$

Answer: A

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23. The position of a particle moving in the xy-plane at any time t is given by $x = (3t^2 - 6t)m$, $y = (t^2 - 2t)m$. Select the correct statement about the moving particle from the following.

A. The acceleration of the particle is zero at t = 0 second

B. The velocity of the particle is zero at t=0 second

C. The velocity of the particle is zero at t=1 second

D. The velocity and acceleration of the particle are never zero

Answer: C

Watch Video Solution

24. An object falling thro ugh a fluid is observed to have accleration give by $a = g - bv$ where $g =$ gravitational acceleration and b is constant. After a long time of release, it is observed to fall with constant speed. What must be the value of constant speed ?

A. $\frac{g}{b}$

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

C. bg

D. b

Answer: A

Watch Video Solution

25. The position of and object moving along x-axis is given by $x = a + bt^2$, where $a = 8.5m$ and b=2.5 ms^(-2) and (t) is measured in seconds. What is the velocity at $t = 0$s and $t = 2.0s$? What is the average velocity between $t = 2.0s$ and $t = 4.0s$?

A. Velocity at t=2 sec is zero

B. average velocity between t=2, t=4 scc is 15 m/s.

C. velocity at t = 4 sec is 10 m/s

D. all the above are true

Answer: B

Watch Video Solution

26. The displacement x of a particle moving in one direction is given by $t = \sqrt{x} + 3$, where x in meter and t in sec. What is its displacement when its velocity is zero

A. 3 m/s

B. 2 m/s

C. 1 m/s

D. zero

Answer: D

Watch Video Solution

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

A. 42m/s

B. 105m/s

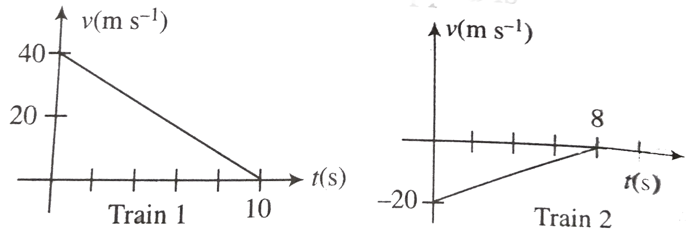
C. 145m/s

D. 180m/s

Answer: B

Watch Video Solution

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



A. 120 m

B. 20 m

C. 60m

D. 280m

Answer: B

Watch Video Solution

29. A car accelerates from rest with $2m/s^2$ on a straight line path and then comes to rest after applying brakes. Total distance travelled by the car is 100 m in 20 seconds. Then, the maximum velocity attained by the car is

A. 10m/s

B. 20 m/s

C. 15 m/s

D. 5 m/s

Answer: A

Watch Video Solution

30. A body falls from 80 m. Its time of descent is $[g = 10ms^{-2}]$

A. 3 s

B. 4 s

C. 5s

D. 6s

Answer: B

Watch Video Solution

31. Two bodies whose masses are in the ratio 2:1 are dropped simultaneously at two places A and B where the accelerations due to gravity are g_A and g_B respectively. If they reach the ground simultaneously, the ratio of the heights from which they are dropped is

A. $g_A : g_B$

B. $2g_A : g_B$

C. $g_A : 2g_B$

D. $\sqrt{g}_a : \sqrt{g}_b$

Answer: A

Watch Video Solution

32. A body falls for 5 s from rest. If the acceleration due to gravity of earth ceases to act, the distance it travels in the next 3 s is

A. 73.5 m

B. 294 m

C. 147 m

D. 49 m

Answer: C

Watch Video Solution

33. A body freely falling from a height h describes $\frac{7h}{16}$ in the last second of its fall. The height h is $(g = 10ms^{-2})$

A. 80 m

B. 45 m

C. 160 m

D. 40 m

Answer: A

Watch Video Solution

34. A body released from the top of a tower of height h takes T seconds to reach the ground. The position of the body at T/4 seconds is

A. at $\frac{h}{16}$ from the ground

B. at $\frac{h}{4}$ from the top of the tower

C. at $\frac{15h}{16}$ from the ground

D. at $\frac{3h}{16}$ from the top of the tower

Answer: C

Watch Video Solution

35. The ratio of times taken by freely falling body to cover first metre, second metre,... is

A. $\sqrt{1} : \sqrt{2} : \sqrt{3}$

B. $\sqrt{1} : \sqrt{2} - \sqrt{1} : \sqrt{3} - \sqrt{2}$

C. $\sqrt{2} : \sqrt{4} : \sqrt{8}$

D. $2 : 3 : 4$

Answer: B

Watch Video Solution

36. A body is droped from a height 122.5 m. If its stopped after 3 seconds and again released the further time of descent is $\left(g = 9.8\mathrm{m/s}^2\right)$

A. 2 s

B. 3 s

C. 4 s

D. 5 s

Answer: C

Watch Video Solution

37. A freely falling body travels ____ of total distance in 5th second

A. 8%

B. 12%

C. 25%

D. 36%

Answer: D

Watch Video Solution

38. If the distance travelled by a freely falling body in the last second of its journey is equal to the distance travelled in the first 2s, the time of descent of the body is

A. 5 s

B. 1.5 s

C. 2.5 s

D. 3 s

Answer: C

Watch Video Solution

39. A ball dropped on to the floor from a height of 10 m rebounds to a height of 2.5 m. If the ball is in contact with the floor for 0.02s, its average acceleration during contact is

A. 2100 ms^{-2}

B. 1050 ms^{-2}

C. 4200 ms^{-2}

D. 9.8 ms^{-2}

Answer: B

Watch Video Solution

40. A splash in heard 3.12 s after a stone is dropped into a well 45 m deep. The speed of sound in air is $\left[g = 10ms^{-2}\right]$

A. 330 ms^{-1}

B. 375 ms^{-1}

C. 340 ms^{-1}

D. 346 ms^{-1}

Answer: B

Watch Video Solution

41. A body is thrown up with a velocity $29.23 \mathrm{~ms}^{-1}$

distance travelled in last second of upward motion is

A. 2.3 m

B. 6 m

C. 9.8 m

D. 4.9 m

Answer: D

Watch Video Solution

42. A body is thrown up with a velocity $40ms^{-1}$. At same time another body is dropped from a height 40 m. Their relative acceleration after 1.3 seconds is

A. 4 g

B. g/2

C. 2 g

D. zero

Answer: D

Watch Video Solution

43. A stone is dropped into a well of 20 m deep. Another stone is thrown downward with velocity 'v' one second later. If both stones reach the water surface in the well simultan eously, v is equal to $\left(g = 10ms^{-2}\right)$

A. 30 ms^{-1}

B. 15 ms^{-1}

C. 20 ms^{-1}

D. 10 ms^{-1}

Answer: B

Watch Video Solution

44. A body is projected with a velocity $50 \mathrm{ms}^{-1}$. Distance travelled in 6th second is $\left[g = 10 m s^{-2}\right]$

A. 5m

B. 10m

C. 15m

D. 20m

Answer: A

Watch Video Solution

45. In above problem ratio of distance traveled in first second of upward motion to first second of downward motion is

A. $1:7$

B. $5:3$

C. $9:1$

D. $3:5$

Answer: C

Watch Video Solution

46. A body is projected vertically up with u. Its velocity at half its maximum height is

A. $\frac{u}{2}$

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

C. $\sqrt{2u}$

D. $\frac{u}{\sqrt{2}}$

Answer: D

Watch Video Solution

47. A body projected up reaches a point A in its path at the end of 4th second and reaches the ground after 5 seconds from the start. The height of A above the ground is $\left(g = 10\mathrm{m}/\mathrm{s}^2\right)$

A. 19.6 m

B. 30.6 m

C. 11 m

D. 20 m

Answer: D

Watch Video Solution

48. A stone is projected vertically up from the ground with velocity $40ms^{-1}$. The interval of time between the two instants at which the stone is at a height of 60 m above the ground is $\left(g = 10\text{ms}^{-2}\right)$

A. 4 s

B. 6 s

C. 8 s

D. 12 s

Answer: A

Watch Video Solution

49. A body is projected vertically up with velocity $98 \mathrm{ms}^{-1}$. After 2 s if the acceleration due to gravity of earth disappears, the velocity of the body at the end of next 3 s is

A. 49 ms^{-1}

B. 49.6 ms^{-1}

C. 78.4 ms^{-1}

D. 94.7 ms^{-1}

Answer: C

Watch Video Solution

50. The distance travelled by a body during last second of its total flight is d when the body is projected vertically up with certain velocity. If the velocity of projection is doubled, the distance travelled by the body during last second of its total flight is

A. 2d

B. d

C. $2d + \dfrac{g}{2}$

D. $2d - \dfrac{g}{2}$

Answer: C

Watch Video Solution

51. A stone is thrown vertically up from a bridge with velocity $3ms^{-1}$. If it strikes the water under the bridge after 2 s, the bridge is at a height of $(g = 10\text{ms}^{-2})$

A. 26 m

B. 14 m

C. 7 m

D. 20 m

Answer: B

Watch Video Solution

52. A bullet fired vertically up from the ground reaches a height 40 m in its path from the ground and it takes further time 2 seconds to reach the same point during descent. The total time of flight is $(g = 10ms^{-2})$

A. 4 s

B. 3 s

C. 6 s

D. 8 s

Answer: C

Watch Video Solution

53. A boy throws n balls per second at regular time intervals. When the first ball reaches the maximum height he throws the second one vertically up. The maximum height reached by each ball is

A. $\dfrac{g}{2(n-1)^2}$

B. $\dfrac{g}{2n^2}$

C. $\dfrac{g}{n^2}$

D. $\dfrac{g}{n}$

Answer: B

Watch Video Solution

Watch Video Solution

54. A stone is dropped freely, while another thrown vertically downward with an initial velocity of 2ms^{-1} from the same point, simultaneously. The time required by them to have a distance of separation 22 m between them is

A. 11 s

B. 5.5 s

C. 44 s

D. 22 s

Answer: A

Watch Video Solution

55. A body is throw up with a velocity 'u'. It reaches maximum height 'h'. If its velocity of projection is doubled the maximum height it reaches is _____

A. 4h

B. h

C. 2h

D. 3h

Answer: A

Watch Video Solution

56. A person in lift which ascents up with acceleration $10ms^{-2}$ drops a stone from a height 10 m. The time of decent is $\left[g=10ms^{-2}\right]$

A. 1 s

B. 2 s

C. 1.5 s

D. 3 s

Answer: A

Watch Video Solution

57. A body is projected up with velocity u. It reaches a point in its path at times t_1 and t_2 seconds from the time of projection. Then $(t_1 + t_2)$ is

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

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

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

D. $\sqrt{\frac{u}{g}}$

Answer: A

Watch Video Solution

58. A particle is projected from the ground at angle such that t_1 time it just clears the top of a pole in its path. It takes further t_2 time to reach the ground. What is height of the pole?

A. $\frac{1}{2}g(t_1 + t_2)$

B. $\frac{1}{2}g(t_1 + t_2)^2$

C. $\frac{1}{2}gt_1t_2$

D. gt_1t_2

Answer: C

Watch Video Solution

59. A stone thrown vertically up with velocity v reaches three points A, B and C with velocities v, $\frac{v}{2}$ and $\frac{v}{4}$ respectively. Then AB:BC is

A. $1:1$

B. $2:1$

C. $4:1$

D. $1:4$

Answer: C

Watch Video Solution

60. A stone is projected vertically upward from the top of a tower with a velocity u and strikes the bottom of the tower with a velocity 3u. The distance travelled by the stone is

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

B. $\frac{3v^2}{2g}$

C. $\frac{3v^2}{g}$

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

Answer: B

Watch Video Solution

61. A stone is thrown vertically from the ground. It reaches the maximum height of 500 m in 10 sec. After what time it will reach the ground from the maximum height reached?

A. 5 s

B. 10s

C. 15 s

D. 20 s

Answer: B

Watch Video Solution

62. How long does it take a brick to reach the ground if dropped from a height of 65 m? What will be its velocity just before it reaches the ground ?

A. 2 s , 10 m/s

B. 3.64 s, 35.67 m/s

C. 12 s , 120 m/s

D. 5 s , 20 m/s

Answer: B

Watch Video Solution

63. A stone is allowed to fall from the top of a tower 300 m height and at the same time another stone is projected vertically up from the ground with a velocity $100 ms^{-1}$. Find when and where the two stones meet ?

A. 2 s, 200.9 m

B. 3s, 255.9 m

C. 4s , 250.8 m

D. 5s , 255.10 m

Answer: B

Watch Video Solution

64. A stone is thrown vertically upward with a speed of $10.0 \mathrm{ms}^{-1}$ from the edge of a cliff 65 m high. What will be its speed just before hitting the bottom ?

A. 3.14 m/s

B. 37.14 m/s

C. 13.71 m/s

D. 14.71 m/s

Answer: B

Watch Video Solution

65. A ball is dropped from a building of height 45 m. Simultaneously another ball is thrown up with a speed 40 m/s. The relative speed of the balls varies with time as

A. t^0

B. t^1

C. t^2

D. $\frac{1}{t}$

Answer: A

Watch Video Solution

66. An object reaches a maximum vertical height of 23.0 m when thrown vertically upward on the earth. How high would it travel on the moon where the acceleration due to gravity is about one sixth that on the earth ? Assume that initial velocity is the same.

A. 138 m

B. 100 m

C. 10 m

D. 69 m

Answer: A

Watch Video Solution

67. A helicopter is ascending vertically with a speed of 8.0ms^{-1}. At a height of 12 m above the earth, a package is dropped from a window. How much time does it take for the package to reach the ground ?

A. 1.23 s

B. 3.23s

C. 5.83s

D. 2.53s

Answer: D

Watch Video Solution

68. Find the time taken for the ball to strike the ground . If a ball is thrown straight upwards with a speed v from a point h meters above the ground .

A. $\frac{v}{g}\left[1+\sqrt{1+\frac{2hg}{v^2}}\right]$

B. $\frac{v}{g}\left[1-\sqrt{1-\frac{2hg}{v^2}}\right]$

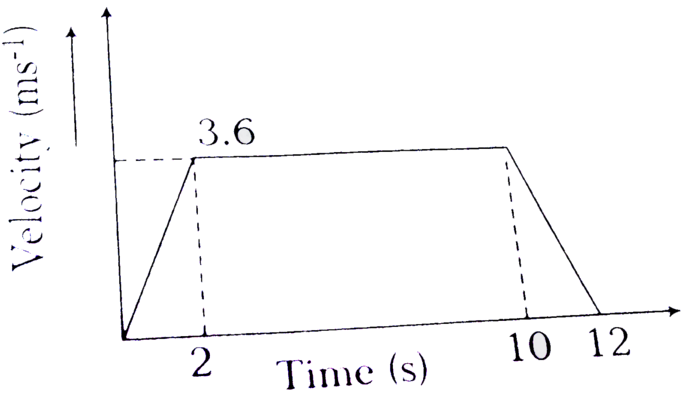
C. $\frac{v}{g}\left[1-\sqrt{1+\frac{2hg}{v^2}}\right]$

D. $\frac{v}{g}\left[2+\frac{2hg}{v^2}\right]$

Answer: A

Watch Video Solution

69. A lift going up. The variation in the speed of the lift is as given in the graph. What is the height to which is the takes the passengers ?



A. 3.6 m

B. 28.8 m

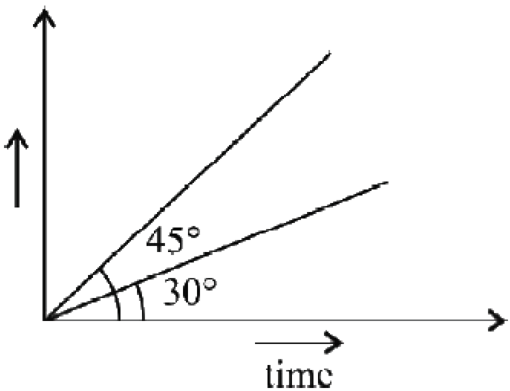
C. 36.0 m

D. 72.0 m

Answer: C

Watch Video Solution

70. The displacement time graph of two moving particles make angles of 30° and 45° with the x-axis. The ratio of the two velocities V_A and V_B is



A. $\sqrt{3} : 1$

B. $1:1$

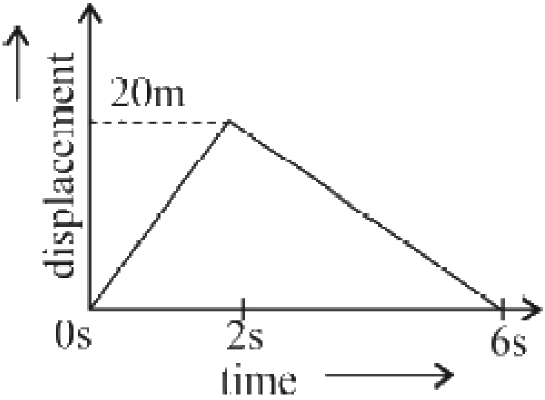
C. $1:2$

D. $1:\sqrt{3}$

Answer: D

Watch Video Solution

71. For the displacement-time graph shown in figure, the ratio of the magnitudes of the speeds during the first two second and the next four second is



A. $1:1$

B. $2:1$

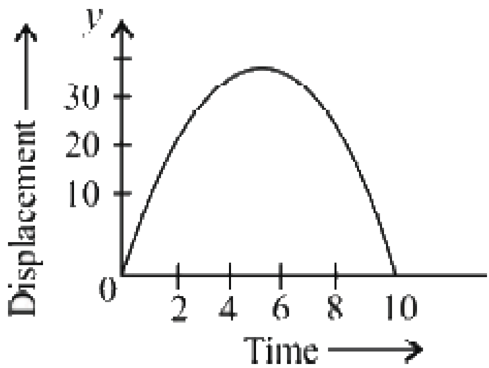
C. $1:2$

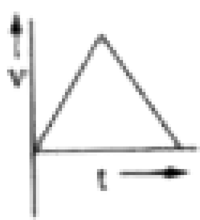
D. $3:2$

Answer: B

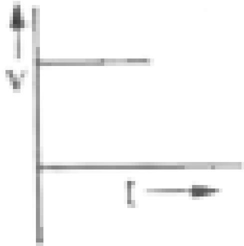
Watch Video Solution

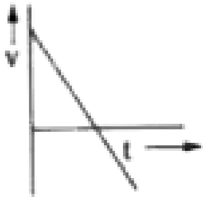
72. The displacement-time graph of a moving object is shown in figure. Which of the velocity-time graphs shown in figure could represent the motion of the same body ?

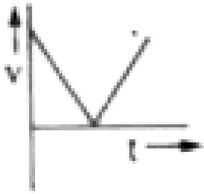




A.

B. 

C. 

D. 

Answer: C

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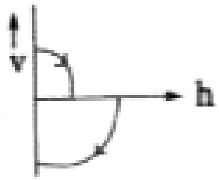
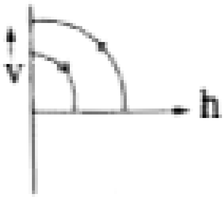
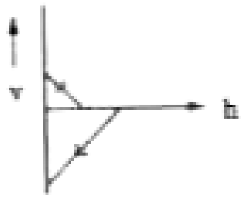
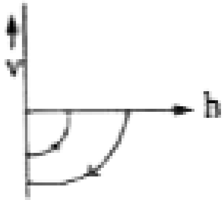
73. A ball is dropped vertically from a height d above the ground. It hits the ground and bounces up vertically to a height d/2. Neglecting subsequent motion and air resistance, its velocity v varies with the heiht h above the ground as

A. 

B. 

C. 

D. 

Answer: A

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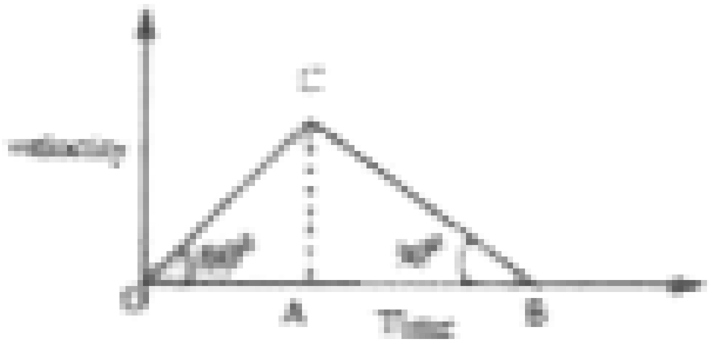
74. The velocity - time graph of a body is shown in fig.

The ratio of the .....during the intervals OA and AB is

____



A. average velocities: 1:1

B. $\dfrac{OA}{AB} : \dfrac{1}{4}$

C. average accelerations, same as distances covered

D. distances covered $: \dfrac{1}{2}$

Answer: A

Watch Video Solution

75. A body projected from the ground reaches a point 'X' in its path after 3 seconds and from there it reaches the ground after further 6 seconds. The vertical distance of the point 'X' from the ground is (acceleration due to gravity =$10 ms^{-2}$)

A. 30m

B. 60m

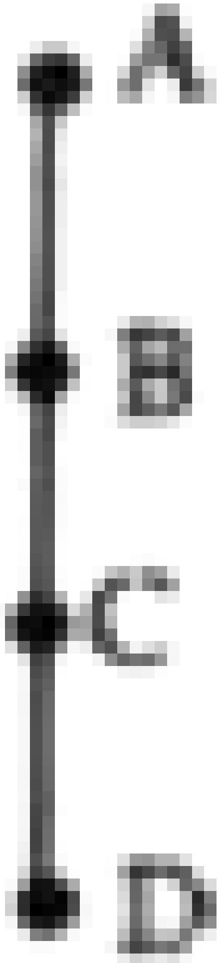
C. 80m

D. 90m

Answer: D

Watch Video Solution

76. A body is falling freely from a point A at certain height from the ground and passes through point B, C and D (vertically as shown) so that BC=CD. The time taken by the particle to move from B to C is 2 seconds and from C to D 1 second. Time taken to move from A to B in second is



A. 0.6

B. 0.5

C. 0.2

D. 0.4

Answer: B

Watch Video Solution

77. An object is thrown vertically upward with a speed of 30 m/s. The velocity of the object half-a-second before it reaches the maximum height is

A. 4.9m/s

B. 9.8m/s

C. 19.6m/s

D. 25.1m/s

Answer: A

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78. A stone is dropped from the top of a tower of height h=60m. Simultaneously another stone is projected vertically upwards from the foot of the tower. They meet at a height $\frac{2h}{3}$ from the ground level. The initial velocity of the stone projected upwards is $\left(g = 10ms^{-2}\right)$

A. $20ms^{-1}$

B. $60ms^{-1}$

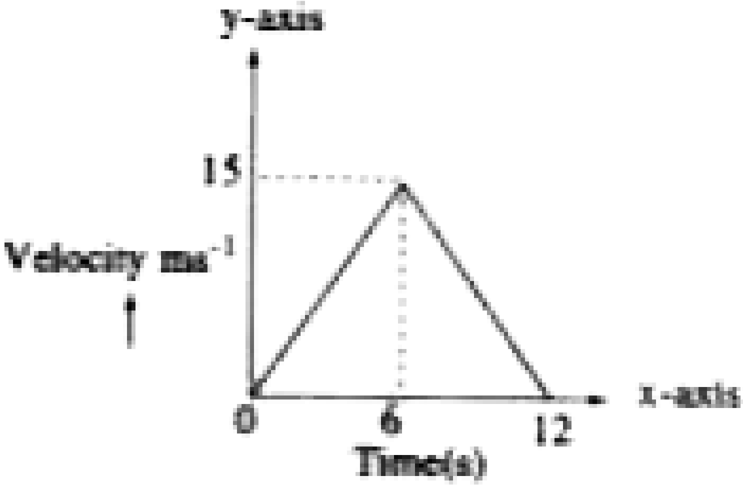
C. $10ms^{-1}$

D. $30ms^{-1}$

Answer: D

Watch Video Solution

79. The velocity and time graph for a particle moving in a straight line s shown in the figure. Then, the average velocity between t=4 s and t=6 s is _____



A. $10.5ms^{-1}$

B. $12.5ms^{-1}$

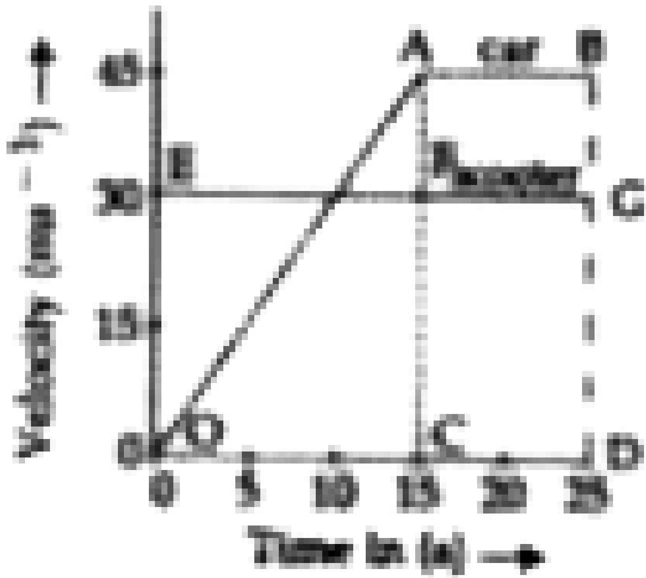
C. $7.5ms^{-1}$

D. $9.5ms^{-1}$

Answer: B

Watch Video Solution

80. The velocity-time graphs of a car and a scooter are shown in the figure. (i) The difference between the distance travelled by the car and the scooter in 15 s and (ii) the time at which the car will catch up with the scooter are, respectively.



