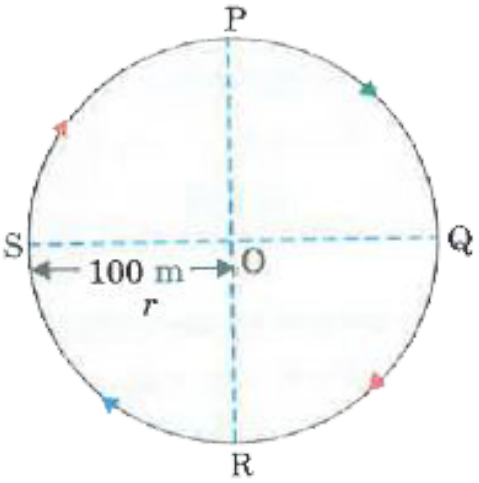
PHYSICS

BOOKS - MODERN PUBLISHERS PHYSICS (HINGLISH)

MOTION IN A STRAIGHT LINE

Solved Example

1. An athlete is running on a circular track PQRS of radius 100 m shown below



He starts from point P and moves clockwise.

(i) Find the distance travelled by him and displacement when he

(a) reaches Q (b) moves from Q to S (c) reaches P again after one revolution

(ii) If he completes one revolution in 5 minutes find his

(a) average speed (b) average velocity

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2. A car travels from X to Y at a speed of 50km/h and returns back from Y to X at a speed of 60km/h Find the average speed and velocity of the car.

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3. On a journey of 80km, a car covers the first 40km with a uniform of 80km/hr. how fast it should travel in the next 40km so that an average speed of 100km/hr is maintained for the entire journey?

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4. A cyclist moves with a speed of 30km/hr in the first 10 minutes, with speed of 15km/hr in the next 20 minute and with a speed of 40km/hr in the last 15 minutes Calculate the average speed of the cyclist.

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5. A body starts from rest and accelerates uniformly at $5m/s^2$ for 7 seconds, along a straight line, it then starts decelerating at a rate of $2m/s^2$ for the next 5 seconds, moves uniformly with a velocity of 25m/s for the next 2 seconds and then retards again and comes to rest in another 3 seconds.

(i) Plot the velocity versus time graph for the body.

(ii) Calculate the total distance travelled by the body with the help of the graph.

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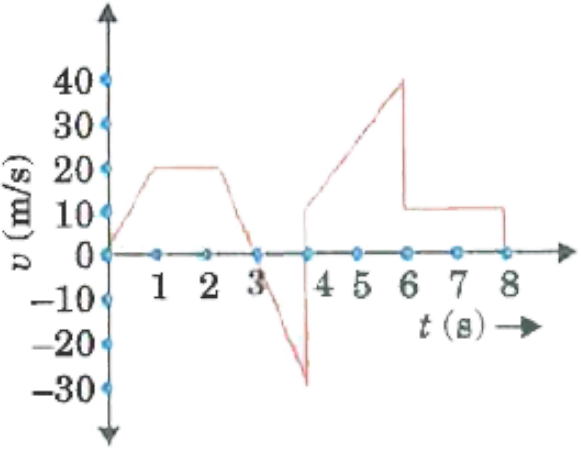
6. The velocity versus time graph of a body moving along a straight path is shown below.



(i) Calculate the distance covered by the body from t=0

to t=8s.

(ii) find its net displacement from t=0 to 8 s.

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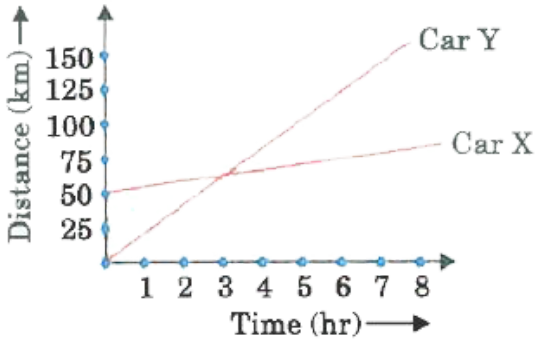
7. The figure given below shows the distance-time graph of the two cars, which began their journey together, in the same direction, from different points of start.

(i) find the speed of car X and Car Y.

(ii) When and where will car Y catch car X?



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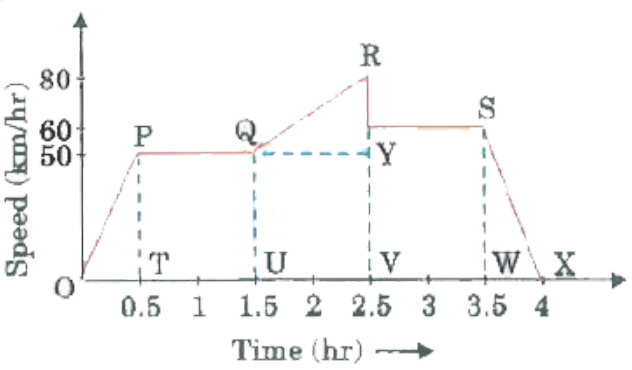
8. The plot of speed for the journey of a bus from one bus stop to another is shown below.



(i) Find the maximum acceleration for deceleration of the bus during the journey

(ii) Calculate the distance covered by the bus from 0.5 hr to 2.5 hr.

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

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10. The acceleration of a particle varies with time t as

$a = t^2 + t + 2$

where t is in seconds.

The particle starts with an initial velocity v-3m/s at t=0.

find the velocity of the particle at the end of 5s.

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11. The displacement x of a particle varies as

$\sqrt{x} = t - 2$

(i) What is the velocity and acceleration of the particle at t=0?

(ii) When will the velocity of the particle become zero?

(iii) What is the displacement of the particle when its velocity is zero?

(iv) Is the motion of the particle uniformly accelerated or not?

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12. A motorcyclist starts from rest and accelerates to a speed of 60km/hr in 50s, on a straight road. Calculate the distance covered by the motorcyclist in this time.

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13. An electron enters an electric field of width 40μ m with a speed of $6 \times 10^3 m/s$ and takes 6ns to cross it. Find its acceleration and velocity just after it exists the field.

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14. On seeing red light ahead, a driver takes 0.3 s to apply the brakes. This is called the reaction time of the driver. If he was initially driving at a speed of 36km/hr and application of the brakes causes a deceleration of $4.0m/s^2$. Calculate the distance travelled by the car after he sees the red light.

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15. Two trains travelling along a straight track are heading towards each other, travelling at 90km/hr and 100km/hr. Drivers of both the trains apply brakes together when the train are 1.0km apart, decelerating

each train at $2.0 m / s^2$. Determine that whether the train accident will be averted.

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16. A truck starts from rest and accelerates uniformly to a velocity of 40m/s in 10s, it then runs with this uniform velocity and is finally brought to rest in 50m by a uniform deceleration. If the total run of the truck is 500m, find its acceleration and total time of journey.

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17. A thief starts his car from a point with an acceleration of $2m/s^2$. The police chasing the thief arives at the point 10s later and continues to chase the thief with a uniform velocity of 40m/s I their car. In what time the police's car will overtake the thief car?

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18. A man is 10m behind the bus stop when the bus left the stop, with an acceleration of $2m/s^2$. What should be the minimum uniform speed of man so that he may catch the bus? If he runs with required minimum speed then how much time it will take to catch the bus?

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19. 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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20. A body covers a distance of 15 m in the 5th second and 20m in the 7th How much it will cover in the 12th second?

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21. An object moving with uniform acceleration has a velocity of 20m/s after 4 seconds and 28m/s after 6 seconds. Calculate the distance travelled by the object in 10th second .

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22. A ball is thrown vertically upwards with a velocity of 4.9m/s Find

(i) the maximum height reached by the ball

(ii) time taken to reach the maximum height

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23. A stone is thrown vertically upwards from the top of a building, with a speed of 14.7m/s. if it returns to the earth in 8s, calculate the height of the building.