A. 112.5 m and 22.5 s

B. 337.5 m and 25 s

C. 112.5 m and 15 s

D. 225.5 m and 10s

Answer: A

Watch Video Solution

PRACTICE EXERCISE

1. If a cyclist takes one minute to complete half revolution on a circular path 120 m radius. What is the average velocity?

A. 1 m/s

B. 3.14 m/s

C. 2 m/s

D. 4 m/s

Answer: B

Watch Video Solution

2. A car travels the first half of a distance between two places a speed of 30 km/hr and the second half of the distance a 50 km/hr. The average speed of the car for the whole journey is

A. 42.5 km/hr

B. 40.0 km/hr

C. 37.5 km/hr

D. 35.0 km/hr

Answer: C

Watch Video Solution

3. A car moves for half of its time at 80 km/h and for rest half of time at 40 km/h. Total distance covered is 60 km. What is the average speed of the car

A. 60 km/h

B. 80 km/h

C. 120 km/h

D. 180 km/h

Answer: A

Watch Video Solution

4. 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

A. 40 km/hr

B. 80 km/hr

C. $46\frac{2}{3}$ km/hr

D. 36 km/hr

Answer: D

Watch Video Solution

5. A man walks on a straight road from his home to a market 2.5 km away with a speed of 5 km/h. Finding the market closed, he instantly turns and walks back home with a speed of 7.5 km/h. The average speed of the man over the interval of time 0 to 40 min, is equal to

A. 5 km/h

B. $\frac{25}{4}$ km/h

C. $\frac{30}{4}$ km/h

D. $\frac{45}{8}$ km/h

Answer: D

Watch Video Solution

6. Moving with a uniform acceleration from the state of rest a body covers 22 m during the 6th sec of its motion. What is the distance covered by if during the first 6 sec?

A. 36 m

B. 48 m

C. 72 m

D. 150 m

Answer: C

Watch Video Solution

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

A. 2 m/s^2 , 10 sec

B. -2m/s^2 10 sec

C. 4m/s^2 , 5 sec

D. 4 m/s^2 , 10 sec

Answer: B

Watch Video Solution

8. Speed of two identical cars are u and 4u at a specific instant. The ratio of the respective distances in which the two cars are stopped from that instant is :

A. $1:1$

B. $1:4$

C. $1:8$

D. $1:16$

Answer: D

Watch Video Solution

9. A car moving with constant acceleration crosses two points A and B with velocities 10 m/s and 20 m/s in its path. Find the velocity of the car midway between A and B. (in m/s).

A. $\sqrt{500}$

B. $5\sqrt{5}$

C. $5\sqrt{10}$

D. $\sqrt{300}$ m/s

Answer: C

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10. A body covers 200 cm in the first 2 sec and 220 cm in the next 4 sec under constant acceleration. Then the velocity of the body after 7 sec is

A. -15 cm/s

B. 115 cm/s

C. 10 cm/s

D. 20 cm/s

Answer: C

Watch Video Solution

11. A car A is traveling on a straight level road with a uniform speed of 60 km/h. It is followed by another car B which is moving with a speed of 70 km/h. When the distance between them is 2.5 km, the car B is given a deceleration of $20\mathrm{km}/\mathrm{h}^2$. After what distance and time will B catch up with A

A. 32.5 km, 0.5 hr

B. 16.5 km, 1 hr

C. 4 km, 2hr

D. 3.25 km, 1.5 hr

Answer: A

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12. Two cars X and Y start off to a race on a straight path with initial velocities of 8 m/s and 5 m/s respectively. Car X moves with uniform acceleration of $1 m/s^2$ and car Y moves with uniform acceleration of

$1.1 m/s^2$. If both the cars reach the winning post together find the length of the track.

A. 1000 m

B. 2000m

C. 2500 m

D. 2280 m

Answer: D

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13. A body weights 500N on the surface of the earth. How much would it weights half-way below the surface of the earth?

A. 1 cm

B. 2 cm

C. 3 cm

D. 4 cm

Answer: A

Watch Video Solution

14. A particle moving with uniform acceleration has its final velocity $\left(v = \sqrt{150 + 8x}\right)$ m/s where x is the distance travelled by the body. Then the acceleration is

A. $+4\text{m}/\text{s}^2$

B. $-4\text{m}/\text{s}^2$

C. $+8\text{m}/\text{s}^2$

D. $-8\text{m}/\text{s}^2$

Answer: A

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15. A solid sphere of radius $2.45m$ is rotating with an angular speed of $10rad/s$. When this rotating sphere is placed on a rough horizontal surface then after sometime it starts pure rolling. Find the linear speed of the sphere after it starts pure rolling.

A. 2 sec

B. 3 sec

C. 4 sec

D. none

Answer: A

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16. When a man stands on a moving escalator he goes up in 50 sec. and when he walks up the moving escalator he goes up in 30 sec. Then the man walks up the stationary escalator in a time of .... sec

A. 60

B. 75

C. 90

D. 18.75

Answer: B

Watch Video Solution

17. A vehicle moving in a straight road has its speed changed from 5 m/s to 8 m/s in 2 sec. What is its average acceleration ?

A. $1 \mathrm{m/s}^2$

B. $1.5 \mathrm{m/s}^2$

C. $2 \mathrm{m/s}^2$

D. $0 \mathrm{m/s}^2$

Answer: B

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18. A bullet moving at 20 m/sec. strikes a wooden plank and penetrates 4 cm before coming to stop. The time taken to stop is

A. 0.08 sec

B. 0.16 sec

C. 0.04 sec

D. 0.004 sec

Answer: D

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19. A vehicle covers first half of its total distance at a speed 20 kmph. and the other half of the distance at 40 kmph. The mean speed over the entire distance.

A. 30 kmph

B. 50 kmph

C. $\frac{40}{3}$ kmph

D. $\frac{80}{3}$ kmph

Answer: D

Watch Video Solution

20. A vehicle moves for 10 minutes at $20\mathrm{ms}^{-1}$ due north and stops for five minutes. Then at continues due north at $40ms^{-1}$ for 20 minutes. Average velocity in the entire journey.

A. $2.857\mathrm{ms}^{-1}$

B. $285.7\mathrm{ms}^{-1}$

C. $28.57\mathrm{ms}^{-1}$

D. $2857\mathrm{ms}^{-1}$

Answer: C

Watch Video Solution

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

A. 450 m

B. 1000 m

C. 1250 m

D. 1400 m

Answer: A

Watch Video Solution

22. Two stones are falling at a place from heights in the ratio 2:3. Their velocities on reaching the ground are in the ratio

A. $\sqrt{3} : \sqrt{2}$

B. $\sqrt{2} : \sqrt{3}$

C. $2 : 3$

D. $3 : 2$

Answer: B

Watch Video Solution

23. A body falls for 4s from rest. If the acceleration due to gravity of earth ceases to act, then the velocity and distance it travels in the next 3sec is

A. 40 m/s , 120 m

B. 30 m/s , 400 m

C. 50 m/s, 50 m

D. 20 m/s , 60 m

Answer: A

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24. A body freely falling from a height h describes $\frac{11h}{36}$ in the last second of its fall. The height h is $(g = 10ms^{-2})$

A. 125 m

B. 180 m

C. 360 m

D. 90 m

Answer: B

Watch Video Solution

25. A body is released from the top of a tower of height h and takes 'T' sec to reach the ground. The position of the body at T/2 sec is

A. $\frac{h}{4}$ from ground

B. $\frac{3h}{4}$ from ground

C. $\frac{h}{8}$ from ground

D. $\frac{5h}{4}$ from ground

Answer: B

Watch Video Solution

26. A particle is released from rest from a tower of height 3h. The ratio of times to fall equal heights 'h' i.e. $t_1 : t_2 : t_3$ is ($\sqrt{3}$ =1.17 & $\sqrt{2}$ = 1.4)

A. $\sqrt{3} : \sqrt{2} : 1$

B. $3 : 2 : 1$

C. $1 : 14 : 1.7$

D. $10 : 4 : 3$

Answer: D

Watch Video Solution

27. A body is dropped from a height 135 m. If after 3 sec acceleration due to gravity of earth cases to act then the further time of descent is $\left(g = 10\mathrm{m/s}^2\right)$

A. 3 sec

B. 6 sec

C. 4 sec

D. 2 sec

Answer: A

Watch Video Solution

28. A freely falling body covers _____ of total distance in 3rd second.

A. 8%

B. 35.5%

C. 55.55%

D. 45.5%

Answer: C

Watch Video Solution

29. A stone is dropped from the top of a tower of height 125 m. The distance travelled by it during last second of its fall is $\left(g = 10ms^{-2}\right)$

A. 22.5 m

B. 45 m

C. 75 m

D. 90 m

Answer: B

Watch Video Solution

30. A ball dropped on to the floor from a height of 40 m and rebounds to a height of 10 m. If the ball is in contact with the floor for 0.02 s, its average acceleration during contact is

A. $1050 \mathrm{m/s}^2$

B. $2100 \mathrm{m/s}^2$

C. $9.8 \mathrm{m/s}^2$

D. $210 \mathrm{m/s}^2$

Answer: B

Watch Video Solution

31. A body is thrown up with a velocity 29.23ms^{-1} distance travelled in last second of upward motion is

A. 14.7 m

B. 9.8 m

C. 4.9 m

D. 1 m

Answer: A

Watch Video Solution

32. Two balls are dropped simultaneously from two points separated by a vertical height of 6 m. The distance of separation between them after next 2s is

A. 9.8 m

B. 6 m

C. 12 m

D. 0

Answer: B

Watch Video Solution

33. A ball is dropped from the top of a tower of height 78.4 m Another ball is thrown down with a certain velocity 2 sec later. If both the balls reach the ground simultaneously, the velocity of the second ball is

A. 29.4 m/s

B. 26.4 m/s

C. 30 m/s

D. 41.6 m/s

Answer: A

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34. A body is projected with a velocity $60ms^{-1}$ vertically upwards the distance travelled in last second of its motion is $\left[g = 10ms^{-1}\right]$

A. 35 m

B. 45 m

C. 55 m

D. 65 m

Answer: C

Watch Video Solution

35. A body is thrown vertically upwards with initial velocity 'u' reaches maximum height in 6 seconds. The ratio of distances travelled by the body in the first second and seventh second is

A. $1:1$

B. $11:1$

C. $1:2$

D. $1:11$

Answer: B

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36. A body is thrown vertically up with certain velocity. If h is the maximum height reached by it, its position when its velocity reduces to 1/3 of its velocity of projection is at

A. $\frac{8h}{9}$ from the ground

B. $\frac{8h}{9}$ from the top most point

C. $\frac{4h}{9}$ from the ground

D. $\frac{h}{3}$ from the top most point

Answer: A

Watch Video Solution

37. A bullet fired vertically up from the ground reaches a point in its path after 3s and 13 s, both times being taken from the instant of firing the bullet. The velocity of projection of the bullet is $(g = 10ms^{-2})$

A. $80ms^{-1}$

B. $40ms^{-1}$

C. $160ms^{-1}$

D. $20ms^{-1}$

Answer: A

Watch Video Solution

38. A body is projected vertically up with a velocity of 58.8 m/s. After 3 s if the acceleration due to gravity of earth disappears. The distance travelled and the velocity of the body at the end of next 5 sec is

A. 147 m , 29.4 m/s

B. 29.4 m, 147 m/s

C. 14.7 m , 2.94 m/s

D. 19.6 m, 240 m/s

Answer: A

Watch Video Solution

39. The distance travelled by a body during last second of its upward journey is d when the body is projected with certain velocity vertically up. If the velocity of projection is doubled, the distance travelled by the body during last second of its upward journey is

A. 2d

B. 4d

C. d/2

D. d

Answer: D

Watch Video Solution

40. A packet is dropped from a balloon rising up with uniform velocity $9.8 \mathrm{ms}^{-1}$. If the balloon is at a height of 39.2 m from the ground at the time of dropping the stone, the stone reaches the ground after

A. 2 s

B. 6s

C. 4 s

D. 8s

Answer: C

Watch Video Solution

41. A body is projected vertically upwards with a velocity 'U'. It crosses a point in its journey at a height 'h' twice, just after 1 and 7 seconds. The value of U in ms^{-1} $[g = 10ms^{-2}]$

A. 50

B. 40

C. 30

D. 20

Answer: B

Watch Video Solution

42. A boy throws a ball in air in such a manner that when the ball is at its maximum height he throws another ball. If the balls are thrown with the time difference 1 second, the maximum height attained by each ball is

A. 9.8 m

B. 19.6 m

C. 4.9 m

D. 2.45 m

Answer: C

Watch Video Solution

43. A stone is dropped freely while another thrown vertically downward with an initial velocity of 4 m/s from the same point simultaneously. The distance of separation between them will become 30 m after a time of

A. 8 sec

B. 10 sec

C. 15 sec

D. 7.5 sec

Answer: D

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44. A body thrown up with a velocity reaches a maximum height of 50 m. Another body with double the mass thrown up with double the initial velocity will reach the maximum height of

A. 100 m

B. 200 m

C. 400 m

D. 50 m

Answer: B

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45. A person in a lift which descends down with an acceleration of $1.8m/s^2$ drops a stone from a height of 2 m. The time of decent is

A. $\sqrt{2}$ sec

B. $2\sqrt{2}$ sec

C. $1/\sqrt{2}$ sec

D. $\frac{1}{2}$ sec

Answer: C

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46. A man in a lift ascending with an upward acceleration a throws a ball vertically upwards with a velocity v with respect to himself and catches it after t_1 seconds. After wards when the lift is descending with the same acceleration a acting downwards the man again throws the ball vertically upwards with the same velocity with respect to him and catches it after t_2 seconds?

A. 3 sec

B. 8 sec

C. 4 sec

D. 5 sec

Answer: B

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47. The velocity of a body moving vertically up is $49ms^{-1}$ at half the maximum height. The height to which it could further rise is

A. 245 m

B. 122.5 m

C. 61.25 m

D. none

Answer: B

Watch Video Solution

48. An object is projected vertically up from the earth's surface with velocity $\sqrt{Rg}$ where R is the radius of the earth and 'g' is the acceleration due to earth on the surface of earth. The maximum height reached by the object is nR. Find value of n.

A. $\dfrac{4u^2}{g}$

B. $\dfrac{5u^2}{g}$

C. $\dfrac{3u^2}{g}$

D. $\dfrac{u^2}{g}$

Answer: B

Watch Video Solution

49. A body is thrown vertically up reaches a maximum height of 78.4 m. After what time it will reach the ground from the maximum height reached ?

A. 4 sec

B. 8 sec

C. 3 sec

D. 5 sec

Answer: A

Watch Video Solution

50. A stone dropped from a cliff hits the ground in 4 sec. Height of the cliff is

A. 39.2 m

B. 29.4 m

C. 9.8 m

D. 78.4 m

Answer: D

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51. A stone is dropped from a tower of height 200 m and at the same time another stone is projected vertically up at 50 m/s. The height at which they meet ? $\left[g = 10\mathrm{m/s}^2\right]$

A. 5 m

B. 100 m

C. 120 m

D. 125 m

Answer: C

Watch Video Solution

52. A stone is thrown vertically up at 20 m/s from a tower 80 m height. The speed with which it hits the ground is $\left[g = 10\mathrm{m/s}^2\right]$

A. 14.4 m/s

B. 28.14 m/s

C. 80 m/s

D. $\sqrt{5}$ 20 m/s

Answer: D

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53. The weight of a body at earth's surface is W. At a depth half way to the centre of earth it will weight

A. 40m

B. 80m

C. 100m

D. 120m

Answer: D

Watch Video Solution

54. A balloon rises with uniform velocity of $10ms^{-1}$. When the balloon is at a height of 75 m if a stone is dropped from it the time taken by it to reach the ground is

A. 3 sec

B. 4 sec

C. 5 sec

D. 7 sec

Answer: C

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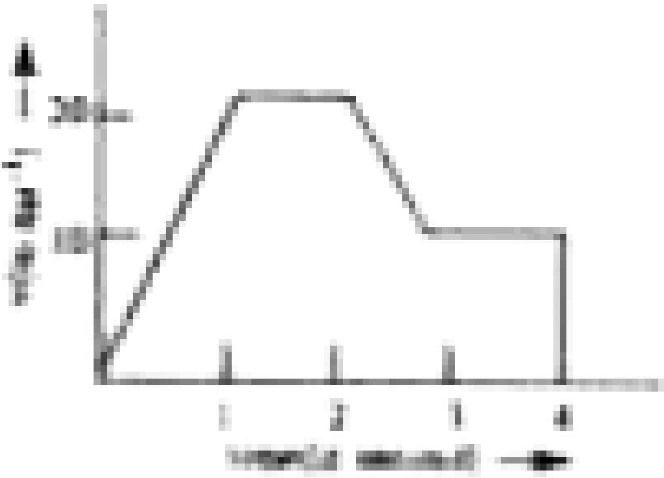
55. The variation of velocity of a particle moving along a straight line is shown in the figure. The distance travelled by the particle in 4s is



A. 55 m

B. 30 m

C. 25 m

D. 60 m

Answer: A

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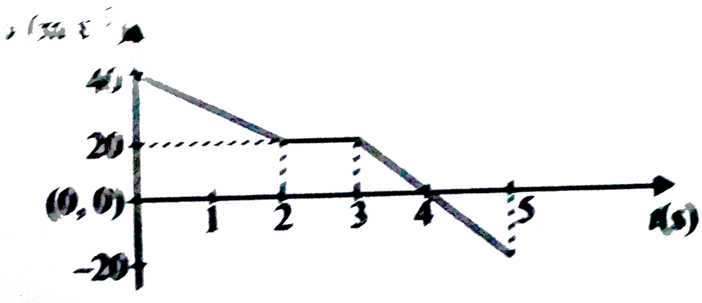
56. In the given v-t graph the distance travelled by the body in 5 seconds will be



A. 60 m

B. 40 m

C. 80 m

D. 100 m

Answer: C

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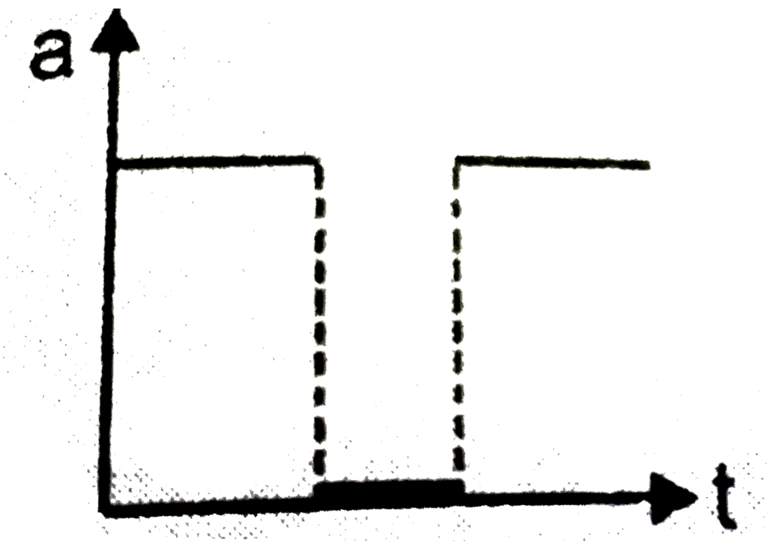
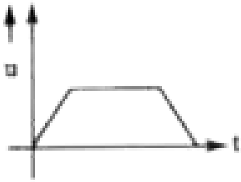
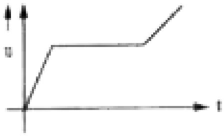
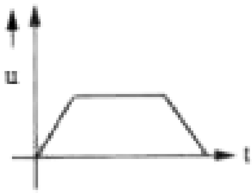
57. Acceleration-times graph of a body is shown.

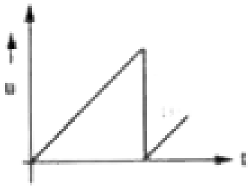
The corresponding velocity- time graph of the same body



A. 

B. 

C. 

D. 

Answer: B

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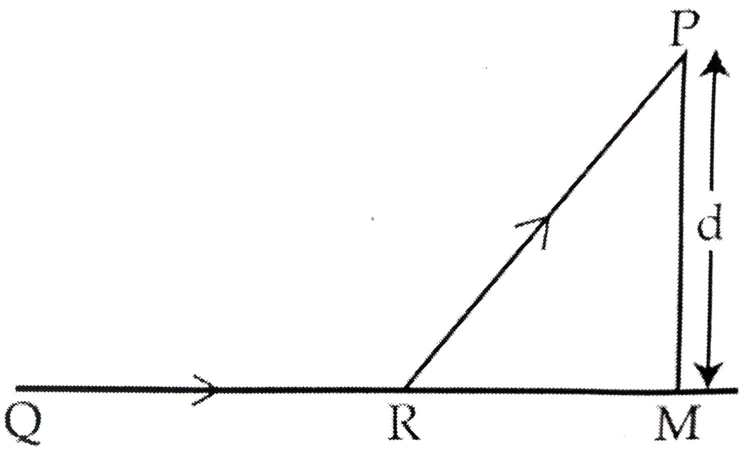
58. A man in a car at location Q on a straight highway is moving with speed v He decides to reach a point P in a field at a distance d from the highway (point M) as shown in th e figure . Speed of the car in the field is half to that on the highway what should be the distacne RM so that the time taken to reach P is minimum ?



A. d

B. $\frac{d}{\sqrt{2}}$

C. $\frac{d}{2}$

D. $\frac{d}{\sqrt{3}}$

Answer: D

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problems

1. Find the distance covered by the particles,in the following figures,(i) and (ii) while a particle travels from A to B as shown by the arrows.

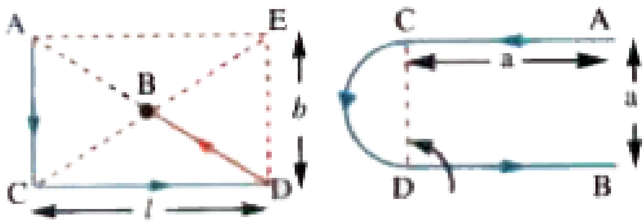

Fig.(i) Fig.(ii)

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2. A particle travels from point A to B on a circular path of radius $15/\pi$ cm.If the are length AB be 10 cm,find the displacement (figure)

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3. A bus between Vijayawada and Hyderabad passed the 100 km,160-km and 220-km points at 10.30 a.m., 11.30 a.m. and 1.30 p.m. Find the average speed of the bus during each of the following intervals:

(a)10.30 a.m. to 11.30 a.m. (b)11.30 a.m. to 1.30. p.m., and (c)10.30 a.m. to 1.30 p.m.

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4. The distance travelled by a particle in time t is given by $s = \left(2.5\frac{m}{s^2}\right)t^2$. Find a. the average speed of the particle during the time 0 to 5.0 s, and b. the instantaneous speed ast t=5.0 is

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5. A man at a speed of 6 km/hr for 1 km and 8 km/hr for the next 1 km. What is his average speed for the walk of 2 km?

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6. A motor vehicle travelled the first third of a distance s at a speed of v_1=10 kmph, the second third at a speed of v_2=20 kmph and the last third at a speed of v_3=60 kmph. Determine the mean speed of the vehicle over the entire distance s.

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7. A car covers 60 km at a uniform speed of 120 kmph and the text 60 km at a uniform speed of 80 kmph.Find the total time taken.

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8. A motorist drives north for 35.0 minutes at 85.0 km/h and then stops for 15.0 minutes. He next continues north, travelling 130 km in 2.00 hours. What is his total displacement

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9. Two cyclists,moving with equal speeds of 10 km/hr,are approaching each oher along a straight road.When the distance between them is 20 km a fly starting from cycle,keeps on flying alternatively from one cycle to the other.If the fly has a constant speed of 40 km/hr.Find the total distance travelled by the fly before the cyclists meet is.

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10. A body moving in a curved path possesses a velocity 3 m/s towards north at any instant of its motion .After 10s ,the velocity of the body was found to be 4 m/s towards west.Calculate the average acceleration during this interval.

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11. Velocity of a particle moving in a straight line varies with its displacement as $v = \left(\sqrt{4+4s}\right)m/s$. Displacement of particle at time $t=0$ is $s=0$. Find displacement of particle at time $t=2s$.

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12. The radius vector of a particle varies with time t as $\vec{r} = \vec{b}\,t(1-\alpha t)$ is a constant vector and a is a positive factor.Find the distance s covered before the particle comes to rest

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13. A point moves in the plane xy according to the law $x = a\sin\omega t$, $y = a(1-\cos\omega t)$, where a and ω are positive constants. Find:

(a) the distance s traversed by the point during the time τ,

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14. A car moving on a straight road accelerates from a speed of 4.1 m/s to a speed of 6.9 m/s in 5.0 s. What was its average acceleration?

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15. A bullet moving with a speed of $150ms^{-1}$ strikes a tree and penetrates 3.5 cm before stopping. What is the magnitude of its retardation in the tree and the time taken for it to shop after striking the tree?

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16. Two cars started simultaneously towards each other from towns A and B which are 480 km apart.It took first car travelling from A to B 8 hours to cover the distance and second car travelling form B to A in 12 hours.Determine when do the car meet after starting and at what distance from town A.Assuming that both the cars travelled with constant speed.

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17. A body ,starting from rest and moving with constant acceleration,covers 10m in the first second.Find the distance travelled by it in the next second.

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18. In a car race, car A takes time t less than car B and passes thre finishing point with a velocity v more than the velocity with which car B passes the point. Assuming that the cars start from rest and travel with Constant accelerations a1 and a2, show that $\frac{v}{t} = \sqrt{a_1 a_2}$.

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19. Show that when a particle moves with uniform acceleration , the distances described in consecutive equal intervals of time are in A.P.

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

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21. A particle is moving along x-direction with a constant acceleration a. The particle starts from $x = x_0$ position with initial velocity u. We can define the position of the particle with time by the relation

$$x = x_0 + ut + \frac{1}{2}at^2$$

plot the position of the particle in relation with time is following situations

(i) If initial position of the particle is on negativ x-axis, initial velocity is positive and acceleration is negative.

(ii) If initial position is positive, initial velocity is negative and acceleration is positive.

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22. A particle is droped under gravety from rest a height h and it travels a distance $\frac{9h}{25}$ in the last second, the height h is (take $g = 9.8ms^{-2}$)

Watch Video Solution

23. A steel ball is dropped from the roof of a building .An observer standing in front of a window 1.25 m high notes that the ball takes 1/8 s to fall from the top to the bottom of the window .The ball reappears at the bottom of the window 2s after passing it on the way down,if the collision between the ball reappears at the bottom of the window 2s after passing it on the way down.If the collision between the ball and the ground is perfectly elastic,then find the height of the building?Take g=10 m/s^2.

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24. Two balls are dropped to the ground from different heights. One ball is dropped 2s after the other, but both strike the ground at the same time 5s after the Ist is dropped.

(a) What is the difference in the heights from which they were dropped ?

(b) From what height was the first ball dropped?

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25. A stone is dropped from a height 300 m and at the same time another stone is projected vertically upwards with a velocity of $100 m / \sec$. Find when and where the two stones meet.

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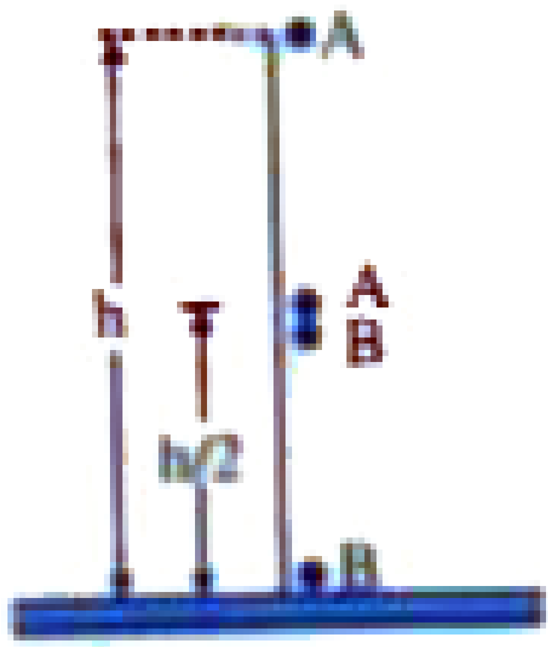
26. A stone A is dropped from rest from a height h above the ground.A second stone B is simultaneously thrown vertically up from a point on the ground with velocity v.The line of motion of both the stones is same .Find if the value of v which would enable the stone B to meet the stone A midway between their initial positions =



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27. A particle P is projected Vertically upward from a point A . Six seconds later, another particle Q is projected vertically upward from A . Both P and Q

reach A simultaneously. The ratio o f maximum heights reached by P and $Q = 65 : 25$. Find the velocity of the projection of Q in m / s.

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28. A body when projected vertically up, covers a total distance D during its time of flight. If there were no gravity, the distance covered by it during the same time is equal to :

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29. Drop of water fall at regular intervals from roof of a building of height (H=16 m), the first drop striking the ground at the same moment as the fifth drop falls from the roof. The distances between separate drops in air as the first drop reaches the ground are.

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

a. Its initial velocity.

b. The time taken to reach the highest point.

c. Its velocity just before hitting the ground.

d. Its displacement between $0.5m$ above the ground.

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

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32. An object falls from a bridge which is 45 m above the water. It falls directly into a small row - boat moving with constant velocity that was 12m from the point of impact when the object was released. What was the speed of the boat ?

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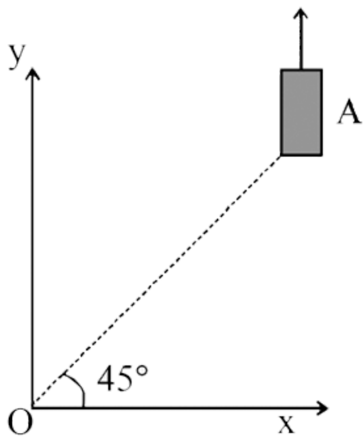
33. On a frictionless horizontal surface , assumed to be the $x-y$ plane , a small trolley A is moving along a straight line parallel to the $y-$ axis (see figure) with a constant velocity of $(\sqrt{3}-1)m/s$. At a particular instant , when the line OA makes an angle of $45(\circ)$ with the $x-$ axis , a ball is thrown along the surface from the origin O. Its velocity makes an angle ϕ with the $x-$ axis and it hits the trolley .

(a) The motion of the ball is observed from the frame of the trolley . Calculate the angle θ made by the velocity vector of the ball with the $x-$ axis in this frame .

(b) Find the speed of the ball with respect to the surface , if $\phi = (4\theta) / (3)$.



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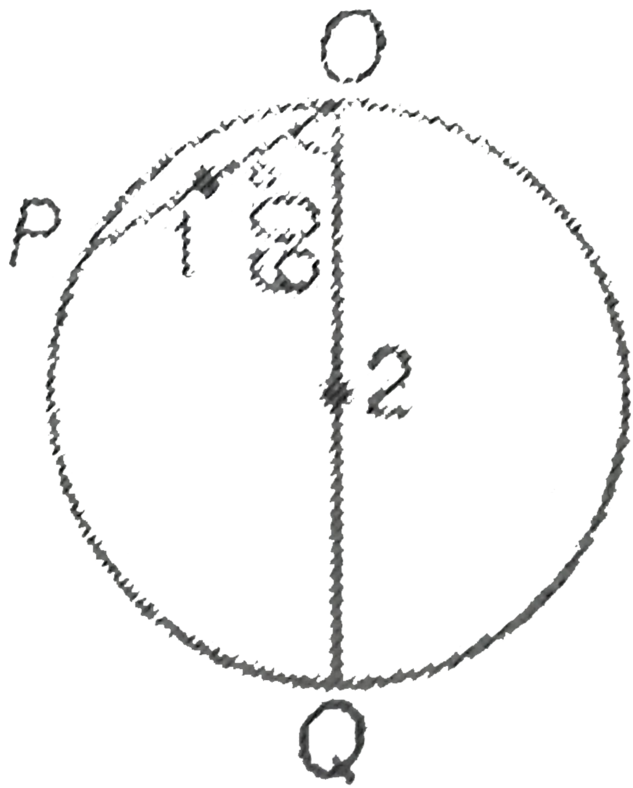
34. Two particles 1 and 2 are allowed to descend on two frictionless chords OP and OQ. The ratio of the speeds of the particles 1 and 2 respectively when they reach on the circumference is



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35. Ball A dropped from the top of a building. A the same instant ball B is thrown vertically upwards from the ground. When the balls collide, they are moving in opposite directions and the speed of A is twice the speed of B. At what fraction of the height of the building did the collision occur?

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36. A helicopter is ascending vertically with a speed of $8.0 \mathrm{ms}^{-1}$. At a height of 12 m above the earth, a package is dropped from a window. How much time does it take for the package to reach the ground ?

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37. A stone is thrown vertically upward with a speed of 10.0 ms^{-1} from the edge of a cliff 65 m high.How much later will it reach the bottom of the cliff ? What will be its speed just before hitting the bottom ?

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38. A body took 't' sec. to come down from top of tower.Find the time taken to cover half the height of the tower .

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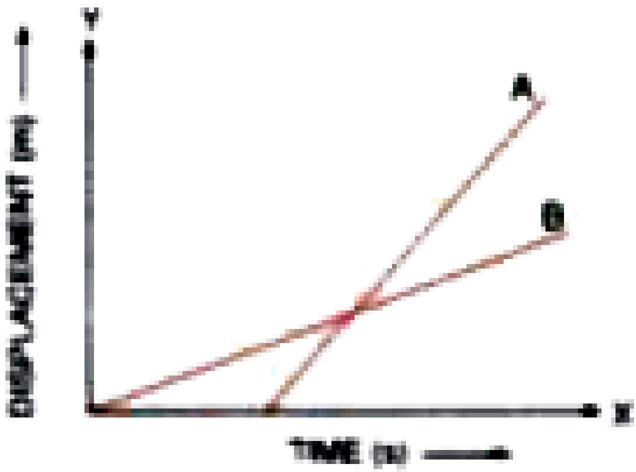
39. Fig. 2.33 shows displacement-time graph of two vehicles A and B moving along a straight road. Which vehicle is moving faster ? Give reason.



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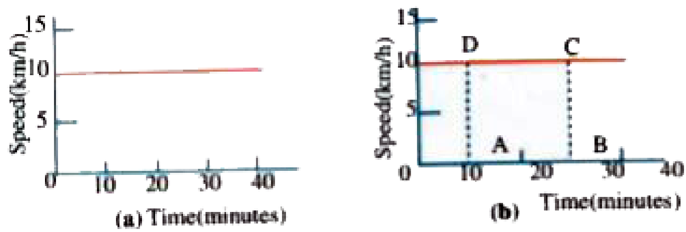
40. Figure a represents the speed-time graph for a particle .Find the distance covered by the particle betweent=10 min and t= 30 min .



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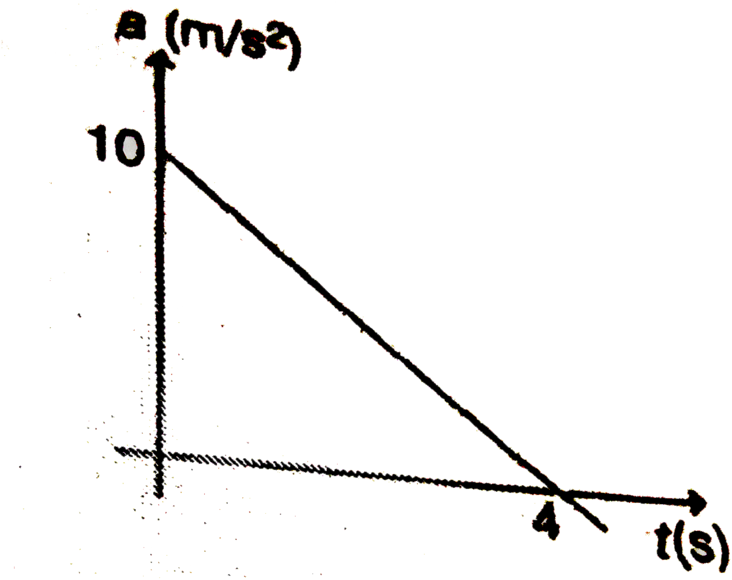
41. The acceleration time graph of a particle moving along a straight line is as shown in figure. At what time (in second) the particle acquire its initial velocity?



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42. Velocity and acceleration of a particle at time $t = 0$are

$u = \left(2\hat{i} + 3\hat{j}\right)m/s$ and $a = \left(4\hat{i} + 3\hat{j}\right)m/s^2$

respectively. Find the velocity and displacement if particle at $t = 2s$.

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43. Velocity-time graph for the motion of a certain body is shown in Fig. Explain the nature of this motion. Find the initial velocity and acceleration and write the equation for the variation of displacement with time. What happens to the moving body at point B? How does the body move after this moment ?

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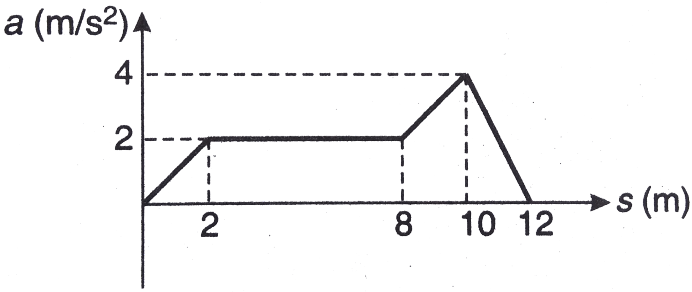
44. The acceleration-displacement graph of a particle moving in a straight line is as shown in figure, initial velocity of particle is zero. Find the velocity of the particle when displacement of the particle is $s = 12m$.



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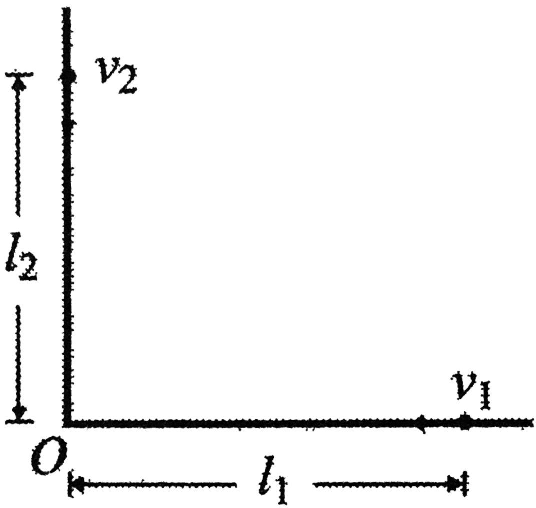
45. Two particles, 1 and 2 move with constant velocities v_1 and v_2 along two mutually perpendicular straight lines towards the intersection point O. At the moment $t = 0$ the particles were located at the distance l_1 and l_2 from the point O. How soon will the distance between the particles become the smallest? What is it equal to?



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46. Acceleration of a particle at any time t is $\vec{a}=\left(2t\hat{i}+3t^2\hat{j}\right)m/s^2$.If initially particle is at rest, find the velocity of the particle at time $t=2s$

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47. Acceleration of a particle at any time t is $\vec{a}=\left(2t\hat{i}+3t^2\hat{j}\right)m/s^2$.If initially particle is at rest, find the velocity of the particle at time $t=2s$

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Numerical exercise(LEVEL-1)

1. A motor vehicle travelled the first third of a distance s at a speed of v_1=10 kmph, the second third at a speed of v_2=20 kmph and the last third at a speed of v_3=60 kmph. Determine the mean speed of the vehicle over the entire distance s.

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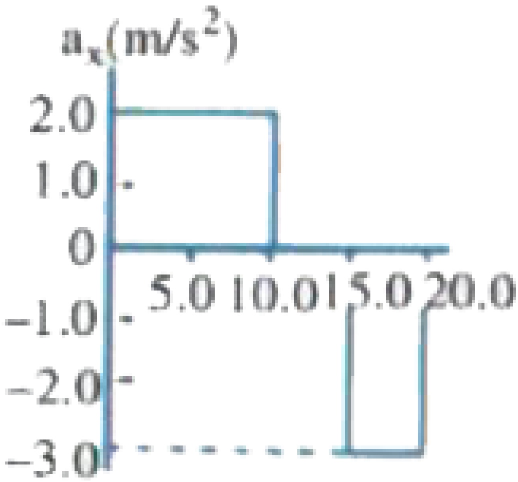
2. A particle starts from rest and accelerates as shown in the graph .Determine (a)the particle's speed at t=10 s and t=20 s and (b)the distance travelled in the first 20 s.



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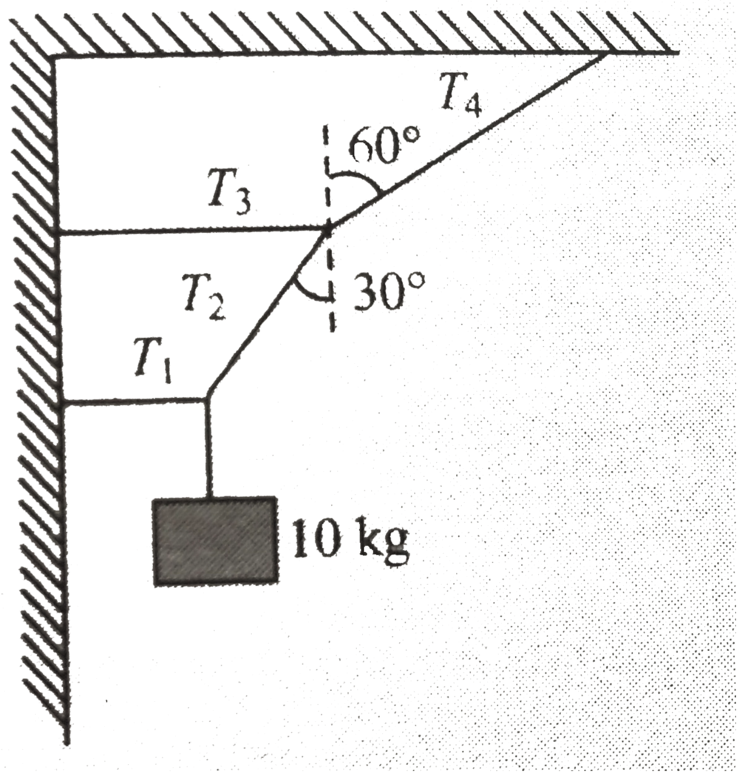
3. Determine tension T_4 in fig.



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4. A motorist drives north for 35.0 minutes at 85.0 km/h and then stops for 15.0 minutes. He next continues north, travelling 130 km in 2.00 hours. What is his total displacement

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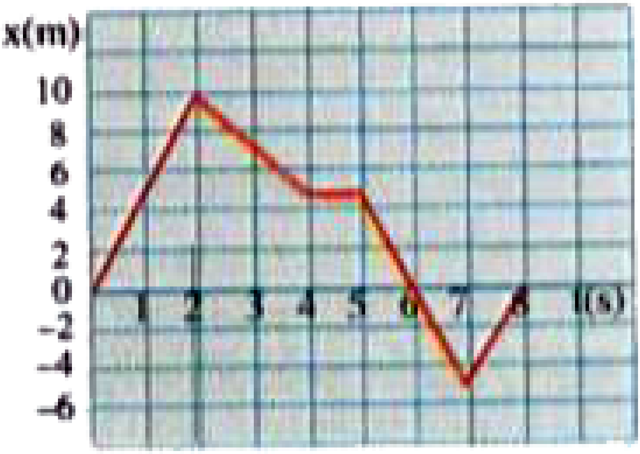
5. i) Find the average velcity in the time intervals

a) 0 to 2 s, b) 0 to 4 s, c)2s to 4s



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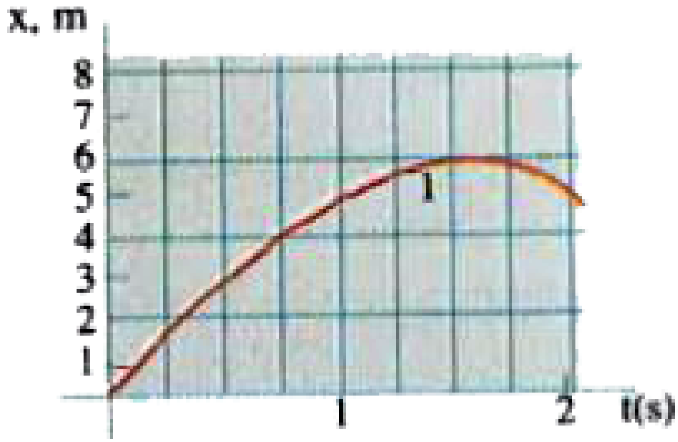
6. Find the average velocity for the time intervals $\Delta t = t_2 - 0.75$ when t_2 is 1.75 ,1.25 and 1.0 s. What is the instantaneous velocity at t=0.75 s?



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7. Velocity of a particle at time $t = 0$ is $2\hat{i}$ m/s. A constant acceleration of $2\frac{m}{s^2}$ acts on the particle for $2s$ at an angle of 60° with its initial velocity. Find the magnitude of velocity and displacement of particle at the end of $t = 2s$.

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8. A car moving on a straight road accelerates from a speed of 4.1 m/s to a speed of 6.9 m/s in 5.0 s. What was its average acceleration?

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9. A solid sphere of radius $2.45m$ is rotating with an angular speed of $10 rad/s$. When this rotating sphere is placed on a rough horizontal surface then after sometime it starts pure rolling. Find the linear speed of the sphere after it starts pure rolling.

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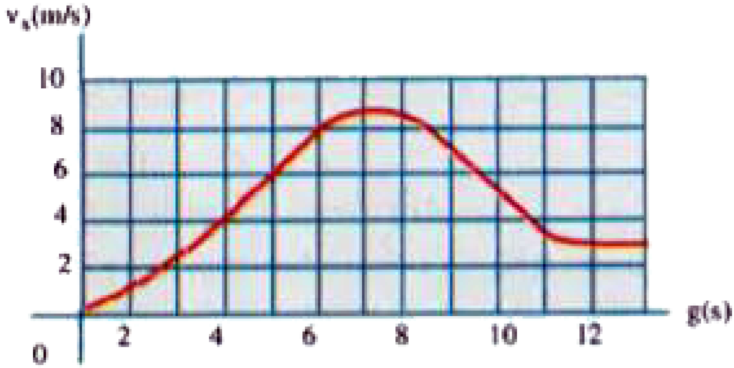
10. Graph of velocity (v) versus time 't' for motion of a motorbike which starts from rest and moves along a stright road is given .

(a)Find the average acceleration for the time interval t_0=0 to t_1=6.0 s

(b) Estimate the time at which the acceleration has its greatest positive value and the value of the acceleration at that instant.

(c) When is the acceleration is zero ?

(d) Estimate the maximum negative value of the acceleration and the time at which it occurs.



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11. A girl is standing on the top edge of an 18 m high building. She tosses a coin upwards with a speed of $7.0ms^{-1}$.How long does it take for the Coin to hit the ground ?How fast is the coin going just before it strikes the ground? $(g = 10ms^{-2})$

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12. A ball is thrown upwards with a speed u from a height h above the ground.The time taken by the ball to hit the ground is

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13. A stone is dropped from top of a cliff.It is seen to hit the ground below after 4.2 s. How high is the cliff?

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14. If an object reaches a maximum vertical height of 23.0 m when thrown vertically upward on earth how high would it travel on the moon where the acceleration due to gravity is about one sixth that on the earth ? Assume that initial velocity is the same.

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15. A stone is thrown vertically upward with a speed of 10.0ms^{-1} from the edge of a cliff 65 m high. What will be its speed just before hitting the bottom ?

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16. A ball is dropped freely from rest.If it travels a distance 55m in the 6th second of its journey find the acceleration.

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17. An object that is dropped freely from rest travels for 5 seconds.What is the distance travelled in the last 2 seconds of its journey.

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18. A ball is vertically project with an initial velocity Of $40ms^{-1}$.Find the (i)maximum height it can reach (ii)and the time of descent.

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19. An object Is vertically projected with an initial velocity of $20ms^{-1}$.Calculate the distance travelled by the object in 3 seconds.(g=$10ms^{-2}$)

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20. A stone is thrown vertically upward with a speed of 10.0 ms^{-1} from the edge of a cliff 65 m high.How much later will it reach the bottom of the cliff ? What will be its speed just before hitting the bottom ?

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21. An object covers 4m in the first two seconds and 4.4m in the next 4 seconds. Find its velocity after 7 seconds from the start.

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22. A balloon starts rising from the ground with a constant acceleration of $1.25m/s^2$. After 8 s, a stone is released from the balloon. Find the time taken by the stone to reach the ground. (Take $g = 10m/s^2$)

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Numerical exercise(LEVEL-2)

1. If a cyclist takes one minute to complete half revolution on a circular path 120 m radius. What is the average velocity?

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2. A car travels the first half of a distance between two places a speed of 30 km/hr and the second half of the distance a 50 km/hr. The average speed of the car for the whole journey is

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3. A car traveled at 80 mph for the first half of the time of a trip and at 40 mph for the second half of the trip. What is the average speed of the car during the entire trip?

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4. 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

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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 km/h. Finding the market closed, he instantly turns and walks back home with a speed of 7.5 km/h. The average speed of the man over the interval of time 0 to 40 min, is equal to

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6. A body starts with a velocity $\left(2\hat{i}+3\hat{j}+11\hat{k}\right)$ m/s and moves with an acceleration $\left(5\hat{i}+5\hat{j}-5\hat{k}\right)m/s^2$. What is its velocity after 0.2 sec ?

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7. A car moving at a constant speed of 36kmph moves north wards for 20 minutes then due to west with the same speed for $8\frac{1}{3}$ minutes.What is the average velocity of the car during this run in kmph

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8. Moving with a uniform acceleration from the state of rest a body covers 22 m during the 6th sec of its motion. What is the distance covered by if during the first 6 sec?