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24. Using the information given in example 2, find (i) the greatest height reached by the stone above the ground.

(ii) the velocity with which it strikes the ground

(iii) time taken to reach the maximum height

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25. A ball is thrown vertically upwards with a velcotiy of $20ms^{-1}$ from the top of a multi-storey building. The height of the point fromwher the ball is thrown if 25m from the ground. (a) How high the ball will rise ? And (b) how long will it be before the ball hits the ground ? Take. $g = 10ms^{-2}$.

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26. A boy projects a stone vertically upwards and catches it back after 5s. How high the stone goes and with what velocity it was thrown? Also calculate the separation between the highest point and the stone 4 s

after it was projected upwards.

Take g=10 m / s^2

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27. A hot air ballon is projected vertically with a net vertical acceleration of $4 m / s^2$, by lighting its burner. The burner is blown out in 2 minutes but the ballon continues to move up. Find the maximum height reached by the balloon before it starts to come down again.

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28. A packet is dropped from a helicopter, which is ascending at a rate of 16m/s , when it is at a height of 14.4m above the ground.

(i) How much time it will take the packet to reach the ground?

(ii) With what velocity it will hit the ground?

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29. A ball is thrown upwards with a speed of 20m/s from the ground. Another ball is dropped from rest from a building 80m high at the same time

(i) Find the difference in their height after they have fallen for 2s?

(ii) If the balls are along the same line of motion, when will they colide?

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30. A stone is dropped from a stationary hot air balloon in the air travels 14.7m in the last second before it hits the ground. Find the height of the balloon from the ground.

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31. A body is falling freely under gravity. It passes two points A and B (A being higher than B) 20m apart

vertically in 2s. Find the elevation of the point above A from where it began to fall.

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32. On a straight road, two cars X and Y are moving in the same direction, Velocity of car X is 20m/s and that of car Y is15 m/s. Find the velocity of X relative to Y and vice versa.

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33. 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 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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34. A train 100m in length, is moving with a velocity of 54km/hr in one direction, Another train, 80m in length, is moving with a velocity of 36km/hr in the opposite direction. Find the time when the two trains will completely cross each other.

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35. A boat rescued people drowning in a river during a flood, with maximum of 5 people at a time 7 people were holding a rock in middle of water flow. The boat arrives and picks 5 of them and left 2 people holding the rock. When the boat began to travel upstream, 2 people holding the rock, left hold of it and start flowing with the water flow. The boat travels 2 km upstream, left the 5 people, turned about and caught with the 2 people drowning. how long will it take the boat to reach those 2 people?

Take, speed of boat w.r.t. to still water =10m/s

Speed of water flow =2m/s

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Practice Problems

1. The minute hand of a table clock is 5cm long. Find the average velocity of the tip of the minute hand between 3.00pm and 3.30pm.

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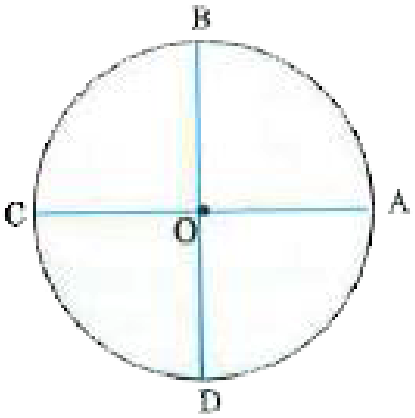
2. A particle is moving in anticlockwise direction along a circle of radius R.



Calculate the distance and displacement covered by the particle (i) from A to C (ii) from A to D.

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3. A bus travelled a total distance s. it covered its journey in consecutive one-third distances with speeds 60km/hr, 70km/hr and 80km/hr, respectively. Calculate the average speed of bus for entire journey.

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4. A body is travelling due east at a speed of 15km/h for one hour and then turns towards south at a speed of 10km/h for one hour. Find the average velocity of the body.

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5. A boy is taking rounds along s 20m will back and forth. He completed 10 rounds in 45minutes. Calculate the average speed and average velocity of the boy.

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6. A car is travelling along a straight line and covers one-fourth of the total distance with a velocity of 10m/s. the remaining distance is covered with a velocity of 5m/s. calculate the average velocity of the car.

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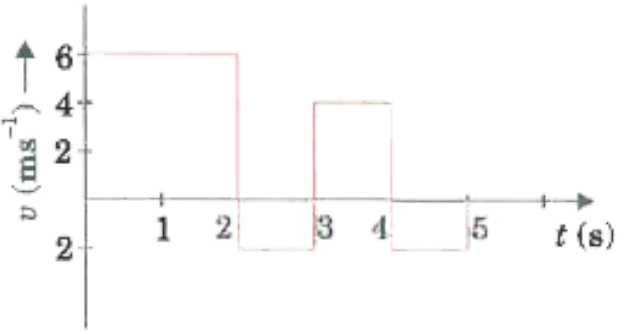
7. Calculate the displacement and distance travelled by the body in 5 s, from the adjoining velocity-time graph



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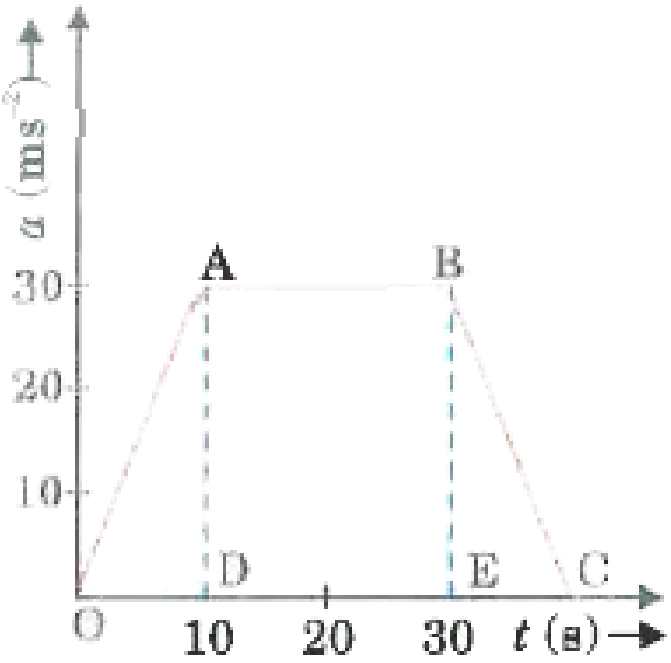
8. From the adjoining acceleration-time graph for a particle, find the average acceleration in initial 30s.



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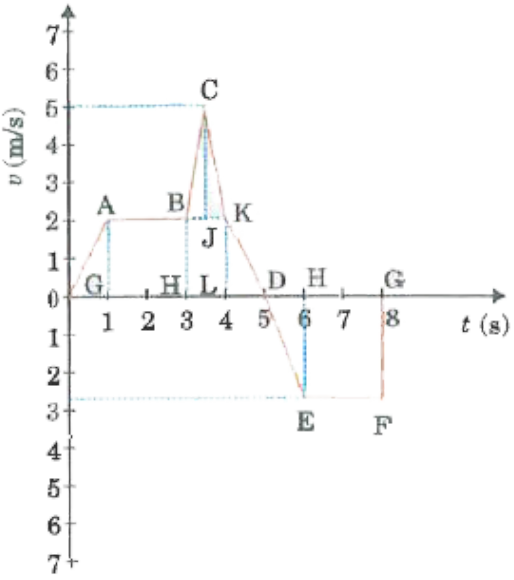
9. Calculate the displacement covered by a moving body in 8s. The velocity time graph of the body is shown below.



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10. A body is projected in a vertical direction. The altitude y is given by

$y = 10t^2 - 9t + 5$

Calculate the initial velocity of the body.