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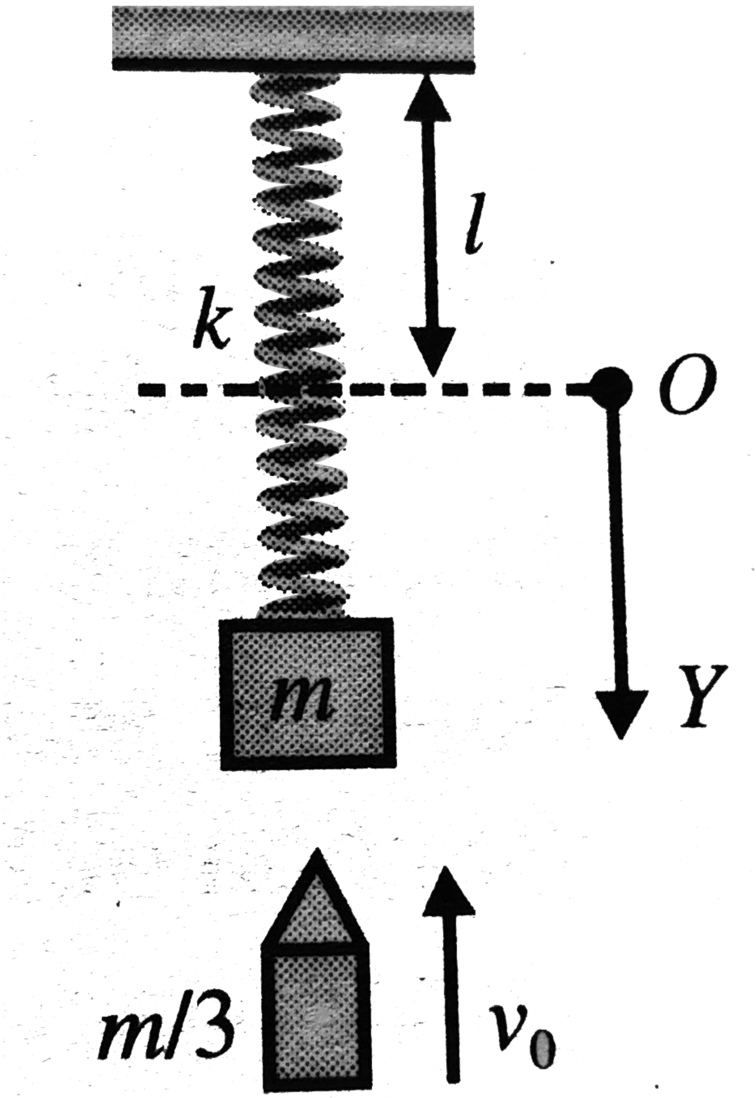

9.

A block of mass m is suspended from one end of a light spring as shown. The origin O is considered at distance equal to natural length of the spring from the ceiling and vertical downwards direction as positive y-axis. When the system is in equilibrium a bullet of mass $\frac{m}{3}$ moving in vertical up wards direction with velocity v_0 strikes the block and embeds into it. As a result, the block (with bullet embedded into it) moves up and start oscillating. Based on the given information, answer the following question:

Q. The time taken by the block bullet system to move from $y = \frac{mg}{k}$ (initial equilibrium position) to $y = 0$ (natural length of spring) is (A represents the amplitude of motion)

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10. A car moving with constant acceleration crosses two points A and B with velocities 10 m/s and 20 m/s in its path. Find the velocity of the car midway between A and B. (in m/s).

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11. A body covers 200 cm in the first 2 sec and 220 cm in the next 4 sec under constant acceleration. Then the velocity of the body after 7 sec is

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12. Two cars X and Y start off to a race on a straight path with initial velocities of 8 m/s and 5 m/s respectively. Car X moves with uniform acceleration of $1\mathrm{m/s}^2$ and car Y moves with uniform acceleration of $1.1\mathrm{m/s}^2$. If both the cars reach the winning post together find the length of the track.

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13. The displacement x of a particle moving in one direction is given by $t = \sqrt{x} + 3$, where x in meter and t in sec. What is its displacement when its velocity is zero

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14. If a body loses half of its velocity on penetrating 3 cm in a wooden block, then how much will it penetrate more before coming to rest

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15. A particle moving with uniform acceleration has its final velocity $(v = \sqrt{150 + 8x})$ m/s where x is the distance travelled by the body. Then the acceleration is

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16. A person is running at his maximum speed of 4 m/s to catch a train. When he is 6 m from the door of the compartment the train starts to leave the station at a constant acceleration of $1 \mathrm{m/s}^2$. Find how long it takes him to catch up the train

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17. When a man stands on a moving escalator he goes up in 50 sec. and when he walks up the moving escalator he goes up in 30 sec. Then the man walks up the stationary escalator in a time of .... sec

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18. An object describes 225 m in the first 3s and 400 m in the next 2s.Calculate the velocity after 5s.From the start.

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19. Ewhen a stone is dropped into a well, the splash of water is heard after $4.25s$. If the depth of the well is 80m , find the velocity of sound

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20. Two stones are through up simultaneously from the edge of a cliff 240 m high with initial speed of 10 m/s and 40 m/s respectively. Which of the following graphs best represents the time variation of relative position of the second stone with respect to the first? Assume stones do not rebound after hitting the ground and neglect air resistance, take . $g = 10m / s^2$

(The figures are schematic and not drawn to scale)

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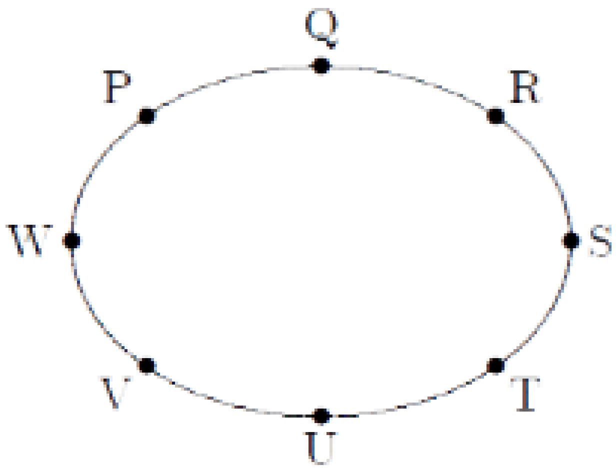
21. A planet travels in an elliptical orbit about a star as shown. At what pair of points is the speed of the planet the same?



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22. The position of a particle moving along the x-axis depends on the time according to the equation $x = ct^2 - bt^3$, where x is in meters and t in seconds.

(a)What units must c and b have ?Let their numerical value be 3.0 and 2.0, respectively.

(b)What distance does the particle move.

(c)WHat is its displacement? At t=1.0,2.0,3.0 and 4.0 ,What are (d) its velocities and (e) its accelretions?

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23. The acceleration of a particle is given by a (t)= (3.00 $m/s^2 - \left(2.00\frac{m}{s^3}\right)$)t. (a) Find the initial speed v_0 such that the particle will have the same x - coordinate at t =5.00 as it had at t=0. (b)What will be the velocity at t =5.00s?

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24. A particle oscillates between the points x=40mm and x=160mm with an acceleration a =k(100-x),where k is a constant.The velocity of the particle is 8 m m/s when =100 mm and is zero at both x=40 mm and x=160mm.Determine (a)the value of k (b) the velocity when x=120 mm.

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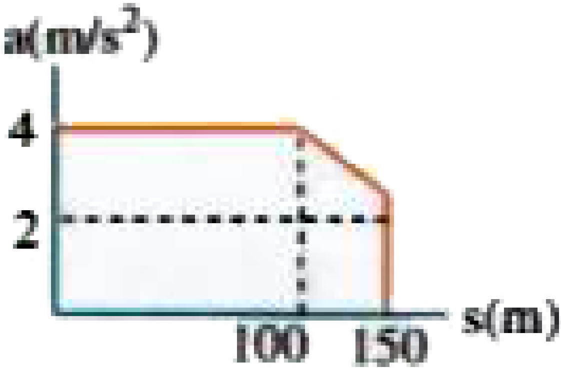
25. The car start from rest at x=0 and is subjected to an acceleration shown by the a-s graph.Draw the v-s graph and determine the time needed to travel 60 m.



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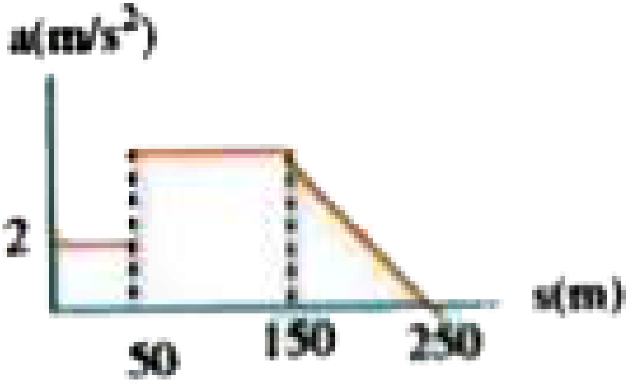
26. Starting from rest at s=0,a boat travels in a straight line with an acceleration on as shown by the a-s graph. Determine the boat's speed at s=40,90 .



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27. A particle leaves the origin with an initial velocity $u = \left(3\hat{i}\right)m/s$ and a constant acceleration $a = \left(-1.0\hat{i} - 0.5\hat{j}\right)m/s^2$.Its velocity v and position vector r when it reaches maximum x coordinate are

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28. A particle A is moving in xy plane with the constant speed of $2\pi m / s$ along the path $x^2 + y^2 + 120y = 0$. At time $t = 0$. When A is at the origin, another particle B starts moving from origin with constant acceleration is such a way that at time $t = 5s$ velocities of both the particles are found to be equal. If sense of motion of A is clockwise, calculate the average speed of B over first five second.

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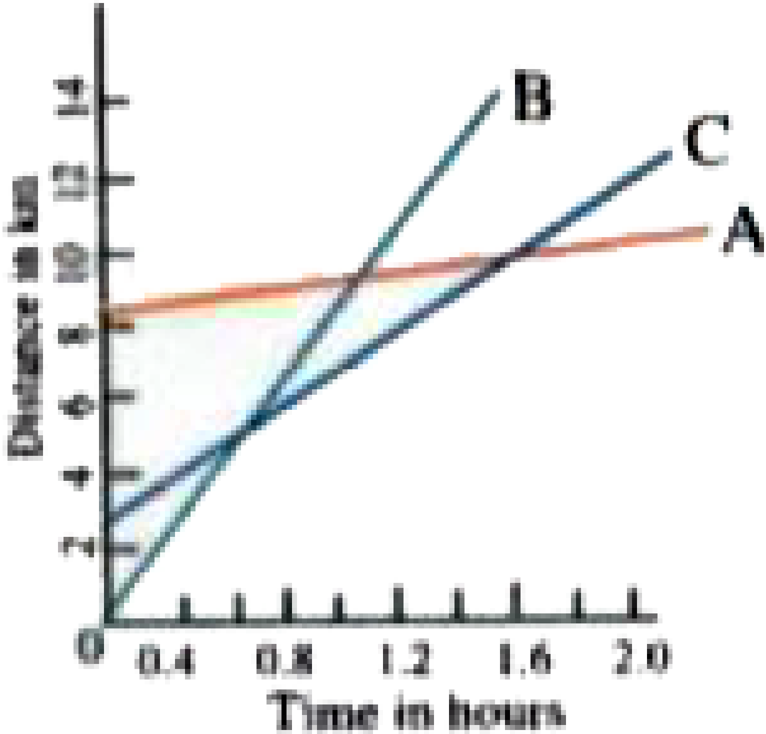
29. Figure shoes the distance -time graph of three person A,B and C.

(a)Which of the three travels the fastest?

(b)Are the three persons ever at the same point on the road?

©how far has c travelled when B passes A?

(d) how far has B travelled by the time it passes C?



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Question for descriptiv Answers

1. Three points are located at the vertices of an equilateral triangle whose side equals a. They all start moving simultaneously with velocity v constant in modulus. With the first point heading continually for the second, the second for the thrid ,and the thrid for the first. How soon will the points converge ?

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

a. initial velocity of the particle,

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

c. speed at any instant.

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3. A train stopping at two stations 4 km apart takes 4 min on the journey from one of the station to the other. Assuming that it first accelerates with a uniform acceleration x and then that of uniform retardation y, prove that $\frac{1}{x} + \frac{1}{y} = 2.$

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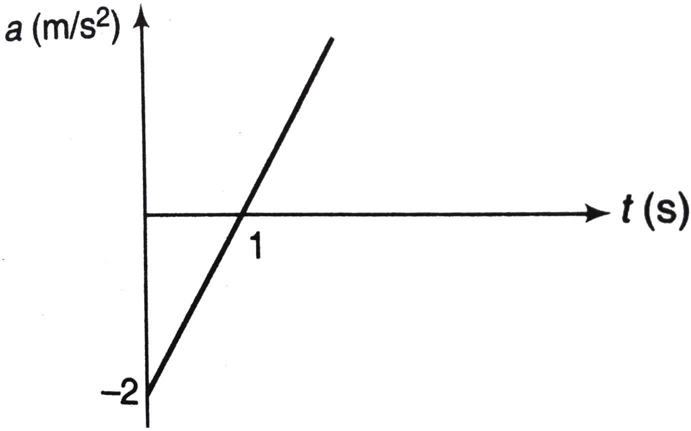
4. The acceleration of particle varies with time as shown.



(a) Find an expression for velocity in terms of t.

(b) Calculate the displacement of the particle in the interval from $t = 2s$ to $t = 4s$. Assume that $v = 0$ at $t = 0$.

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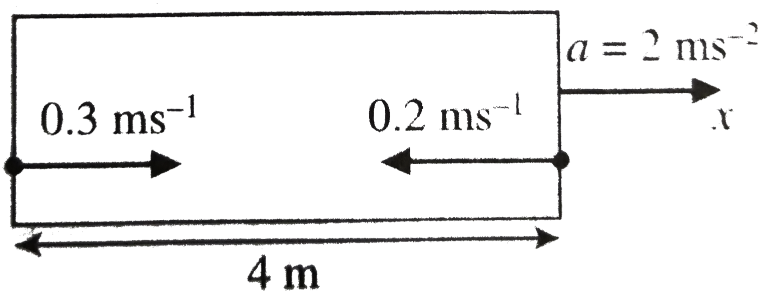
5. A rocket is moving in a gravity free space with a constant acceleration of $2ms^{-2}$ along +x direction (see figure). The length of a chamber inside the rocket is 4 m. A ball is thrown from the left end of the chamber in +x direction with a speed of $0.3ms^{-1}$ from its right end relative to the rocket. The time in seconds when the two balls hit each other is



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6. From a tower of height H, a particle is thrown vertically up with a speed V. The time taken by the particle to hit the ground 3 tiem that taken by it to reach the highest point of is path . Then find H.

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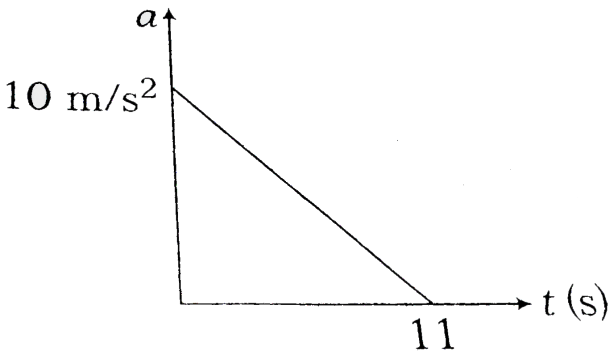
7. A particle starts from rest. Its acceleration (a) versus time (t) graph is as shown in the figure. The maximum speed of the particle will be



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Short answer type question

1. If the average velocity of an object is zero in some time interval , what can you say about the displacement of the object for that interval?

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2. Can the instantaneous velocity of an object during a time interval ever be greater in magnitude than average celocity over the entire interval ? Can it be less?

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3. Give examples for the particle where (a) the velocity is in opposite direction to the acceleration (b)the velocity of the particle is zero but is acceleration is not zero.

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4. Can equation of Kinematics be used in a situation where the acceleration varies in time?Can they be used when acceleration is zero?

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5. A particle moves in a straight line with uniform acceleration. Its velocity at time $t=0$ is v_1 and at time $t=t$ is v_2. The average velocity of the particle in this time interval is $\frac{v_1+v_2}{2}$. Is this statement true or false?

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6. Show that tiem of ascent of a vertically projected body is equal to time of descent.

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7. In case of an object vertically projected, show that the speed of the object upon reaching the point of projection is equal to speed of projection .

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8. Explain the terms , velocity and instantaneous velocity. When are they equal?

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9. Can the velocity of an object be in a direction other than the direction of acceleration of the object ? Explain.

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10. A stone is thrown up in the air . It rises to a height h and then returns to the thrower. For the time that

the stone is in air , sketch the following graphs : y versus t, v versus t, a versus t.

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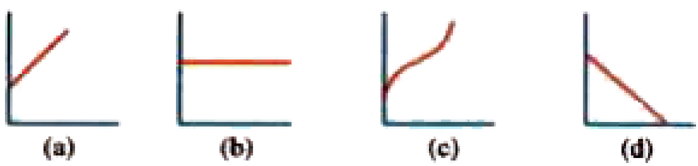
11. The figure below shows four graphs of x versus time,which graph shows a constant,positive ,non-zero velocity?



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12. The refractive index of glass is 1.50 and the speed of light in air is 3 x 108 ms-1 . Calculate the speed of light in glass.

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13. Derive the equation of motion

$x = v_0 t + \frac{1}{2} a t^2$ using appropriate graph.

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14. Represent graphically the motion of a body starting from rest and moving with uniform acceleration both in terms of velocity -time and displacement - time .

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15. Show that tiem of ascent of a vertically projected body is equal to time of descent.

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16. For a stone what is the ratio of the distance covered in its 1st, 3rd and 5th seconds of its free fall.

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very Short answer type question

1. Give two examples of the motion of big objects where the object can be treated as a particle and where it cannot be?

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2. The state of motion is realative .Explain?

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3. Can an object have (1) a constant velocity even through its speed is changing (2) a constant speed even through its velocity is changing ?

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4. A uniform round object of mass M, radius R and moment of inertia about its centre of mass I_{cm} has a light, thin string wrapped several times around its circumference. The free end of string is attaced to the celling and the object is released from rest. Find the acceleration of centre of the object and tension n the string. [Take $\frac{I_{cm}}{MR^2} = k$]

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5. How is average velocity different from instantaneous velocity ?

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6. Give an example of a motion for which both the acceleration and velocity are negative?

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7. "Speed of a particle can be negative",Is thi statement correct?.If not why?'

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8. Can a body in free fall be in equilibrium ?Explain?

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9. Name the situation where the speed of an object is constant while the velocity Is not?

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10. Under what condition is the magnitude of the average velocity of a particle moving in onbe dimension smaller than the average speed over same time interval?

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11. Is it possible that the average velocity for some interval may be zero although the average velocity for a shorter interval included in the first interval is not zero?

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12. The acceleration due to gravity is always down word i.e., along the -ve y direction can be choose this direction as the positive direction for the acceleration due to gravity

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13. Can an object accelerate if is speed is constant?

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14. Can an object accelerate If its velocity is constant?

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15. Can a particle have a constant velocity and varying speed ?

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SOLVED PROBLEMS BASED ON KINEMATICAL EQUATIONS

1. A particle is at x=+5 m at t=0,

x=-7m at t=6 s and x =+2 at t=10s.Find the averahe velocity of the particle during the intervals

(a)t=0 to t=6s

(b)t=6s to t=10s,

(c)t=0 to t=10 s.

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2. A particle transversed half of the distance with a velocity of V0. The remaining parts of the distance was covered with velocity V_l, for half of the time and with V2 for other half of the time. Find the mean velocity of the particle averaged and the whole time of motion.

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

a. relative velocity of B with respect to A?

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

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4. The displacement of x of a particle at the instant when its velocity v is given by $v = \sqrt{3x + 16}$. Find its acceleration and initial velocity.

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5. If S_n=2+0.4n find initial velocity and acceleration

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6. A body starts from rest and moves with uniform acceleration of $5ms^{-2}$ for 8 seconds. From that times the acceleration ceases. Find the distance covered in 12s starting from rest.

Watch Video Solution

7. The two ends of a train moving with uniform acceleration pass a certain point with velocity u and v. Find the velocity with which the middle point of the train passes the same point.

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8. A driver having a definite reaction time is capable of stopping his car over a distance of 30 m on seeing a red traffic signal, when the speed of the car is 72 km/hr andover a distance of 10 m when the speed is 36 km/hr. Find the distance over which he can stop the car if it were running at a speed of 54 km/hr.

Assume that his reaction time and the deceleration of the car remains same in all the three cases.

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9. The speed of a train is reduced from 60km/h to 15 km/h, while it travels a distance of 450m. If the retardation is uniform, find how much further it will travel before coming to rest?

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10. A bullet loses $1/20$ of its velocity in passing through a plank. What is the least number of plank required to stop the bullet .

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11. A body covers 100 cm in first 2 seconds and 128 cm in the next four seconds moving with constant acceleration. Find the velocity of the body at the end of 8 sec ?

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12. A car is moving with a velocity of 20 m/s. The driver sees a stationary truck ahead at a distance of 100 m. After some reaction time Δt the brakes are applied producing a retardation of $4m/s^2$? What is the maximum reaction time to avoid collision ?

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13. A bus starting from rest, accelerates at the rate of f through a distance S, then continues at constant speed for time t and declerates at the rate f/2 to come to rest. If the total distance travelled is 15 S then S =

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14. A driver can stop his car from the red signal at a distance of 20 m when he is driving at 36 kmph and 41.25 m when he is driving at 54 kmph. Find his reaction time.

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15. A car starts from rest and moves with uniform acceleration 'a', At the same instant from the same point a bike crosses with a uniform velocity 'u'. When and where will they meet ? What is the velocity of car with respect to the bike at the time of meeting?

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16. Two bodies start moving in the same straight line at the same instant of time from the same origin. The first body moves with a constant velocity of $40ms^{-1}$, and the second starts from rest with a constant acceleration of $4ms^{-2}$.Find the time that elapses before the second catches the first body. Find the also the greatest distance between them prior to it and time at which this occurs.

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17. Two trains one travelling at 54 kmph and the other at 72 kmph are headed towards one an other along a straight track. When they are $\frac{1}{2}$ km apart, both drivers simultaneously see the other train and apply their brakes. If each train is decelerated at the rate of $1ms^{-2}$, will there be collision ?

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18. In a car race, car A takes time t less than car B and passes thre finishing point with a velocity v more than the velocity with which car B passes the point. Assuming that the cars start from rest and travel with Constant accelerations a1 and a2, show that $\frac{v}{t} = \sqrt{a_1 a_2}$.

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19. A particle moving along a straight line with initial velocity u and acceleration a continuous its motion for n seconds. What is the distance covered by it in the last nth second?

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PROBLEM BASED ON GRAPHS

1. A bus accelerates from rest at a constant rate α for some time, after which it decelerates at a constant rate β to come to rest. If the total time elapsed is t seconds then, evaluate.

(a)the maximum velocity achieved and (b)the total distance travelled graphically.

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2. $ABCD$ is a parallelogram and $E\,and\,F$ are the centroids of triangles $ABD\,and\,BCD$ respectively, then $EF =$

(a)AE

(b) BE

(c) CE

(d) DE

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3. Velocity-time graph for the motion of a certain body is shown in fig.Explain the nature of this motion .Find the initial velocity and acceleration and write the equation for the variation of displacement with time.What happens to the moving body at point B? How will the body move after this moment?

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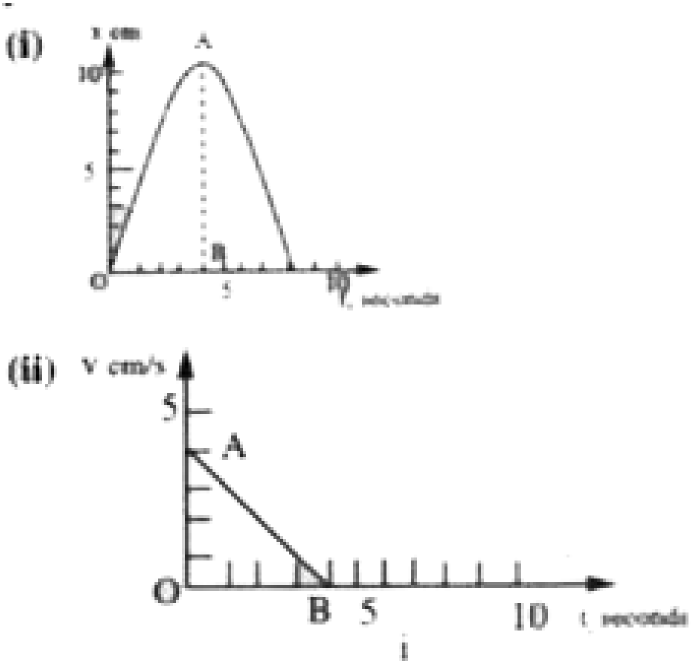
4. The graphs in (i) and (ii) show the S-t graph and V - t graph of a body. Are the motions shown in the graphs represented by OAB the same ?



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

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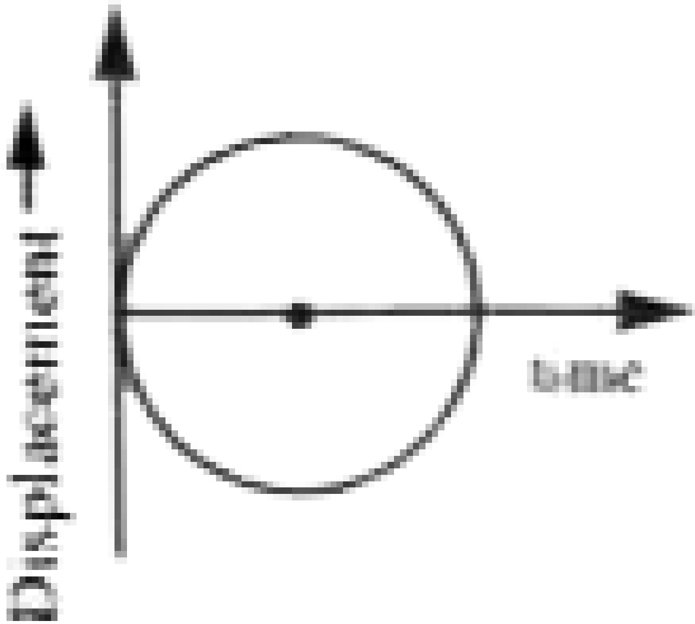
6. Figure given here shows the displacement time graph for a particle. Is it practically possible ? Explain.



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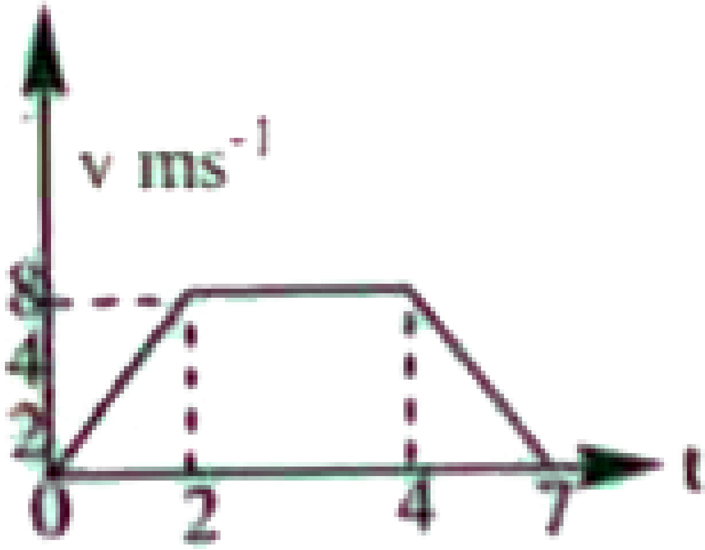
7. Figure given here shows the variation of velocity of a particle with time.

Find the displacement. ,



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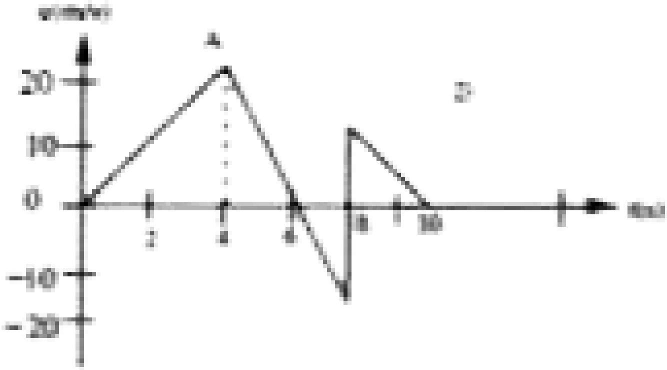
8. The velocity-time graph of a body moving in a straight line is shown in Fig. Find the displacement and distance travelled by the body in 10 sec.



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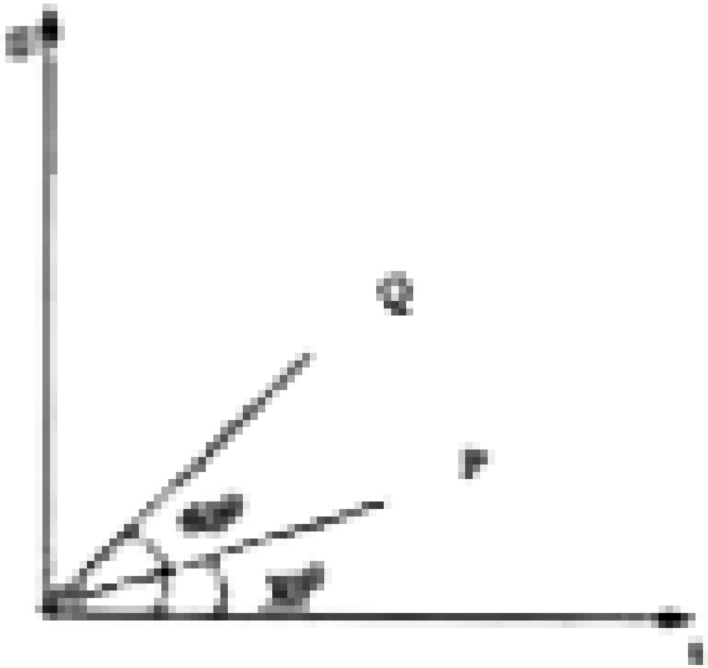
9. The displacement-time graphs of two particles P and Q are as shown in the figure. The ratio of their

velocities V_P and V_Q will be



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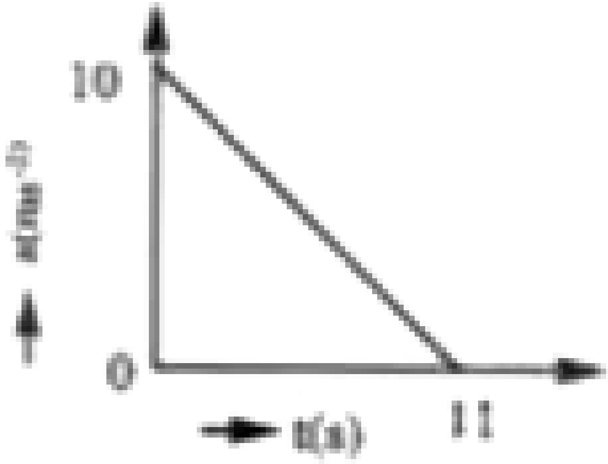
10. The a -t graph is shown in the figure. The maximum velocity attained by the body from rest will be



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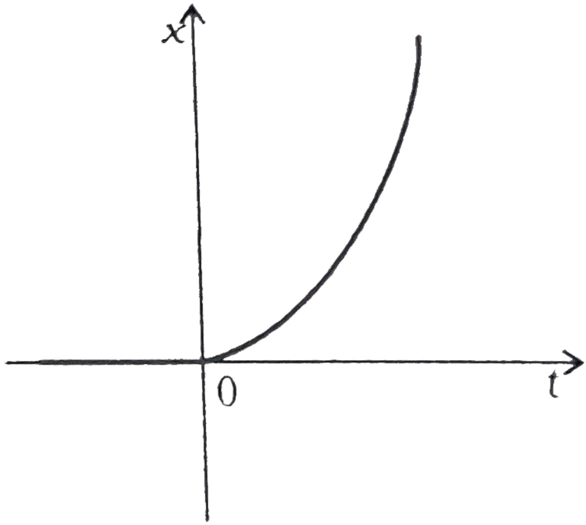
11. Figure 3.21 shows the $x-t$ plot of one-dimensional motion of a particle. Is it correct to say from the graph that the particle moves in a straight line for $t < 0$ and on a parabolic path for $t > 0$? If not, suggest a suitable physical context for this graph.



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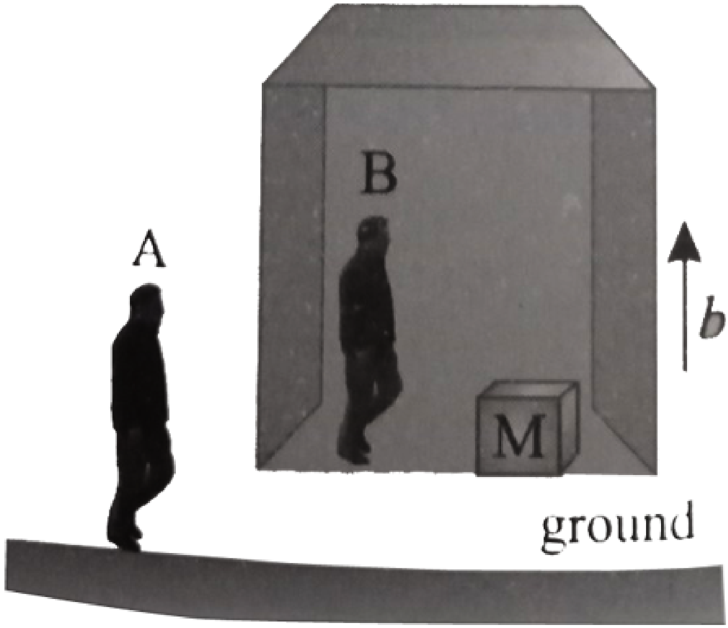

12.

A block of mass M is kept in elevator (lift) which starts moving upward with constant acceleration b as shown in figure. Initially elevator at rest. The block is observed by two observers A and B for a time interval $t = 0$ to $t = T$. Observer B is at rest with respect to elevator and observer A is standing on the ground.

Q. The observer A finds that the work done by gravity on the block is

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PROBLEM BASED ON CALCULUS

1. The motion of a particle along a straight line is described by the function $s = 6 + 4t^2 - t^4$ in SI units. Find the velocity, acceleration, at t = 2s, and the average velocity during 3^{rd} second.

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2. A particle moves according to the equation $t = \sqrt{x} + 3$, where will be the particle come to the rest for the first time

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3. The velocity of a particle moving in the positive direction of the X-axis varies as $V = K\sqrt{S}$ where K is a positive constant. Draw V-t graph.

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4. A point moves rectilinearly with deceleration whose modulus depends on the velocity v of the

particle as $\alpha = k\sqrt{v}$, where k is a positive constant. At the initial moment the velocity of the point is equal to V_0. What distance will it take to cover that distance?

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5. Two bodies begin to fall freely from the same height but the second falls T second after the first. The time (after which the first body begins to fall) when the distance between the bodies equals L is:

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6. For a freely falling body, Find the ratio of the times taken to fall successive equal distances.

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7. A ball of mass is thrown vertically upwards by applying a force by hand. If the hand moves while applying the force and the ball goes up to height further, find the magnitude of the force. (Take $g = 10ms^{-2}$)

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8. If a freely falling body covers half of its total distance in the last second of its journey, Find its time of fall.

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9. A rocket is fired vertically upwards with a net acceleration of $4m/s^2$ and initial velocity zero. After $5s$ its fuel is finished and it decelerates with g. At the highest point its velocity becomes zero. Then, it accelerates downwards with acceleration g and return back to ground. Plot velocity-time and displacement -time graphs for the complete journey. Take $g = 10m/s^2$.

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10. A ball is thrown upward with an ini tial velocity of 100ms^{-1}. After how much time will it return ? Draw velocity - time graph for the ball and find from the graph (i) the maximum height attained by the ball and (ii) height of the ball after 15 s. Take $g = 10ms^{-2}$

.

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11. Ball A dropped from the top of a building. A the same instant ball B is thrown vertically upwards from the ground. When the balls collide, they are moving in opposite directions and the speed of A is twice the speed of B. At what fraction of the height of the building did the collision occur?

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12. A stone is allowed to fall from the top of a tower 300 m height and at the same time another stone is projected vertically up from the ground with a velocity $100ms^{-1}$. Find when and where the two stones meet ?

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13. An object falls from a bridge which is 45 m above the water. It falls directly into a small row - boat moving with constant velocity that was 12m from the point of impact when the object was released. What was the speed of the boat ?

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14. If an object reaches a maximum vertical height of 23.0 m when thrown vertically upward on earth how high would it travel on the moon where the acceleration due to gravity is about one sixth that on the earth ? Assume that initial velocity is the same.

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15. Drop of water fall at regular intervals from roof of a building of height (H=16 m), the first drop striking the ground at the same moment as the fifth drop falls from the roof. The distances between separate drops in air as the first drop reaches the ground are.

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16. Two balls are dropped to the ground from different heights. One ball is dropped 2s after the other, but both strike the ground at the same time 5s after the Ist is dropped.

(a) What is the difference in the heights from which they were dropped ?

(b) From what height was the first ball dropped?

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17. An elevator ascends with an upward acceleration of $0.2m/s^2$. At the instant its upward speed is 3 m/sec a loose bolt 5m high from the floor drops from the ceiling of the elevator. Find the time until the bolt strikes the floor and the displacement it has fallen

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18. A body falls freely from a height of 125m $(g = 10m/s^2)$ after 2 sec gravity ceases to act Find the time taken by it to reach the ground?

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19. A parachutist drops freely from an aeroplane for 10 seconds before the parachute opens out. Then he descends with a net retardation of 2m/sec^2. His velocity when he reaches the ground is 8 m/sec. Find the height at which he gets out of the aeroplane ?

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20. A stone is dropped into a well and the sound of splash is heard after 5.3 sec. If the water is at a depth of 122.5 m from the ground, the velocity of sound in air is

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21. A body is thrown vertically up with a velocity of 100 m/s and another one is thrown 4 sec after the first one. How long after the first one is thrown will they meet?

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22. A ball is thrown vertically upward with a velocity 'u' from the balloon descending with velocity v. After what time, the ball will pass by the balloon ?

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23. A ball dropped from the 9th story of a multi - storeyed building reaches the ground in 3 second. In the first second of its free fall, it passes through storeys, where n is equal to (Take $g = 10ms^{-2}$)

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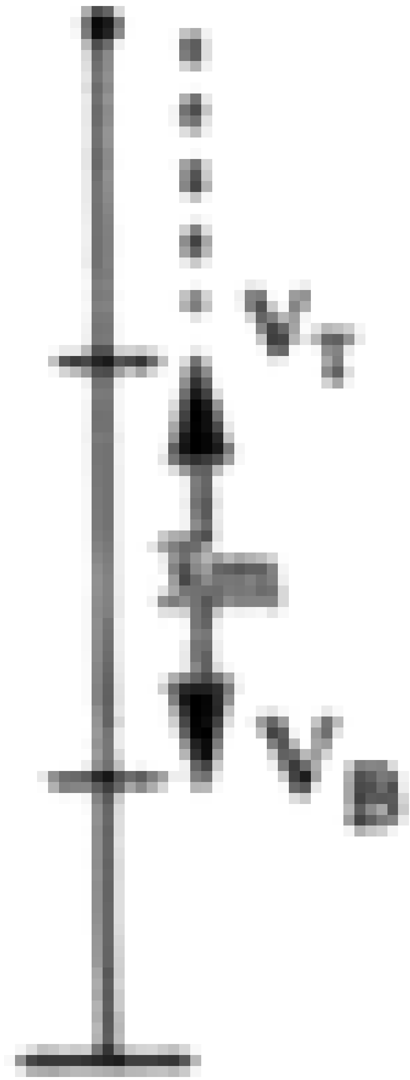
24. A stone is dropped into water from a bridge 44.1 m above the water. Another stone is thrown vertically downward 1 s later. Both strike the water simultaneously. What was the initial speed of the second stone?

Watch Video Solution

25. A ball is dropped from the top of a building. It takes 0.5s to fall past the 3m length of a window some distance from the top of the building. If the velocity of the ball at the top and at the bottom of the window are V_T and V_B respectively then $V_T + V_B$

=?



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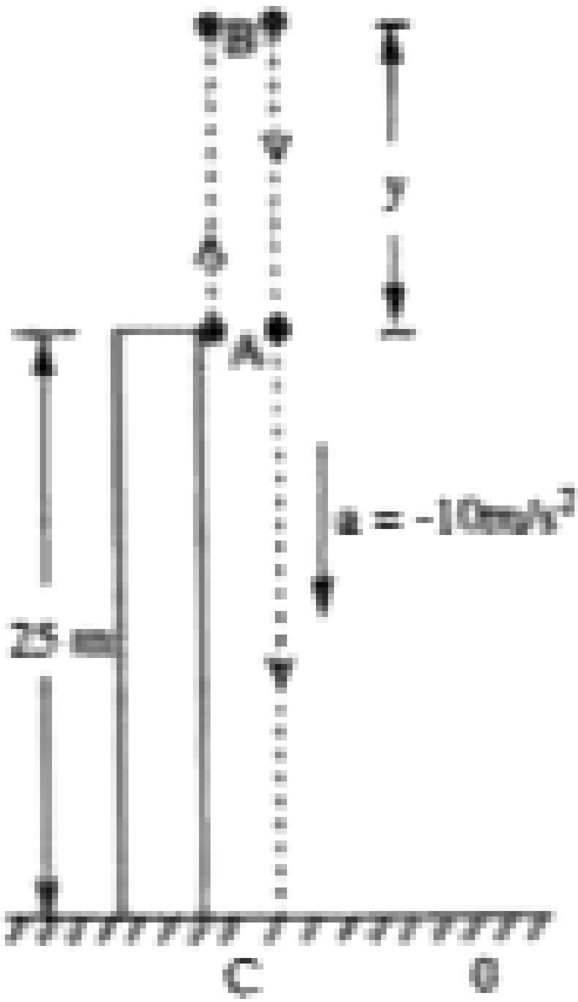
26. A ball is thrown vertically upwards with a velocity of $20ms^{-1}$ from the top of a multistorey building. The height of the point from where the ball is thrown is 25.0 m from the ground. (a) How high will the ball rise ? and (b) how long will it be before the ball hits the ground? Take $g = 10ms^{-2}$



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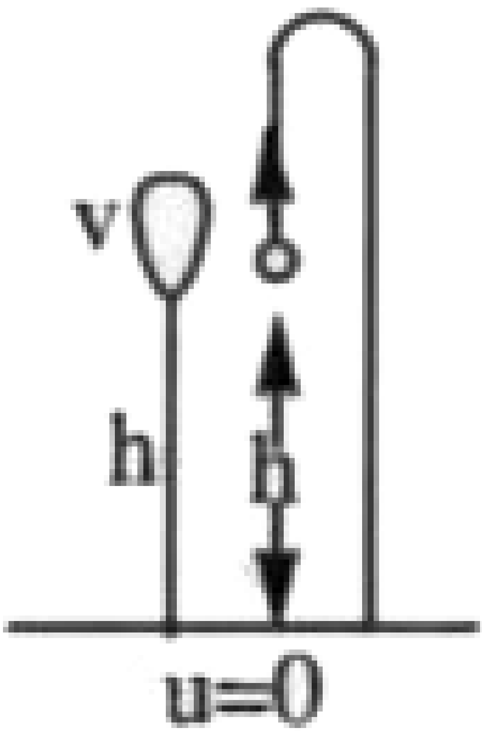
27. A balloon starts from rest from the ground and moves with uniform acceleration g/8. When it reaches a height h a ball is dropped from it. Find the time taken by the ball to reach the ground.



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28. A body is projected vertically up with velocity u from a tower. It reaches the ground with velocity nu. The height of the tower is $H = \frac{u^2}{2g}(n^2 - 1)$

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EXERCISE-IA

1. A particle starts from the origin, goes along x-axis to the point (10 m, 0) and then returns along. The same line to the point (-10 m, 0). The distance and displacement of the particle during the trip are

A. 60m,-20m

B. 40m,-40m

C. 40m,40m

D. 80m,40m

Answer: A

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2. The muerical value of the ratio of average velocity to average speed is.

A. Unity

B. unity or less then 1

C. unity or more

D. less then unity

Answer: B

Watch Video Solution

3. A person travelling on a straight line moves with a uniform velocity v_1 for a distance x and with a uniform velocity v_2 for the next equal distance. The average velocity v is given by

A. $v = \frac{v_1 + v_2}{2}$

B. $v = \sqrt{v_1 v_2}$

C. $\frac{2}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

D. $\frac{1}{v} = \frac{1}{v+_1} + \frac{1}{v_2}$

Answer: C

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4. A lift is coming from 8th floor and is just about to reach 4th floor. Taking ground floor as origin and positive direction upwards for all quantities, which one of the following is correct ?

A. $x < 0, v < 0, a > 0$

B. $x > 0, 0c < 0, a < 0$

C. $x > 0, v < a > 0$

D. $x > 0, v > 0, a < 0$

Answer: A

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5. The correct statement from the following is

A. A body having zero velocity will not necessarily have zero acceleration.

B. A body having zero velocity will necessarily have zero acceleration.

C. A body havinf uniform speed can have only uniform acceleration.

D. A body having nonuniform velocity will have zero acceleration.

Answer: A

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6. Which of following statements is incorrect?

A. Path length is a scalr quantity whereas displacement is a vector quantity
B. The magnitude of displacement is always equal to the path length traversed by an object over a given time interval
C. The displacement depends only on the end points whereas path length depends on the actual path followed.
D. The path length is always positive whereas displacement can be positive,negative and zero.

Answer: B

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7. The displacement of a particle starts from rest is proportional to the square of time, then the particle travels with

A. Uniform acceleration

B. Uniform velocity

C. Increasing acceleration

D. Decreasing velocity

Answer: A

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8. Acceleration of a particle change when

A. Direction of velocity changes

B. Magnitude of velocity changes

C. Either of above

D. Speed is constant

Answer: C

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9. What determines the nature of the path followed by the particle

A. Speed

B. Velocity

C. Acceleration

D. None of these

Answer: B

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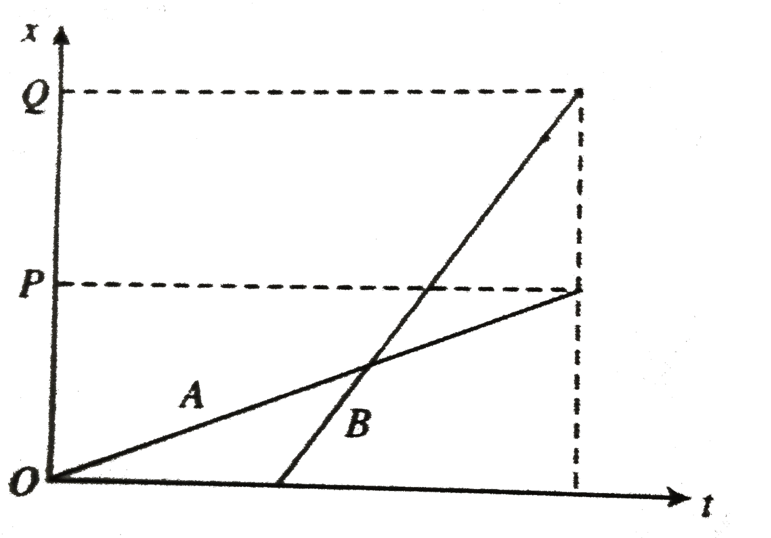
10. The position-time (x-t) graphs for two children A and B returning from their school O to their homes P and Q, respectively, are shown in . Choose the correct entries in the brackets



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).

A. A lives closer to the school than B.

B. A starts from the school earlier than B.

C. A walks faster than B.

D. A and B reach home at the same time.

Answer: C

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11. At time t = 0, two bodies A and B at the same point. A moves with constant velocity v and B starts from rest and moves with constant acceleration. Relative velocity of B w.r.t. A when the bodies meet each other is

A. V/2

B. V/3

C. V

D. 2V

Answer: C

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12. Two bodies of different masses are dropped simultaneously from the top of a tower. If air resistance is same on both of them,

A. The hevier body reaches the ground earlier

B. The lighter body reaches the ground earlier

C. Both reach the ground simultaneously

D. Cannot be decided

Answer: A

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13. At a metro station, a girl walks up a stationary escalator in time t_1. If she remains stationary on the escalator, then the escalator take her up in time t_2. The time taken by her to walk up on the moving escalator will be

A. $(t_1 + t_2)/2$

B. $t_1 t_2/(t_2 - t_1)$

C. $t_1 t_2/(t_2 + t_1)$

D. $t_1 - t_2$

Answer: C

Watch Video Solution

14. Two bodies of different masses are dropped simultaneously from the top of a tower. If air resistance is same on both of them,

A. the heavier body reaches the ground earlier

B. the lighter body reaches the ground earlier

C. Both reach the ground simultaneously

D. Cannot be decided

Answer: C

Watch Video Solution

15. The acceleration of a moving body can be found from

A. Area under velocity-time graph

B. Area unfer distance-time graph

C. Slope of the velocity -time graph

D. Slope of distance -time graph

Answer: C

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16. A body falls freely from a height 'h' its average velocity when it reaches earth is

A. $\sqrt{gh}$

B. $\sqrt{\frac{gh}{2}}$

C. $\sqrt{2gh}$

D. $g\sqrt{h}$

Answer: B

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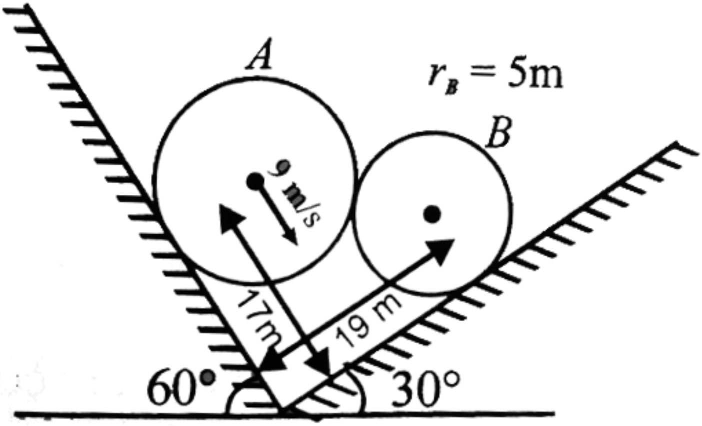
17.



System is shown in the figure. Velocity of sphere A is 9 $\frac{m}{s}$. Find the speed of sphere B.

A. A,B are true

B. A,B are false

C. A true ,B false

D. A false ,B true

Answer: C

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18. For a moving body at any instant of time

A. IF the body is not moving.the acceleration is necessarily zero.

B. If the body is slowing,the retarding is negative .

C. If the body is slowing,the distance is negative.

D. If displacement ,velocity and acceleration at that instant are known,we can find the displacement at any given time in future.