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11. The displacement of a particle moving along a straight line is given by

`s=3t^(3)+2t^(2)-10t. find initial velocity and acceleration of particle.

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12. A particle is moving with an intial velocity of $5ms^{-1}$. What will be the velocity of the particle at t=3s, if the acceleration of the particle is given by

$a = 16t^3 - 12t^2 + 6t - 25$

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13. The velocity of an object varies as $v = h\frac{t^2}{4}$. Calculate the change in position of the ball is time t.

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14. A particle is moving with an initial velocity of 2m/s and covers a distance of 20m in 5s. Find (a) acceleration

of particle (b) time taken by the particle to attain a velocity of 10m/s.

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15. A particle is moving under a constant acceleration of $3m/s^2$. The initial velocity of the particle is 10m/s. calculate the distance travelled by the particle is 5s and also in th 5th second of its motion.

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16. A particle moves 20m in 3rd second and 30m in 5th second of its journey what will be the distance covered

by the body in 4s after 6th second?

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17. A particle is initially at rest. It starts moving with a constant acceleration, the speed of the particle in t seconds is 50m/s and after one second the speed becomes 75m/s. calculate the acceleration of the particle and distance covered in $(t+1)^{\text{th}}$ second of its motion.

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18. What will be the minimum stopping distance required by a car to stop if it is moving with a velocity of 40m/s with a deceleration of $20m/s^3$? How much time will it take to stop the car?

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19. A ball is thrown vertically upwards from ground with such a speed so that it just reaches the top of a building and then falls back. If it takes 7s for the ball to return to the hands of thrower. Calculate the height of the building approximately.

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20. A ball A is dropped from the top of a tower 500m high and at the same instant another ball b is projected upwards with the velocity of 100m/s. after how much time and where the two balls will meet?

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21. Two bodies are dropped from two different building, one at a height 200m and another at a height of 150m above the ground. What will be difference in height of the bodies after they have fallen for 2s? $\left(g = 10m/s^2\right)$

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22. Two balls are released from the same height at an interval of 2s. When will the separation between the balls be 20m after the first ball is released? Take $g = 10m/s^2$.

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23. A bus A travelling at a speed of 70 km/h just overtakes another bus B at a speed of 60km/h. The length of each bus is 10m. Calculate the time taken by the bus A to overtake bus B.

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24. A boy starts running on a straight line path with speed of 20km/h starting from same point. What is the position of the girl w.r.t. boy in 20 minutes?

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25. Two trains A and B each of length 200m are running on parallel tracks. A overtake B in 30s and A crosses B in 15s. What are the velocities of trains A and B?

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26. The speed of a man along with the river is 20km/h and speed of the man against the river current is 10km/h. calculate the speed of the man in still water and speed of the river.

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27. Two cars A and B are moving in same direction with a speed of 40km/h. the distance between cars A and B is constant and is 5km. Another car C is also moving in the same direction. If at a certain instant car B is overtaking C, then car A takes 20 minutes to overtake C. find speed of C?

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28. A thief's car moving on a straight road with a speed of 80km/h it is followed by a police car moving at a constant speed of 120km/h, crossing a T-point 20s later than the thief's car. At what distance from the T-point the police car will catch the thief's car?

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Conceptual Questions

1. How is the vehicle over speeding determined while crossing the toll intercity ?

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2. For a moving object the distance covered by it is always greater than or equal to the displacement of the object in a given time interval . Comment .

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3. A toy cart is designed in such a way that after moving 500 cm forward it reversed 300 cm back at a rate of 100 cm per five seconds. Find the time taken by the cart to cover a distance of 1 m.

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4. Represent the motion of an object in unifrom motion along a straight line when both initial distance and velocity of the object is positive .