Answer: D

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19. A body falls freely from a height 'h' after two seconds if accelaration due to gravity is reversed the body

A. Continues to fall down

B. Falls down with retatdation & goes up again with acceleration after some time

C. Falls down with uniform velocity

D. Raises up with acceleration

Answer: B

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20. A body falls freely from a height 'h' after two seconds if we assume that gravity disappears the body

A. Continues to fall down with uniform velocity

B. Falls down with acceleration

C. Falls down & floats

D. Falls down with declaration

Answer: A

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21. In the case of a body freely falling from small height

A. the changes of position are equal in equal intervals of time

B. The changes of velocity are equal in unequal intervals of time

C. the changes of acceleration is zero in eqaul or unequal intervals of time

D. None

Answer: C

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22. A hydrogen balloon released on the moon from a height will

A. Move up with accelration 9.8 ms-2

B. Move down with acceleration 9.8 ms-2

C. Move down with acceleration $\frac{9.8}{6}ms^{-2}$

D. neither move up nor move down

Answer: C

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23. A freely falling body traveled xm in n^{th} second distance travelled in $n-1^{th}$ second is

A. x

B. x+g

C. x-g

D. 2x+3g

Answer: C

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24. A body is projected up with a velocity $50 \mathrm{~ms}^{-1}$ after one second if accelaration due to gravity disappears then body

A. Floats in air

B. Continue to move up with constant velocity

C. Continue to move up with acceleration

D. Goes up and falls down

Answer: B

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25. A body falls freely from a height 'h' after two seconds if accelaration due to gravity is reversed the body

A. Continues to fall down

B. Falls down witgh retardation & goes up again with acceleration after some time

C. Falls down with uniform velocity

D. Raises up with acceleration

Answer: B

Watch Video Solution

26. A stone is released from an elevator going up with an acceleration a. The acceleration of the stone after the release is

A. a upward

B. (g-a) upward

C. (g-a) downward

D. g downward

Answer: D

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27. From the top of a tower body A is thrown up vertically with velocity u and another body B is thrown vertically down with the same velocity u.If V_A and V_B are their velocities when they reach the ground and t_A and t_B are their times of flight ,then

A. $V_A = V_B$ and $t_A = t_B$

B. $V_A > V_B$ and $t_A > t_B$

C. $V_A = V_B$ and $t_A > t_B$

D. $V_A < V_B$ and $t_A < t_B$

Answer: C

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28. At the maximum height of a body thrown vertically up

A. Velocity is not zero but acceleration is zero

B. Acceleration is not zeto but velocity is zero

C. Both acceleration and velocity are zero

D. Both acceleration and velocity are not zero

Answer: B

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29. Following are four different relations about displacement, velocity and acceleration for the motion of a particle in general. Choose the incorrect one (s).

(a)$v_{av} = \frac{1}{2}[v(t_1) + v(t_2)]$

(b)$v_{av} = \frac{r(t_2) - r(t_1)}{t_2 - t_1}$

(c)$r = \frac{1}{2}(v(t_2) - v(t_1))(t_2 - t_1)$

(d)$a_{av} = \frac{v(t_2) - v(t_1)}{t_2 - t_1}$

A. a and b

B. a and d

C. b and c

D. a and c

Answer: D

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30. A body thrown vertically up with velocity u reaches the maximum height h after T seconds. Which of the following statements is true ?

A. At a height $\frac{h}{2}$ from the ground its velocity is $\frac{u}{2}$

B. At a time T its velocity is u

C. At a time 2T its velocity is u directed downwards

D. None of the above

Answer: C

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31. A balloon rases up with uniform velocity 'u'. A body is dropped from ballon. The time of descent for the body is given by is

A. $\frac{\sqrt{2h}}{g}$

B. $h = ut + \frac{1}{2}ft^2$

C. $h = \ - ut + \frac{1}{2}\mathrm{gt}^2$

D. $-h = ut + \frac{1}{2}\mathrm{gt}^2$

Answer: C

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32. In the above problem if body is thrown down with velocity 'u' the equation for the descent time is

A. $h = \frac{1}{2}\mathrm{gt}^2$

B. $h = ut + \frac{1}{2}\mathrm{gt}^2$

C. $-h = -ut + \frac{1}{2}\mathrm{gt}^2$

D. $-h = -ut + \frac{1}{2}\mathrm{gt}^2$

Answer: B

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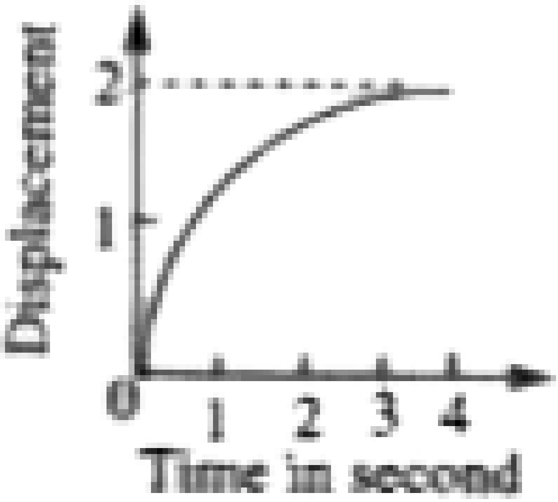
33. The displacement of a particle as a function of time is shown in the figure. The figure shows that



A. The particle starts with certain velocity but the motion is retarded and finally the particle stops

B. The velocity of the particle is constant throughout

C. The acceleration of the particle is constant throughout

D. The particle starts with constast velocity,then motion is accelerated and finally the particle moves with another constant velocity.

Answer: A

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34. From the top of a tower two bodies are projected with the same initial speed of 40ms^{-1}, first body vertically upwards and second body vertically downwards. A third body is freely released from the top of the tower. If their respective times of flights are T_1, T_2 and T_3 identify the correct descending order of the times of flights

A. T_1, T_2, T_3

B. T_2, T_3, T_1

C. T_2, T_1, T_3

D. T_1, T_3, T_2

Answer: D

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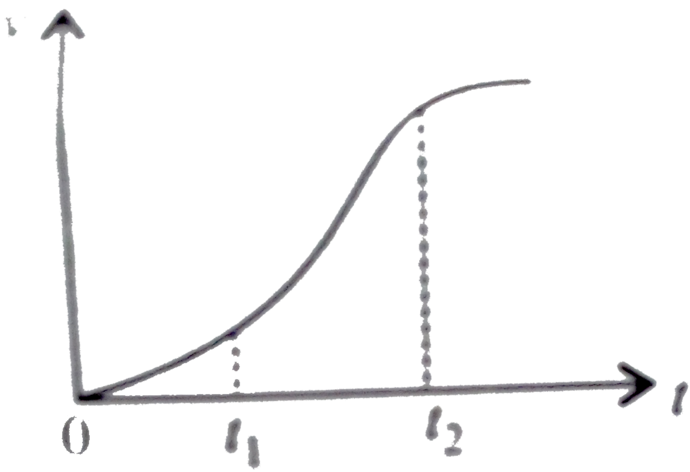
35. The velocity-time graph of a particle in one-dimensional motion is shown in the figure. Which of the following formulae is correct for describing the motion of the particle over the time interval t_1 to t_2?



A.

$$x(t_2) = x(t_1) + v(t_1)(t_2 - t_1) + \left(\frac{1}{2}\right)a(t_a - t_1)^2$$

B. $v(t_2) = v(t_1) + a(t_2 - t_1)$

C. $v_{\text{average}} = \dfrac{(x(t_2) + x(t_1))}{t_2 - t_1}$

D. $a_{\text{average}} = \dfrac{(v(t_2) - v(t_1))}{t_2 - t_1}$

Answer: D

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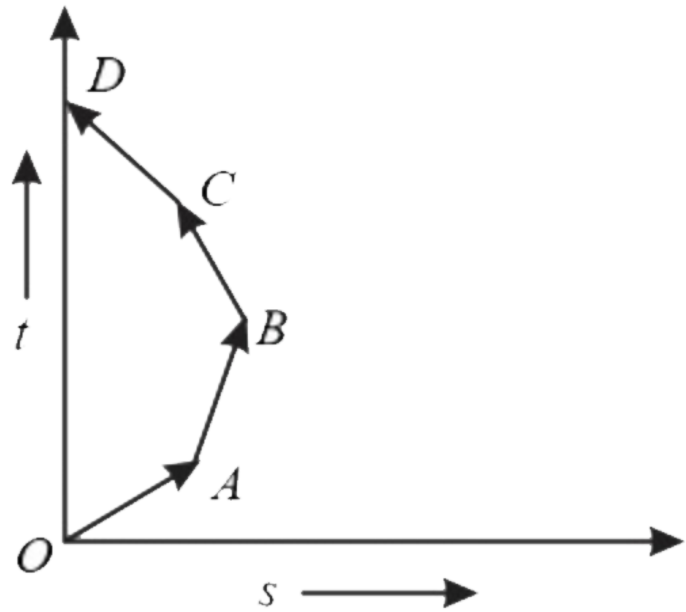
36. Which of the following options is correct for the object having a straight line motion represented by the following graph ?



A. The object moves with constantly increasing velocity from O to A then it moves with constant velocity.

B. Velocity of the object increases uniformly.

C. Average velocity is zero.

D. The graph shown is impossible.

Answer: C

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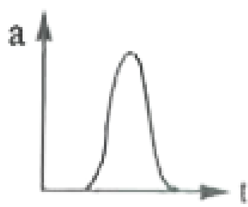
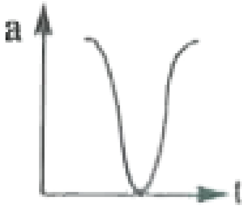
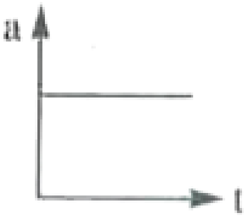
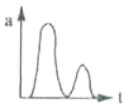
37. A uniformaly moving cricket ball is turned back by hitting it with a bat for a very shor time interval. Show the variation of its acceleration with time (Take acceleration in the backward direction as positive).

A. 

B. 

C. 

D. 

Answer: A

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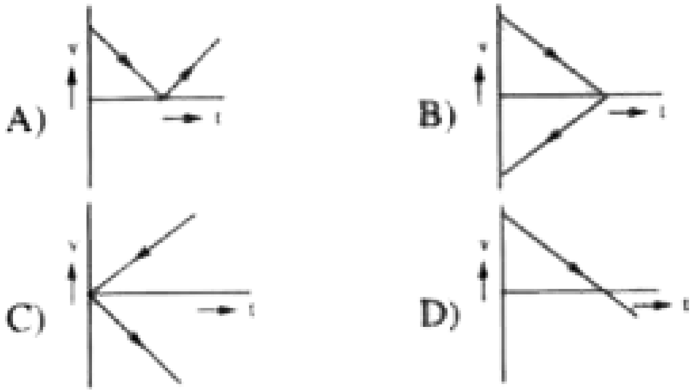
38. A ball is thrown vertically upwards. Which of the following graph/graphs represent velocity-time graph of the ball during its flight (air resistance is neglected)



A. A

B. B

C. C

D. D

Answer: D

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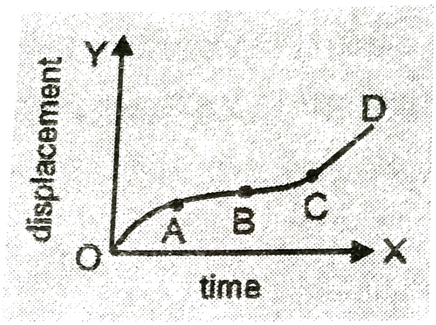
39. The graph between the displacement x and time t for a particle moving in a straigh lin ais shown in figure. During the internal OA,AB,BC and CD, the acceleration of the particle is:



	OA,	AB,	BC,	CD
(1)	+	0	+	+
(2)	–	0	+	0
(3)	+	0	–	+
(4)	–	0	–	0

A. $\begin{array}{cccc} OA & AB & BC & CD \\ + & 0 & + & + \end{array}$

B. $\begin{array}{cccc} OA & AB & BC & CD \\ - & 0 & + & 0 \end{array}$

C. $\begin{array}{cccc} OA & AB & BC & CD \\ - & 0 & - & + \end{array}$

D. $\begin{array}{cccc} OA & AB & BC & CD \\ - & 0 & - & 0 \end{array}$

Answer: B

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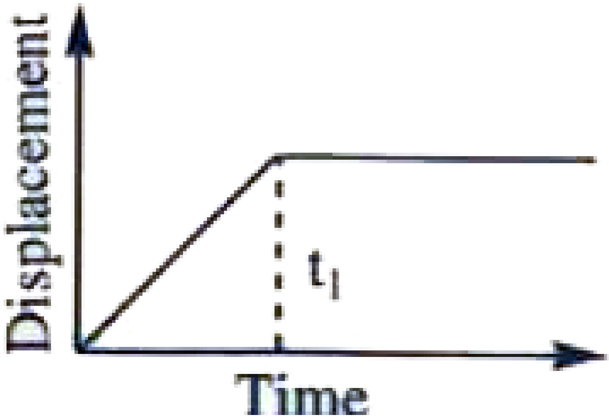
40. The x-t graph shown in figure represents.



A. Constant velocity

B. Velocity of the body is continuously changing.

C. Instantaneous velocity

D. The body travels with constant speed up to time t_1 and then stops

Answer: D

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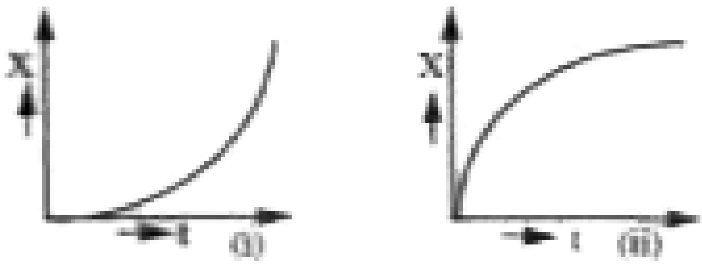
41. Figures (i) and (ii) below show the displacement - time graphs of two particles moving along the x-axis. We can say that



A. Both the particles are having a uniformly retarted motion.

B. Both the particles are having a uniformly accelerated motion while particle (ii) is having a uniformly retarded motion.

C. Particle (i) is having a uniformly retarded motion while particle (ii) is having a uniformly retarted motion.

D. Particle (i) is having a uniformly retarded motion while particle (ii) is having a uniformly accelerated motion.

Answer: C

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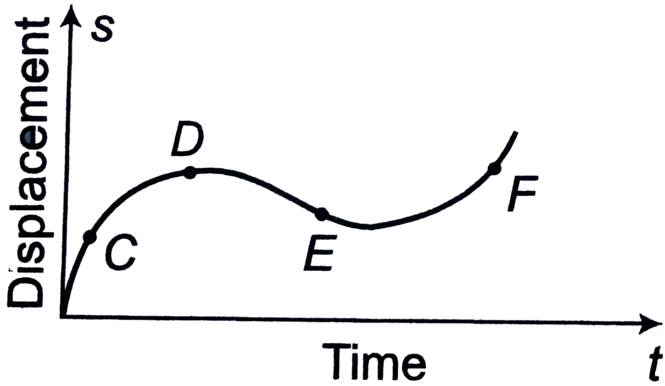
42. The displacement-time graph of moving particle is shown below



The instantaneous velocity of the particle is negative at the point

A. D

B. F

C. C

D. E

Answer: D

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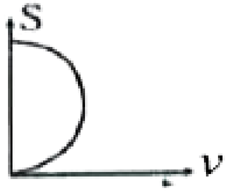
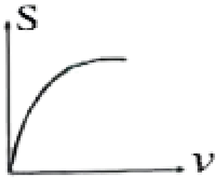
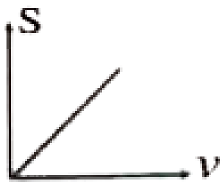
43. An object is moving with a uniform acceleration which is parallel to its instantaneous direction of motion. The displacement velocity (v) graph of this object is

A. 

B. 

C. 

D. 

Answer: C

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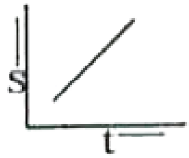
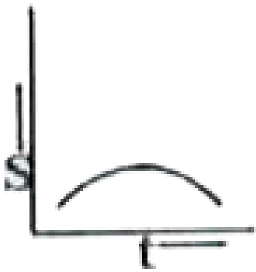
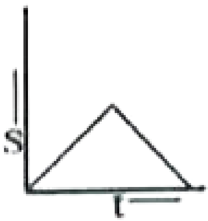
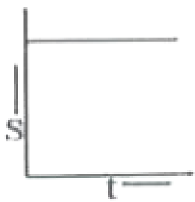
44. Which of the following graph represents uniform motion

A. 

B. 

C. 

D. 

Answer: A

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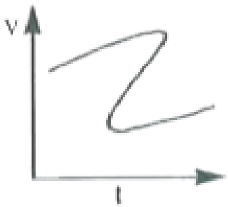
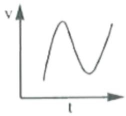
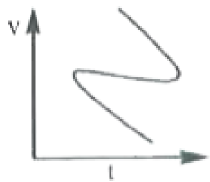
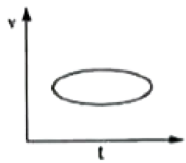
45. Which of the following velocity-time graphs shows a realistic situation for a body motion?

A. 

B. 

C. 

D. 

Answer: B

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46. The area under acceleration-time graph gives

A. Distance travelled

B. Change in acceleration

C. Force acting

D. Change in velocity

Answer: D

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47. Consider the motion of the tip of the minute hand of a clock.In one hour

a)The displacement is zero

b)The distance covered is zero

c)The average speed is zero

d)The average velocity is zero

A. a & b are correct

B. a,b & c are correct

C. a & d are correct

D. b,c & d are correct

Answer: C

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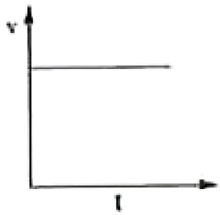
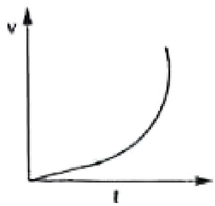
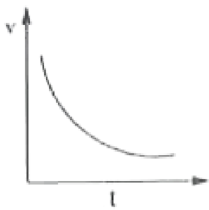
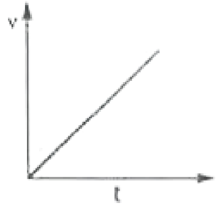
48. Which of the following velocity-time graphs represent uniform motion

A. 

B. 

C. 

D. 

Answer: A

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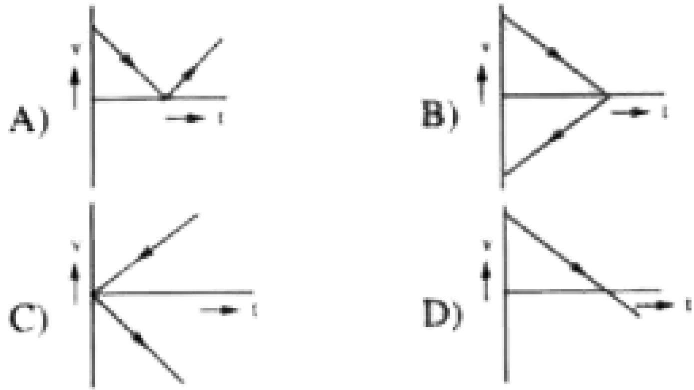
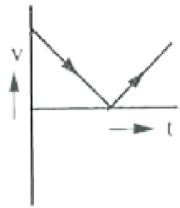
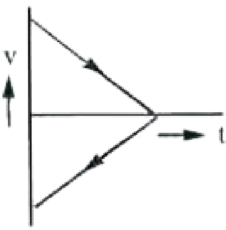
49. A ball is thrown vertically upwards. Which of the following graph/graphs represent velocity-time graph of the ball during its flight (air resistance is neglected)

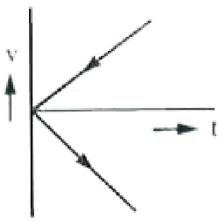




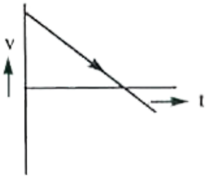
A.



B.



C.

D. 

Answer: D

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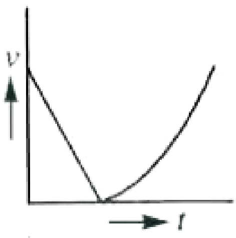
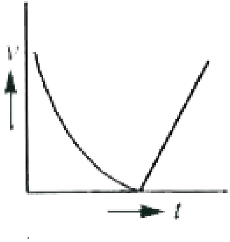
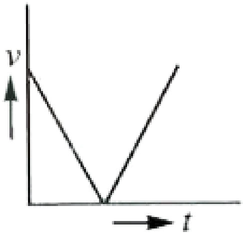
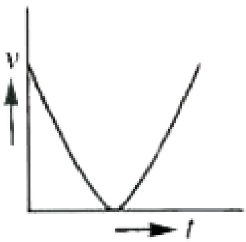
50. Which of the following is wheat fruit?

A. 

B. 

C. 

D. 

Answer: C

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51. A particle is moving along x-direction with a constant acceleration a. The particle starts from $x = x_0$ position with initial velocity u. We can define the position of the particle with time by the relation

$$x = x_0 + ut + \frac{1}{2}at^2$$

plot the position of the particle in relation with time is following situations

(i) If initial position of the particle is on negativ x-axis, initial velocity is positive and acceleration is negative.

(ii) If initial position is positive, initial velocity is negative and acceleration is positive.

A. a & b are correct

B. b & c are correct

C. a & c are correct

D. c & d are correct

Answer: D

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52. An object may have

(a) varying speed without having varying velocity

(b) varying velocity without having varying speed

(c) nonzero acceleration without having varying velocity

(d) nonzero acceleration without having varying speed.

A. a,b & c are correct

B. b & d are correct

C. a,b & d are correct

D. a & d are correct

Answer: B

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53. The velocity of a particle is zero at $t = 0$.

(a) The acceleration at $t= 0$ must be zero.

(b) The acceleration at $t = 0$ may be zero.

(c) If the acceleration is zero from $t = 0$ to $t=10s$, the speed is also zero in this interval.

(d) If the speed is zero from t=0 to t=10 s the acceleration is also zero in this interval.

A. a,b & d are correct

B. b,c & d are correct

C. a,b & c are correct

D.

Answer: B

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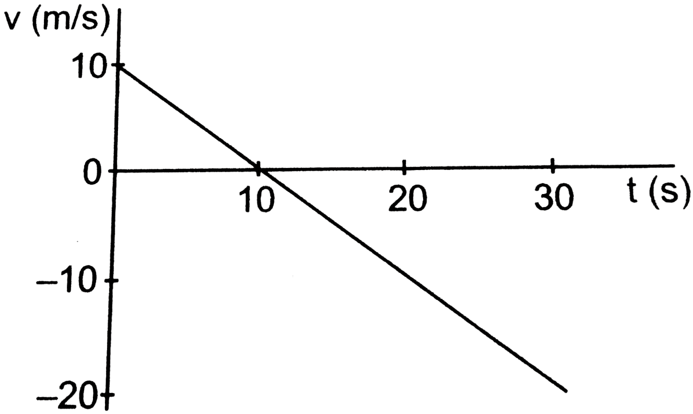
54. The velocity time plot for a particle moving on straight line is shown in the figure.



A. a & b are correct

B. b & are correct

C. c & d are correct

D. a & d are correct

Answer: D

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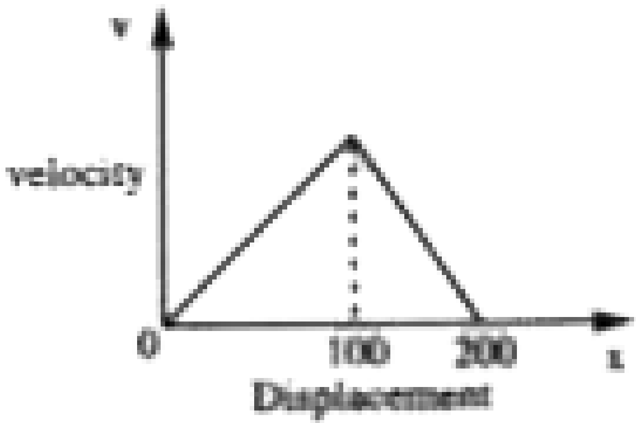
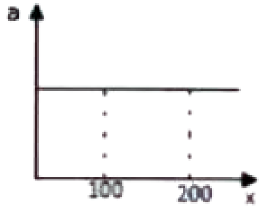
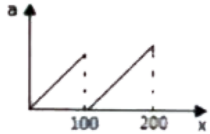
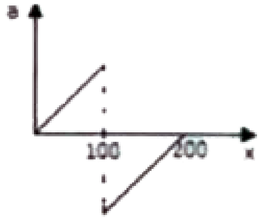
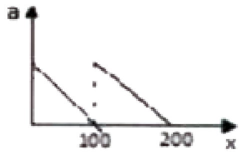
55. Velocity (v) versus displacement (x) plot of a body moving along a straight line is as shown in the graph. The corresponding plot of acceleration (a) as a function of displacement (x) is



A. 

B. 

C. 

D. 

Answer: C

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56. For an object moving with uniform acceleration, travelling 50m in 5th sec, 70m in 7th sec.