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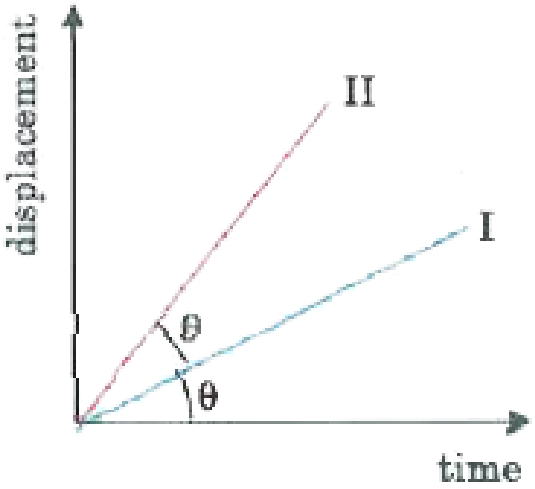
5. From the given displacement - time graph of two cars moving on a straight road , which of the following is

moving with greater velocity ?



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6. For a moving object is it possible that magnitude of average speed is less than magnitude of average velocity ?

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7. For a 5 cm long minute hand in the wall clock , find the displaceement of the tip of the hand in an interval of 30 minutes . Also find the ratio of distance to displacement .

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8. The pilot landing or taking off the aero plane is an inertial observer or non - inertial frame of refrence.

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9. A man goes to market by walk to purchase some groceries . On the way back home after purchasing he takes an autorickshaw to home . Represent the gives journey in form of displacement time graph.

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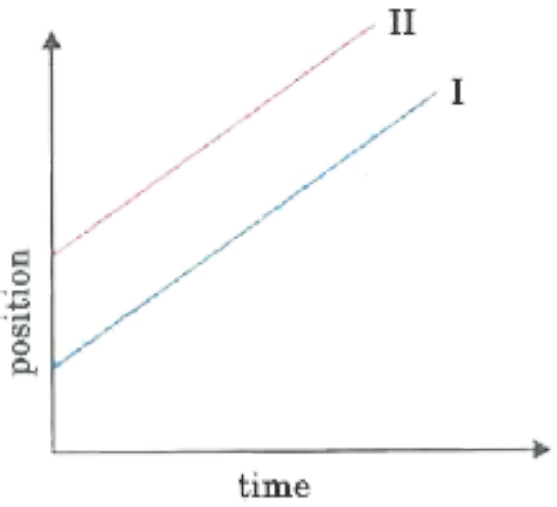
10. For the given position - time graph of two object comment on their relative velocities .



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11. When is a moving object considered as a point object ? Give some example.

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12. What can be concluded from a position -time graph of a moving object with negative slope ?

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13. Is it possible for a moving object to have instantaneous velocity equal to the average velocity ?

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14. Give an example when the direction of the acceleration of the moving object is opposite ot the direction of the motion .

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Tough Tricky Problems

1. A stone is thrown up from the top of a tower and it takes time t_1 to reach the ground. A second stone is thrown down with the same speed and it takes time t_2 to reach the ground . How much time a third stone would take to reach the ground, if it is dropped down?

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2. A particle is moving in a straight line along X-axis and its x-coordinate varies with time as:

$x = t^2 - 4t + 6$

Find the distance and displacement of particle in time interval t=0to t=3s.

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3. A particle is moving along a straight line such that its displacement x and time t are related as follows:

$x^2 = 1 + t^2$

Show that acceleration of the particle can be represented as: $a = \frac{1}{x} - \frac{t^2}{x^3}$.

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4. An elevator accelerates from rest at a constant rate α for time interval t_1 and travels a distance S_1 It them retards at a constant rate β for time interval t_2 and finally comes to rest after travelling a distance S_2 during its retardation Show that:

$$\frac{S_1}{S_2} = \frac{t_1}{t_2} = \frac{\beta}{\alpha}.$$

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5. A driver is driving a car at a speed of 90km/h. he spots a child standing on his way and decided to apply the brakes but it took him 0.3s to actually apply the brakes. If the retardation produced by the brakes is

$10m/s^2$, calcualtion the total distance covered by car before coming to rest

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6. A truck is moving at a constant speed of 50km/h on a straight road which terminates on a wall. A fly starts moving with a constant speed of 100km/h from the wall towards the truck when the truck is at a distance 25km from the wall. Fly reaches the truck and then turns back towards the wall and then turns back towards the wall and then on reaching the wall it again turns towards the truck and so on. it makes several trips between the truck and the wall, before the truck just reaches the wall.