(a)Its initial velocity is 5 m/s

(b) Its acceleration is $20 \mathrm{m/s}^2$

(c)Its travels 100 m in 9th sec

(d) Its average velocity during 9th sec is 90 m/s

A. a is ture

B. a & d are true

C. a & b are true

D. a & c are true

Answer: B

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57. A body projected vertically with a velocity 'u' from the ground. Its velocity

(a)At half of maximum height u/2

b) At $3/4^{th}$ of maximum height $\frac{u}{\sqrt{2}}$

(c) At $1/3^{rd}$ of maximum height $\sqrt{\frac{2}{3}}u$

(d) At $1/4^{th}$ of maximum height $\frac{\sqrt{3}}{2}u$

A. a and b correct

B. b is correct

C. c and d correct

D. a is correct

Answer: C

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58. Read the following statements and choose the correct answer.

(a) For a freely falling body the average velocity is proportional to square root of height of fall.

(b) For a freely falling body the displacements in successive equal time intervals are in the ratio 1:4:9:....

(c) For a vertically projected body the displacement during last second of time of flight changes with velocity of projection.

(d) For a body projected from the top of the tower the displacement of the body is negative when the body crosses the point of projection

A. a,c,d are true

B. both a,b are true

C. b & c are true

D. c and d are true

Answer: A

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59. Height of the body from the ground can be calculated by using the formula

$h = -ut + (1/2)(gt^2)$ in

(a) A body projected vertically with velocity 'u' from the top of tower, reaches the ground in 't' sec.

(b) A body dropped from a balloon moving up with uniform velocity, reaches the ground in 't' sec

(c) A body dropped from a helicopter moving up with uniform velocity, reaches the ground in 't' sec

(d) A body projected vertically from the ground reaches the ground in 't' sec.

A. a,b and c correct

B. a,b,c and d are correct

C. a is only correct

D. b and d are correct

Answer: A

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60. A balloon from rest accelerates uniformly upward with 'a' ms^{-2}, for t seconds of time. A stone is released from the balloon. Now, read the following statements to pick the right ones.

(a) The stone's initial velocity is zero, relative to balloon

(b) The stone's initial velocity is nonzero, relative to earth

(c) The time taken to reach the ground from the balloon's frame of reference is inversely proportional to $\sqrt{(a+g)}$

(d) The time take to reach the ground from earth's frame of reference is directly proportional to $\sqrt{(a+g)}$

A. a,b,c

B. a,c,d

C. a,b,d

D. a,c

Answer: A

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61. In one dimensional motion, instantaneous speed v satisfies $(0 \le v < v_0)$ then

A. The displacement in time T must always take nonnegative values.

B. The displacement x in time T satisfies $-V_0 < x < V_0T.$

C. The acceleration is always an nonnegative number

D. The motion has no turning points.

Answer: B

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62. A particle starts from point A moves along a straight line path with an acceleration given by a = p - qx where p, q are connected and x is distance from point A . The particle stops at point B. The maximum velocity of the particle is

A. $\frac{p}{q}$

B. $\frac{p}{\sqrt{q}}$

C. $\frac{q}{p}$

D. $\frac{\sqrt{q}}{p}$

Answer: B

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EXERCISE-IB

1. Assertion : Displacement of a body may be zero, when distance travelled by it is not zero.

Reason : The displacement is the longer distance between initial and final position

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true (R)is false

D. Both (A) and (R) are false

Answer: C

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2. Asserion : The position-time graph of a body moving uniformly in a straight line is parallel to position axis.

Reason : The position-time graph in a non-uniform motion gives constant velocity at all instants of time.

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3. (A):The position -time graph of a body may be a straight line parallel to time axis

(R):It is possible that position of a body does not change with time.

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4. Assertion : If a particle is thrown upwards, then distance travelled in last second of upward journey is independent in last second of upward journey is independent of the velocity of projection.

Reason : In last second, distance travelled is $4.9m$.

(Taken, $g = 9.8ms^{-2}$)

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5. (A):If a particle is thrown upward then distance travelled in last second of upward journey is independent of the velocity of projection.

(R):The slope of tangent to path always measure the magnitude of velocity at that point

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

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

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7. (A):Displacement can decrease with time,but distance can never decrease with time.

(R):Distance can be many valued function ,but displacement can be single valued function.

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8. (A):The displacement of a particle starting from rest is directly proportional to the cube of the time of travel then the particle is moving with non uniform acceleration.

(R):Acceleration $\overrightarrow{a} = \frac{d^2 \overrightarrow{s}}{dt^2}$

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9. (A):A metal ball and a wooden ball of same radius are dropped from the same height in vaccum reach the ground same time.

(R):In vacuum all the bodies dropped from same height take same time to reach the round.

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10. (A):Body may be moving with uniform speed and non uniform acceleration

(R):A body may have uniform velocity and nonzero acceleration . 1)Both A and R are true and R is correct explanation of A 2)Both A and R are true R is not the correct explanation of A 3)A is true R is False 4)Both A and R are false

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11. (A):Acceleration is the rate of change of velocity .

(R):A body having nonzero acceleration can have a constant velocity.

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12. Assertion A body is momentarily at rest at the instant if it rverse the direction.

Reason A body connot have acceleration,If its velocity is zero at a given instant of time

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13. (A): Velocity-time graph for an object in uniform motion along a straight path is a straight line parallel to the time axis.

(R):In uniform motion of an object velocity increases as the square of time elapsed.

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14. (A):A body may be accelerated even when it is moving at uniform speed.

(R):When direction of motion of the body is changing then body may have acceleration.

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15. (A):Average speed is equal to total distance travelled divided by total time taken .

(R):The average speed of an object may be equal to arithmetic mean of individual speed

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16. Assertion : The average and instantaneous velocitties have same value in a uniform motion.

Reason : In uniform motion,the velocity of an object increases uniformly.

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17. (A):The speedometer of an automobile measure the instantaneous speed of the automobile.

(R):Average velocity is equal to total distance divided by total time taken.

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18. (A):A negative acceleration of a body is associated with a slowing down of a body.

(R):Acceleration is vector quantity.

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19. (A):A body thrown up from the top of a tower and another body thrown down from the same point strike the ground witht the same velocity.

(R):Initial speed and acceleration are common for both.

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20. (A):The body falls freely,when acceleration of body is equal to acceleration due to gravity.

(R):A body falling freely will have constant velocity.'

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21. (A):Displacement of a body is the signed sum of the area under velocity-time graph.

(R):Displacement is a vector quantity.

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22. Two balls of different masses are thrown vertically upwards with the same speed. They pass through the point of projection in their downward motion with the same speed (neglect air resistance).

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23. (A):The Instantaneous velocity does not depend on instantaneous position vector.

(R):The instantaneous velocity and average velocity of a particle are always same.

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24. (A):A balloon ascends from the surface of earth with constant speed.When it was at a height 50m above the ground,a packet is dropped from it .To an abserver on the balloon,the displacement of the packet,from the moment it is dropped to the moment it reaches the surface of earth is 50m.

(R):Displacement vector does not depend upon the reference frame used to measure it.

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25. Assertion: Always $\left|\frac{d\vec{v}}{dt}\right| = \frac{d}{dt}\left|\vec{v}\right|$, where $\vec{v}$ has its usual meaning.

(Reason): Acceleration is rate of change of velocity.

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26. Assertion : A lift is ascending with decreasing speed means acceleration of lift is downwards.

Reason : A body always moves in the direction of its acceleration.

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27. Assertion : The $v - t$ graph perpendicular to time axis is not possible in particle.

Reason : Infinite acceleration cannot be realised in particle.

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28. Assertion : The average velocity of a particle having initial and final velocity v_1 and v_2 is $v_1 + v_2 / 2$.

Reason : If r_1 and r_2 be the initial and final displacement in time t, then $v_{av} = \frac{r_1 - r_2}{t}$.

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29. (A):Body projected vertically up or down from the top of a tower with same velocity will reach the ground with same velocity.

(R):Both the bodies projected vertically up and town will have same displacement and acceleration.

Watch Video Solution

30. Assertion : The relative velocity between any two bodies moving in opposite direction is equal to sum of the velocities of two bodies.

Reason : Sometimes relative velocity between two bodies is equal to difference in velocities of the two bodies.

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EXERCISE-2

1. A person travels along a straight road for half the distance with velocity V_1 and the remaining half distance with velocity V_2 the average velocity is given by

A. $V_1 V_2$

B. $\left(\frac{V_2}{V_1}\right)^2$

C. $\frac{V_1 + V_2}{2}$

D. $\frac{2V_1 V_2}{V_1 + V_2}$

Answer: D

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2. If a cyclist takes one minute to complete half revolution on a circular path 120 m radius. What is the average velocity?

A. 1 m/s

B. 2 m/s

C. 3 m/s

D. 4 m/s

Answer: D

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3. A car travelling with a speed 125 KMPH along a straight line comes to rest after travelling a distance 245 m.The time taken by the car to come to rest,in second is

A. 11

B. 12

C. 16

D. 14

Answer: D

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4. A drunked is walking along a straight road. He takes 5 steps forward and 3 steps backward and so on. Each step is 1 m long and takes 1 s. There is a pit on the road 11 m away from the starting point. The drunked will fall into the pit after

A. 21s

B. 29s

C. 31s

D. 37s

Answer: B

Watch Video Solution

5. If a car covers 2/5th of the total distance with v1 speed and 3/5th distance with v2 then average speed is:

A. $\frac{1}{2}\sqrt{V_1 V_2}$

B. $\frac{V_1 + V_2}{2}$

C. $\frac{2V_1 V_2}{V_1 + V_2}$

D. $\frac{5V_1 V_2}{3V_1 + 2V_2}$

Answer: D

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6. A motor vehicle travelled the first third of a distance s at a speed of v_1=10 kmph, the second third at a speed of v_2=20 kmph and the last third at a speed of v_3=60 kmph. Determine the mean speed of the vehicle over the entire distance s.

A. 15 kmph

B. 12kmph

C. 10 kmph

D. 18 kmph

Answer: D

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7. A motorist drives north for 35.0 minutes at 85.0 km/h and then stops for 15.0 minutes. He next continues north, travelling 130 km in 2.00 hours. What is his total displacement

A. 85 km

B. 179.6 km

C. 20 km

D. 140 km

Answer: B

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8. A person walks along a straight road from his house to a market 2.5kms away with a speed of 5 km/hr and instantly turns back and reaches his house with a speed of 7.5 kms/hr. The average speed of the person during the time interval 0 to 50 minutes is (in m/sec)

A. $4\frac{2}{3}$

B. $\frac{5}{3}$

C. $\frac{5}{6}$

D. $\frac{1}{3}$

Answer: B

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9. A particle moving with a constant acceleration describes in the last second of its motion 9/25th 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.?

A. 5s, 150 cm

B. 10s,150 cm

C. 15s,100cm

D. None

Answer: A

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10. A car moving with constant acceleration covers the distance between two points 180 m apart in 6 sec. Its speed as it passes the second point is 45 m/s. What is its acceleration and its speed at the first point

A. $-5m/s^2$, 15 m/s

B. $-15m/s^2$, 5 m/s

C. $-5m/s^2$,-15 m/s

D. $5m/s^2$,15 m/s

Answer: D

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11. A car moving with a speed of $50 km h^{-1}$ can be stopped by brakes after atleast 6 m. If the same car is moving at a speed of $100 km h^{-1}$ the minimum stopping distance is

A. 12 m

B. 18 m

C. 24 m

D. 6 m

Answer: C

Watch Video Solution

12. A particle starts moving from rest with uniform acceleration. It travels a distance x in the first 2 sec and a distance y in the next 2 sec. Then

A. y=x

B. y=2x

C. y=3x

D. y=4x

Answer: C

Watch Video Solution

13. The reaction time for an automobile driver is 0.7 sec. If the automobile can be decelerated at $5\text{m}/\text{s}^2$ calculate the total distance travelled in coming to stop from an initial velocity of 8.33 m/s after a signal is observed.

A. 12.77 m

B. 14.82 m

C. 16.83 m

D. 19.65m

Answer: A

Watch Video Solution

14. If the particle is moving along a straight line given by the relation $x = 2 - 3t + 4t^3$ where s is in cms., and t in sec. Its average velocity during the third sec is

A. 73 cm/s

B. 80 cm/s

C. 85 cm/s

D. 90 cm/s

Answer: A

Watch Video Solution

15. A bullet fired into a fixed target loses half of its velocity in penetrating 15 cm. How much further it will penetrate before coming to rest?

A. 5 cm

B. 15 cm

C. 7.5 cm

D. 10 cm

Answer: A

Watch Video Solution

16. 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

A. $-8m/s^2$

B. $-3.5m/s^2$

C. $-7m/s^2$

D. $180m/s^2$

Answer: B

Watch Video Solution

17. If the velocity of a particle is $v = At + Bt^2$, where A and B are constant, then the distance travelled by it between $1s$ and $2s$ is :

A. $\frac{3}{2}A + 4B$

B. 3A+7B

C. $\frac{3}{2}A + \frac{7}{3}B$

D. $\frac{A}{2} + \frac{B}{3}$

Answer: C

Watch Video Solution

18. The acceleration of a particle is increasing linerly 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

A. $V_0 t + \frac{1}{3} b t^2$

B. $V_0 t + \frac{1}{2} b t^2$

C. $V_0 t + \frac{1}{6} b t^3$

D. $V_0 t + \frac{1}{3} b t^3$

Answer: C

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19. A particle moves along a straight line such that its displacement at any time t is given by $s = (t^3 - 6t^2 + 3t + 4)m$

The velocity when the acceleration is zero, is

A. 3 m/s

B. 42 m/s

C. $-9m/s$

D. $-5m/s$

Answer: C

Watch Video Solution

20. A bus starts from rest with a constnat acceleration of $5m/s^2$. At the same time a car travelling with a constnat velocity 50 m/s overtakes and passes the bus. How fast is the bus travelling when they are side by side ?

A. 10 m/s

B. 50 m/s

C. 100 m/s

D. none

Answer: C

Watch Video Solution

21. A person walks up a stalled escalator in 90 s. When just standing on the same moving escalator, he is carried in 60 s. The time it would take him to walk up the moving escalator will be

A. 30 s

B. 45 s

C. 36 s

D. 48 s

Answer: C

Watch Video Solution

22. Two trains are each 50 m long moving parallel towards each other at speeds $10ms^{-1}$ and $15ms^{-1}$ respectively, at what time will they pass each other ?

A. 8 s

B. 4s

C. 2 s

D. 6 s

Answer: B

Watch Video Solution

23. A car moving on a straight road accelerates from a speed of 4.1 m/s to a speed of 6.9 m/s in 5.0 s. What was its average acceleration?

A. $0.56m/s^2$

B. $1.56m/s^2$

C. $5.6m/s^2$

D. $1.2m/s^2$

Answer: A

Watch Video Solution

24. A body starting with a velocity 'v' returns to its initial position after 't' second with the same speed, along the same line. Acceleration of the particle is

A. $\frac{-2V}{t}$

B. $\frac{2V}{t}$

C. $\frac{V}{2t}$

D. $\frac{t}{2V}$

Answer: A

Watch Video Solution

25. The position of a particle moving in the xy-plane at any time t is given by $x=\left(3t^{2}-6t\right)m, y=\left(t^{2}-2t\right)m.$ Select the correct statement about the moving particle from the following.

A. The acceleration of the particle is zero at t=0 second

B. The velocity of the particle is zero at t =t0 second

C. The velocity and acceleration of the particle are never zero

D. The velocity and acceleration of the particle are never zero

Answer: C

Watch Video Solution

26. An object falling thro ugh a fluid is observed to have accleration give by $a = g - bv$ where $g =$ gravitational acceleration and b is constant. After a long time of release, it is observed to fall with constant speed. What must be the value of constant speed ?

A. $\frac{g}{b}$

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

C. bg

D. b

Answer: A

Watch Video Solution

27. The position of an object moving along x-axis is given by x $= a + bt^2$ where a =8.5 m, b=2.5 ms^{-2} and t is measured in seconds.Then which of the following is true ?

A. Velocity at t=2 sec is zero

B. Average velocity between t=2,t=4 sec is 15 m/s

C. Velocity at t=4 sec is 10 m/s

D. All the above are true

Answer: B

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

A. 42 m/s

B. 105 m/s

C. 145 m/s

D. 180 m/s

Answer: B

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29. A body falls from 80 m. Its time of descent is $\left[g = 10ms^{-2}\right]$

A. 3 s

B. 4 s

C. 5 s

D. 6 s

Answer: B

Watch Video Solution

30. Two bodies whose masses are in the ratio 2:1 are dropped simultaneously at two places A and B where the accelerations due to gravity are g_A and g_B respectively. If they reach the ground simultaneously, the ratio of the heights from which they are dropped is

A. $g_A : g_B$

B. $2g_A : g_B$

C. $g_A : 2g_B$

D. $\sqrt{g_a} : \sqrt{g_b}$

Answer: A

Watch Video Solution

31. A body falls for 5 s from rest. If the acceleration due to gravity of earth ceases to act, the distance it travels in the next 3 s is

A. 73.5 m

B. 294 m

C. 147 m

D. 160 m

Answer: C

Watch Video Solution

32. A body freely falling from a height h describes $\frac{7h}{16}$ in the last second of its fall. The height h is $(g = 10ms^{-2})$

A. 80m

B. 45 m

C. 160 m

D. 40 m

Answer: A

Watch Video Solution

33. A body released from the top of a tower of height h takes T seconds to reach the ground. The position of the body at T/4 seconds is

A. at $\frac{h}{16}$ from the ground

B. at $\dfrac{h}{14}$ from the top of the tower

C. at $\dfrac{15h}{16}$ from the ground

D. at $\dfrac{3h}{16}$ from the top of the tower

Answer: C

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34. A stone falls freely under gravity. It covers distances h_1, h_2 and h_3 in the first 5 s, the next 5 s and the next 5 s respectively. The relation between h_1, h_2 and h_3 is

A. $h_2 = 3h_1$ and $h_3 = 3h_2$

B. $h_1 = h_2 = h_3$

C. $h_1 = 2h_2 = 3h_3$

D. $h_1 = \frac{h_2}{3} = \frac{h_3}{5}$

Answer: D

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35. The ratio of times taken by freely falling body to cover first metre, second metre,... is

A. $\sqrt{1} : \sqrt{2} : \sqrt{3}$

B. $\sqrt{1} : \sqrt{2} - \sqrt{1} : \sqrt{3} - \sqrt{2}$

C. $\sqrt{2}:\sqrt{4}:\sqrt{8}$

D. $2:3:4$

Answer: B

Watch Video Solution

36. A body is droped from a height 122.5 m. If its stopped after 3 seconds and again released the further time of descent is $\left(g=9.8\mathrm{m}/\mathrm{s}^2\right)$

A. 2 s

B. 3 s

C. 4 s

D. 5 s

Answer: C

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37. A freely falling body travels ____ of total distance in 5th second

A. 0.08

B. 0.12

C. 0.25

D. 0.36

Answer: D

Watch Video Solution

38. If the distance travelled by a freely falling body in the last second of its journey is equal to the distance travelled in the first 2s, the time of descent of the body is

A. 5s

B. 1.5 s

C. 2.5 s

D. 3s

Answer: C

Watch Video Solution

39. A ball dropped on to the floor from a height of 10 m rebounds to a height of 2.5 m. If the ball is in contact with the floor for 0.02s, its average acceleration during contact is

A. $2100ms^{-2}$

B. $1050ms^{-2}$

C. $4200ms^{-2}$

D. $9.8ms^{-2}$

Answer: B

Watch Video Solution

40. If a ball is thrown vertically upwards with speed u, the distance coverd during the last t second of its ascent is

A. $ut - \frac{1}{2}gt^2$

B. $\frac{1}{2}gt^2$

C. ut

D. (u+gt)t

Answer: B

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41. A splash in heard 3.12 s after a stone is dropped into a well 45 m deep. The speed of sound in air is $[g = 10ms^{-2}]$

A. $330ms^{-1}$

B. $375ms^{-1}$

C. $340ms^{-1}$

D. $346ms^{-1}$

Answer: B

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42. A body is thrown up with a velocity $29.23 \mathrm{ms}^{-1}$ distance travelled in last second of upward motion is

A. 2.3 m

B. 6m

C. 9.8 m

D. 4.9 m

Answer: D

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43. A body is thrown up with a velocity $40 ms^{-1}$. At same time another body is dropped from a height 40 m. Their relative acceleration after 1.3 seconds is

A. 4g

B. g/2

C. 2g

D. zero

Answer: D

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44. A stone is dropped into a well of 20 m deep. Another stone is thrown downward with velocity 'v' one second later. If both stones reach the water surface in the well simultan eously, v is equal to $(g = 10ms^{-2})$

A. $30ms^{-1}$

B. $15ms^{-1}$

C. $20ms^{-1}$

D. $10ms^{-1}$

Answer: B

Watch Video Solution

45. A body is projected with a velocity 50ms^{-1}. Distance travelled in 6th second is $\left[g = 10ms^{-2}\right]$

A. 5 m

B. 10 m

C. 15 m

D. 20 m

Answer: A

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46. In above problem ratio of distance traveled in first second of upward motion to first second of downward motion is

A. $1:7$

B. $5:3$

C. $9:1$

D. $3:5$

Answer: D

Watch Video Solution

47. A body is projected vertically up with u. Its velocity at half its maximum height is

A. $\frac{u}{2}$

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

C. $\sqrt{2}u$

D. $\frac{u}{\sqrt{2}}$

Answer: D

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48. A body projected up reaches a point A in its path at the end of 4th second and reaches the ground after 5 seconds from the start. The height of A above the ground is $\left(g = 10\mathrm{m}/\mathrm{s}^2\right)$

A. 19.6 m

B. 30.6 m

C. 11m

D. 20 m

Answer: D

Watch Video Solution

49. A stone is projected vertically up from the ground with velocity $40ms^{-1}$. The interval of time between the two instants at which the stone is at a height of 60 m above the ground is $\left(g = 10\mathrm{ms}^{-2}\right)$

A. 4s

B. 6s

C. 8s

D. 12s

Answer: A

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50. A body is projected vertically up with velocity $98\mathrm{ms}^{-1}$. After 2 s if the acceleration due to gravity of earth disappears, the velocity of the body at the end of next 3 s is

A. $49ms^{-1}$

B. $49.6ms^{-1}$

C. $78.4ms^{-1}$

D. $94.7ms^{-1}$

Answer: C

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51. The distance travelled by a body during last second of its total flight is d when the body is projected vertically up with certain velocity. If the velocity of projection is doubled, the distance travelled by the body during last second of its total flight is

A. 2d

B. d

C. $2d + \frac{g}{2}$

D. $2d - \frac{g}{2}$

Answer: C

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52. A stone is thrown vertically up from a bridge with velocity $3ms^{-1}$. If it strikes the water under the bridge after 2 s, the bridge is at a height of $(g = 10\text{ms}^{-2})$

A. 26 m

B. 14 m

C. 7m

D. 20m

Answer: B

Watch Video Solution

53. A bullet fired vertically up from the ground reaches a height 40 m in its path from the ground and it takes further time 2 seconds to reach the same point during descent. The total time of flight is $(g = 10ms^{-2})$

A. 4s

B. 3s

C. 6s

D. 8s

Answer: C

Watch Video Solution

54. A boy throws n balls per second at regular time intervals.When the first ball reaches the maximum height he throws the second one vertically up .The maximum height reached by each ball is

A. A) $\dfrac{g}{2(n-1)^2}$

B. B) $\dfrac{g}{2n^2}$

C. C) $\dfrac{g}{n^2}$

D. D) $\dfrac{g}{n}$

Answer: B

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55. A stone is dropped freely, while another thrown vertically downward with an initial velocity of 2ms^{-1} from the same point, simultaneously. The time required by them to have a distance of separation 22 m between them is

A. 11s

B. 5,5s

C. 44s

D. 22s

Answer: A

Watch Video Solution

56. A body is throw up with a velocity 'u'. It reaches maximum height 'h'. If its velocity of projection is doubled the maximum height it reaches is _____

A. 4h

B. h

C. 2h

D. 3h

Answer: A

Watch Video Solution

57. A person in lift which ascents up with acceleration $10ms^{-2}$ drops a stone from a height 10 m. The time of decent is $[g = 10ms^{-2}]$

A. 1s

B. 2s

C. 1.5 s

D. 3s

Answer: A

Watch Video Solution

58. A body is projected up with velocity u. It reaches a point in its path at times t_1 and t_2 seconds from the time of projection. Then $(t_1 + t_2)$ is

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

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

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

D. $\sqrt{\frac{u}{g}}$

Answer: A

Watch Video Solution

59. A stone thrown vertically up with velocity v reaches three points A, B and C with velocities v, $\frac{v}{2}$ and $\frac{v}{4}$ respectively. Then AB:BC is

A. $1:1$

B. $2:1$

C. $4:!$

D. $1:4$

Answer: C

Watch Video Solution

60. A stone is projected vertically upward from the top of a tower with a velocity u and strikes the bottom of the tower with a velocity 3u. The distance travelled by the stone is

A. $\frac{V^2}{2g}$

B. $\frac{3V^2}{2g}$

C. $\frac{3V^2}{g}$

D. $\frac{V^2}{g}$

Answer: B

Watch Video Solution

61. A stone is thrown vertically from the ground. It reaches the maximum height of 500 m in 10 sec. After what time it will reach the ground from the maximum height reached?

A. 5s

B. 10s

C. 15s

D. 20s

Answer: B

Watch Video Solution

62. How long does it take a brick to reach the ground if dropped from a height of 65 m? What will be its velocity just before it reaches the ground ?

A. 2s,10 m/s

B. 3.64 s,35.67 m/s

C. 12s,120 m/s

D. 5s,20 m/s

Answer: B

Watch Video Solution

63. A stone is allowed to fall from the top of a towards 300 m height and at the same time another stone is projected vertically up from the ground with a velocity 100 ms^{-1}.Find when and where the two stones meet?

A. 2s,200.9 m

B. 3 s,255.9m

C. 4s,250.8 m

D. 5s,255.10 m

Answer: B

Watch Video Solution

64. An object reaches a maximum vertical height of 23.0 m when thrown vertically upward on the earth. How high would it travel on the moon where the acceleration due to gravity is about one sixth that on the earth ? Assume that initial velocity is the same.

A. 138 m

B. 100 m

C. 10 m

D. 69 m

Answer: A

Watch Video Solution

65. A stone is thrown vertically upward with a speed of 10.0ms^{-1} from the edge of a cliff 65 m high. What will be its speed just before hitting the bottom ?

A. 3.14 m/s

B. 37.14 m/s

C. 13.71 m/s

D. 14.71 m/s

Answer: B

Watch Video Solution

66. A helicopter is ascending vertically with a speed of 8.0ms^{-1}. At a height of 12 m above the earth, a package is dropped from a window. How much time does it take for the package to reach the ground ?

A. 1.23 s

B. 3.23s

C. 5.83.s

D. 2.53 s

Answer: D

Watch Video Solution

67. A ball is thrown upwards with a speed u from a height h above the ground.The time taken by the ball to hit the ground is

A. $\frac{v}{g}\left[1+\sqrt{1+\frac{2hg}{V^2}}\right]$

B. $\frac{v}{g}\left[1-\sqrt{1-\frac{2hg}{v^2}}\right]$

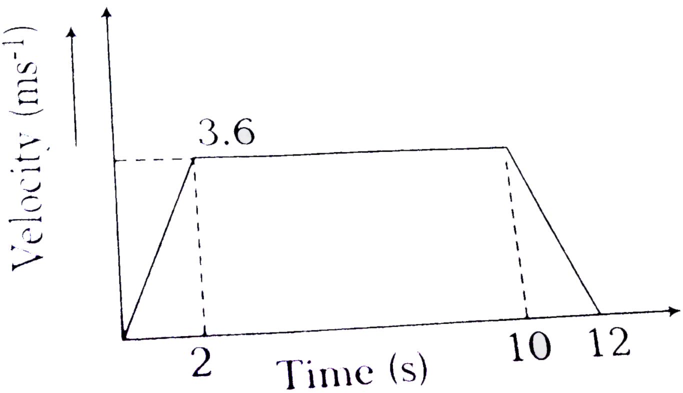
C. $\frac{v}{g}\left[1-\sqrt{1+\frac{2hg}{v^2}}\right]$

D. $\frac{v}{g}\left[2+\frac{2hg}{v^2}\right]$

Answer: A

Watch Video Solution

68. A lift going up. The variation in the speed of the lift is as given in the graph. What is the height to which is the takes the passengers ?



A. 3.6 m

B. 28.8 m

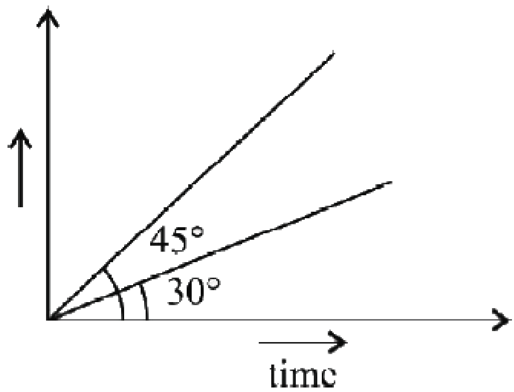
C. 36.0 m

D. 72.0 m

Answer: C

Watch Video Solution

69. The displacement time graph of two moving particles make angles of 30° and 45° with the x-axis. The ratio of the two velocities V_A and V_B is



A. $\sqrt{3} : 1$

B. $1:1$

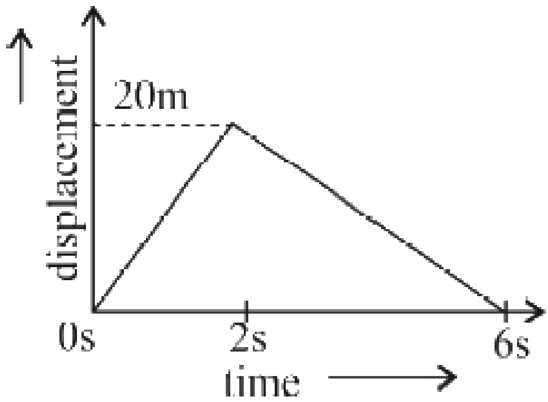
C. $1:2$

D. $1:\sqrt{3}$

Answer: D

Watch Video Solution

70. For the displacement-time graph shown in figure, the ratio of the magnitudes of the speeds during the first two second and the next four second is



A. $1:1$

B. $2:1$

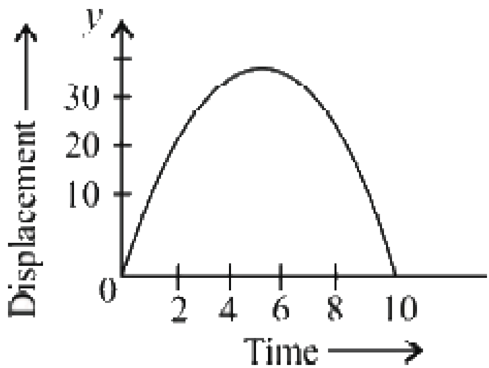
C. $1:2$

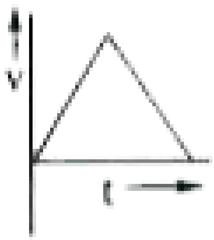
D. $3:2$

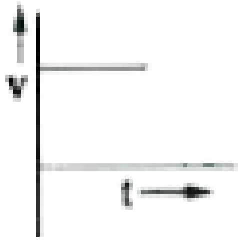
Answer: B

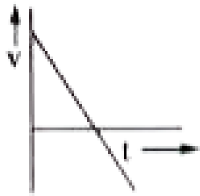
Watch Video Solution

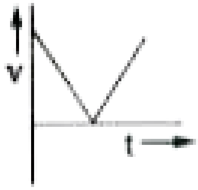
71. The displacement-time graph of a moving object is shown in figure. Which of the velocity-time graphs shown in figure could represent the motion of the same body ?



A. 

B. 

C. 

D. 

Answer: C

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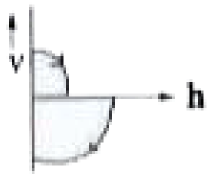
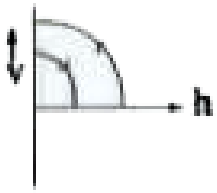
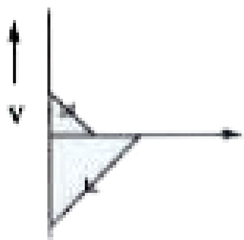
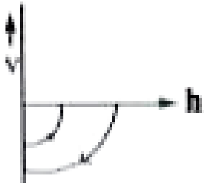
72. A ball is dropped vertically from a height d above the ground. It hits the ground and bounces up vertically to a height d/2. Neglecting subsequent motion and air resistance, its velocity v varies with the heiht h above the ground as

A. 

B. 

C. 

D. 

Answer: A

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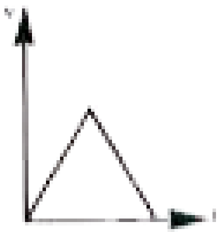
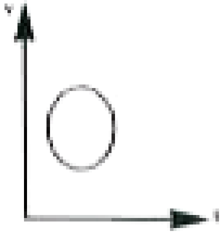
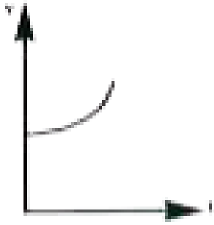
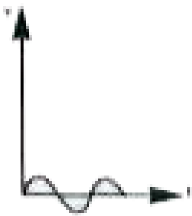
73. Which of the following curves does not represent motion in one dimensions?

A. 

B. 

C. 

D. 

Answer: B

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74. Two cars P and Q start from a point at the same time in a straight line and their positions are represented by

$X_P(t) = at + bt^2$ and $X_Q(t) = ft - t^2$. At what time do the cars have the same velocity ?

A. $\dfrac{a-f}{1+b}$

B. $\dfrac{a+f}{2(b-1)}$

C. $\dfrac{a+f}{2(1+b)}$

D. $\dfrac{f-a}{2(1+b)}$

Answer: D

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75. The displacement of a particle moving along the x-axis is given by equation $x = 2t^3 - 21\mathrm{t}^2 + 60t + 6$ .The possible acceleration of the particle when its velocity is zero is

A. A) $-18m/s^2$

B. B) $30m/s^2$

C. C) $9m/s^2$

D. D) $-9m/s^2$

Answer: A

Watch Video Solution

76. A Wheel of circumference C is at rest on the ground.When the wheel rolls forward through half a revolution ,then the displacement of point contact will be

A. $C\sqrt{\frac{1}{\pi^2}+\frac{1}{4}}$

B. $\frac{C}{2}$

C. $\pi\sqrt{c^2+4}$

D. $C\sqrt{\frac{1}{\pi}+\frac{1}{2}}$

Answer: A

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EXERCISE-3

1. A particle transversed half of the distance with a velocity of V0. The remaining parts of the distance was covered with velocity V_l, for half of the time and with V2 for other half of the time. Find the mean velocity of the particle averaged and the whole time of motion.

A. $\dfrac{2V_0(v_1+v_2)}{v_1+v_2+2v_0}$

B. $\dfrac{v_0(v_1+v_2+2v_1v_2)}{2v_1+v_2}$

C. $\dfrac{v_1+v_2}{2}$

D. $\dfrac{v_0+2v_1v_2}{2(v_1+v_2)}$

Answer: B

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2. Two cars 1 & 2 strating 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.

A. $\dfrac{V_1 - V_2}{S}$

B. $\dfrac{V_1 + V_2}{S}$

C. $\dfrac{(V_1 + V_2^2)}{2S}$

D. $\dfrac{(V_1 - V_2^2)}{2S}$

Answer: D

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

A. 50m

B. 8 m

C. 12m

D. 42m

Answer: B

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4. The position x of a particle varies with time t as $x = at^2 - bt^3$.The acceleration of the particle will be zero at time t equal to

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

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

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

D. Zero

Answer: C

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5. The relation $3t = \sqrt{3x} + 6$ describe the displacement of a particle in one direction where x is in metres and t in sec.

The displacement, when velocity is zero is

A. 24 metres

B. 12 metres

C. 5 metres

D. Zero

Answer: D

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6. An electron starting from rest has a velocity that increases linearly with the time that is v=kt,where k=2 $m / \sec^2$.The distance travelled in the first 6 seconds will be

A. 9m

B. 16m

C. 27 m

D. 36m

Answer: A

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7. A car accelerates from rest at a constant rate 'alpha' for some time after which it decelerates at a constant rate β to come to rest. If the total time elapsed is t, the maximum velocity acquired by the car is given by :

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

B. $\left(\frac{\alpha^2-\beta^2}{\alpha\beta}\right)t$

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

D. $\dfrac{(\alpha+\beta)t}{\alpha\beta}$

Answer: C

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8. Two town A and B are connected by a regular bus service with a bus leaving in either direction every T minutes. A man leaving in either direction every 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. The period T of the bus service is

A. 9 min,40 Kmph

B. 12 min,10 Kmph

C. 12 min,40 Kmph

D. 9 min ,60 Kmph

Answer: A

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9. Two cars start in a race with velocities u_1 and u_2 and travel in a straight line with acceleration $'a'$ and b. If both reach the finish line at the same time, the range of the race is

A. $\dfrac{2(u_1 - u_2)}{(\beta - \alpha)^2}(u_1\beta - u_2\alpha)$

B. $\dfrac{2(u_1 - u_2)}{B\eta + \alpha}(u_1\alpha - u_2\beta)$

C. $\dfrac{2(u_1 - u_2)^2}{(\beta - \alpha)^2}$

D. $\dfrac{2u_1u_2}{\beta\alpha}$

Answer: A

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10. The displacement x of a particle varies with time according to the relation $x = \dfrac{a}{b}\alpha - e^{-bt}\Big)$ Then :

A. At $t=1/b$,the displacement of the particle in nearly (2/3) (a/b)

B. The velocity and acceleration of the particle at $t=0$ are a and -ab respectively

C. Both 1 and 2

D. At $t=1/b$,the displacement of the particle is (3/5) (a/b)

Answer: B

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11. A particle moving along x-axis has acceleration f, at time t, given by $f = f_0\left(1 - \frac{t}{T}\right)$, where f_0 and T are constants. The particle at $t = 0$ has zero velocity. In the time interval between $t = 0$ and the instant when $f = 0$, the particle's velocity (v_x) is

A. $\frac{1}{2}f_0T^2$

B. f_0T^2

C. $\frac{1}{2}f_0T$

D. f_0T

Answer: C

Watch Video Solution

12. A train takes t sec to perform a journey , if travel for t/n sec with uniform acceleration then for $\left(\frac{n-3}{n}\right)t$ sec with uniform speed v and finally it comes to rest with uniform retardation. Then average speed of train is

A. $(3n-2)\frac{V}{2n}$

B. $(2n-3)\frac{v}{2n}$

C. $(3n-2)\frac{v}{3n}$

D. $(2n-3)\frac{v}{3n}$

Answer: B

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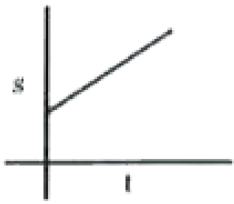
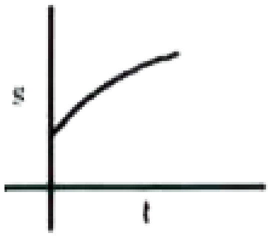
Watch Video Solution

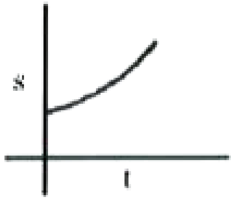
13. A particle moving along straight line has velocity $v = \mu s$ where s is in the displacement . If $s = s_0$ then which of the following graph best represent s versus t

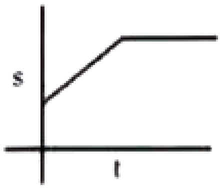


A.



B.

C. 

D. 

Answer: C

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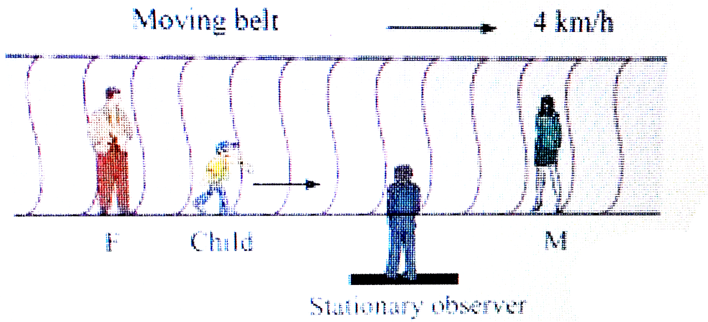
14. On a long horizontally moving belt (Fig.3.26), a child runs to and fro with a speed $9 kmh^{-1}$ (with respect to the belt) between his father and mother located 50 m apart on the moving belt. The belt moves with a speed of $4kmh^{-1}$. For an observer on a stationary platform outside, what is the

(a) speed of the child running in the direction of motion of the belt ?

(b) speed of the child running opposite to the direction of motion of the belt ?

(c) time taken by the child in (a) and (b)?

Which of the anseres alter if motion is viewed by one of the parents ?



A. 4 km h^{-1}

B. $5 km h^{-1}$

C. 9 km h^{-1}

D. 13 kmh^{-1}

Answer: D

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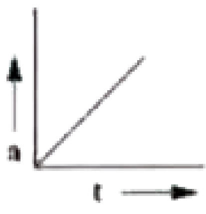
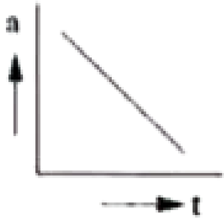
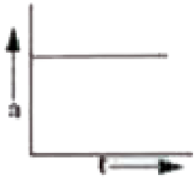
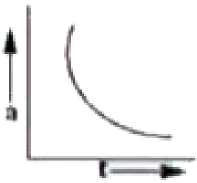
15. The distance travelled by a body moving along a line in time t is proportional to t^3. The acceleration - time (a, t) graph for the motion of the body will be

A. 

B. 

C. 

D. 

Answer: A

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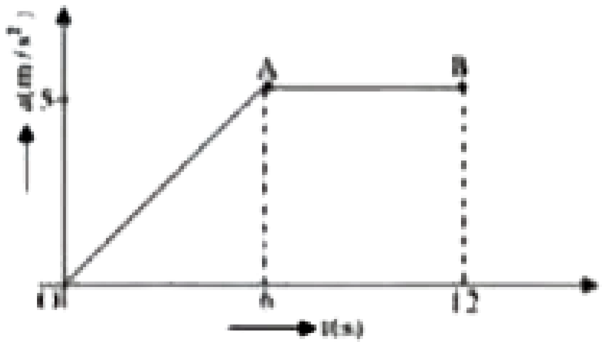
16. For an airplane to take-off it accelerates according to the graph shown and takes 12 s to take -off from the rest position .The distance travelled by the airplane in 6sec is



A. 20 m

B. 30 m

C. 40m

D. 50m

Answer: B

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17. Water drops fall from the roof a building 20 m high at regular time intervals. If the first drop strikes the floor when the sixth drop begins to fall, the heights of the second and fourth drops from the ground at that instant are $\left(g = 10ms^{-2}\right)$

A. 12.8 m and 3.2m

B. 12.8m and 7.2m

C. 19.2m and 0.8m

D. 7.2m and 16.8m

Answer: D

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18. Two balls are dropped from the same height at two different places A and B where the acceleration due to gravities are g_A and g_B. The body at 'B' takes 't' seconds less to reach the ground and strikes the ground with a velocity greater than at 'A' by $v m/s$. Then the value of v/t is

A. $\dfrac{1}{\sqrt{g_A g_B}}$

B. $2\sqrt{g_A g_B}$

C. $\frac{1}{g_A g_B}$

D. $\sqrt{g_A g_B}$

Answer: D

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19. The distance travelled by a falling body in the last second of its motion, to that in the last but one second is 7: 5, the velocity with which body strikes the ground is

A. 19.6 m/s

B. 39.2 m/s

C. 29.4 m/s

D. 49 m/s

Answer: B

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20. A body P is thrown vertically up with velocity $30ms^{-1}$ and another body Q is thrown up along the same vertically line with the same velocity but 1 second later from the ground. When they meet $(g = 10ms - 2)$

A. P travels for 2.5 s

B. Q travels for 3.5 s

C. P travels for 3.5s

D. Q travels for 1s

Answer: C

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21. A particle is projected vertically up and another is let fall to meet at the same instant. If they have velocities equal in magnitude when they meet, the distance travelled by them are in the ratio of

A. $1:1$

B. $1:2$

C. $3:1$

D. $2:3$

Answer: C

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22. A stone is dropeed from a height of10 cm above the top of a window 80 cm high. The time taken by the stone to cross the window is $\left(g = 9.8ms^{-2}\right)$

A. $\frac{1}{7}s$

B. $\frac{3}{7}s$

C. $\frac{2}{7}s$

D. $\frac{4}{7}s$

Answer: C

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23. A particle starts from rest with uniform acceleration a. Its velocity after 'n' second is 'v'. The displacement of the body in the last two second is

A. $\frac{2v(n-1)}{n}$

B. $\frac{v(n-1)}{n}$

C. $\dfrac{v(n+1)}{n}$

D. $\dfrac{2v(n+1)}{n}$

Answer: A

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24. Two balls are projected simultaneously with the same speed from the top of a tower - one upwards and the other downwards. If they reach the ground in 6s and 2s, the height of the tower is $\left(g=10ms^{-2}\right)$

A. 120m

B. 60m

C. 80m

D. 30m

Answer: B

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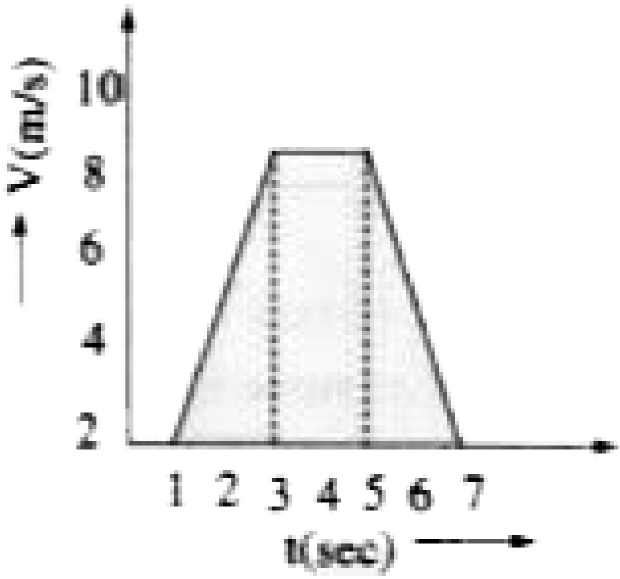
25. For the velocity - time graph shown in figure below the distance covered by the body in last two seconds of its motion is what fraction of the total distance covered by it in all the total distance covered by it in all the seven seconds



A. $\frac{1}{2}$

B. $\frac{1}{4}$

C. $\frac{1}{3}$

D. $\frac{2}{3}$

Answer: B

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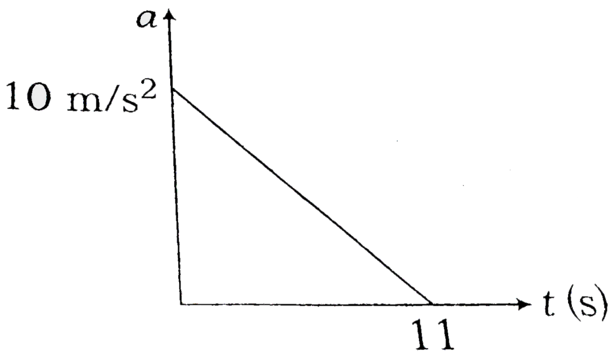
26. A particle starts from rest. Its acceleration (a) versus time (t) graph is as shown in the figure. The maximum speed of the particle will be



A. 110 m/s

B. 55m/s

C. 550m/s

D. 660 m/s

Answer: B

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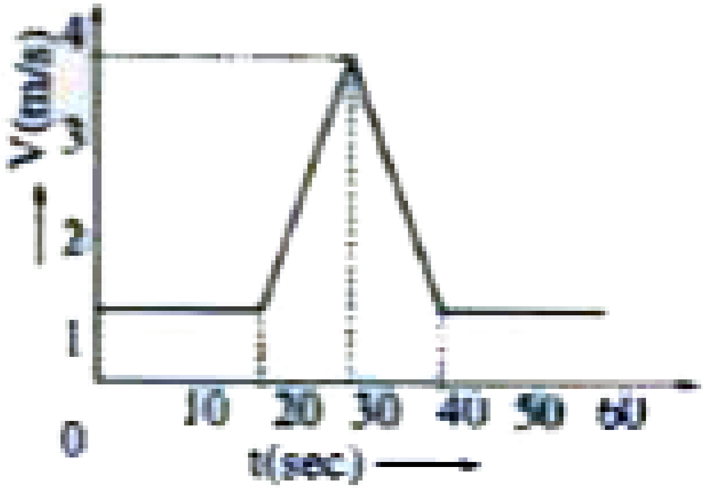
27. Velocity -time (v-t) graph for a moving object is shown in the figure .Total displacement of the object during the time interval when there is non-zero acceleration and reatardation is



A. 60m

B. 50m

C. 30m

D. 40m

Answer: B

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28. A ball is thrown form the top of a tower in vertically upward direction. Velocity at a point h meter below the point of projection is twice of the velocity at a point h merer above the point of projection, Find the maximum height reached by the ball above the top of towe.

A. 2h

B. $\frac{4}{3}h$

C. 3h

D. $\frac{5h}{3}$

Answer: D

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

A. $\frac{(x+y)^2}{4x}m$

B. $\frac{4(x+y)^2}{x}m$

C. $\frac{4x}{(x+y)^2}m$

D. $4x(x+y)^2 m$

Answer: A

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30. A body is thrown vertically upward from a point A 125 m above the ground. It goes up to a maximum height of 250 m above the ground and passes through A on its downward journey. The velocity of the body when it is at a height of 70 m above the ground is $(g = 10m/s^2)$

A. $50ms^{-1}$

B. $60ms^{-1}$

C. $80ms^{-1}$

D. $20ms^{-1}$

Answer: B

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31. A projectile moving vertically upwards with a velocity of 200 m/s breaks into two equal parts at the height of 490 m. One part starts moving vertically upwards with a velocity of 400 m/s. How much time after the break up will the other part hit the ground?

A. $\sqrt{10}s$

B. $2\sqrt{10}s$

C. 5s

D. 10 s

Answer: D

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