(a) What is the total distance travelled by the fly during this period?

(b) how many trips the fly makes between the truck and the wall?

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7. Height of a tower is 125m and a particle is dropped from rest from the top of the tower. After two seconds of its fall, another particle is projected downwards with a speed u such that both the particles reach the ground simultaneously. What is the value of u?

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8. A particle is moving in a straight line. It covers half of the total distance with velocity v_0 Remaining half distance is covered with a velocity v_1 for half the time and with velocity v_2 for another half of time. Find the average velocity of the particle.

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9. There is one tower of height h. one particle A is projected upward from top of the tower with a speed u_1 at time t=0 . At time t=t_0 another particle B is projected upward from the bottom of the tower with a speed u_2. When will the particles cross each other?

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10. A particle starts moving rectilinearly at time $t = 0$ such that its velocity v changes with time t according to the equation $v = t^2 - t$, where t is in seconds and v in ms^{-1}. Find the time interval for which the particle retards.

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Ncert Textbook Exercises

1. In which of the following exmples of motion, can the body be considered approxinmately a point object :

(a) a railway carriage moving without jerks between two

two stations.

(b) a mondey sistting on top of a man cycling smoothly on a circulat track. (c) a spinning cricket ball that turns sharply on hitting the round . (d) a tumbling beake theat has slopped off the edge of a table ?

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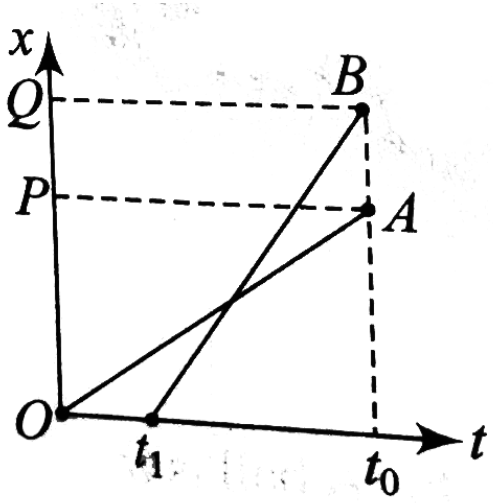
2.



The position-time (x-t) graphs for two children A and B

returning from their school O to their homes P and Q respectively along straight line path (taken as x-axis) are shown in figure. Choose the correct statement (s):

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

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4. 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

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5. A jet airplance travelling at the speed of $500km^{-1}$ ejects its products of combustion at the speed of $1500kmh^{-1}$ relative to the jet plane. What is the speed

of the burnt gases with respect to observer on the ground ?

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6. A car moving aling a straight highway with speed of $126 kmh^{-1}$ is brought to a stop within a distance of $200 m$. What is the retardation of the car (assumed uniform) ans how doest it take fro the car to stop ?

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7. Two trains A and B of length 400 m each are moving on two parallel tracks with a uniform speed of

$72kmh^{-1}$ in the same direction, with A ahead of B. The dirver of B decides to overtake A and accelerates by $1ms^{-2}$. If after 50s, the guard of B just brushed past the driver of A, what was the original distance between them ?

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8. On a two - lane road, car A is travelling with a speed of 36 kmph. Two cars B and C approach car A in opposite direction with a speed of 54 kmph each. At a certain instant, when the distance AB is equal to AC both being 1 km, B decides to overtake A before C does. What minimum acceleration of car B is required to avoid an accident ?

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

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10. A player throwsa a ball upwards with an initial speed of $29.4ms^{-1}$.

(i) What is the direction of acceleration during the upwared motion of the ball?

(ii) What are the velocity and acceleration of the ball at the highest point of its motion?

(iii) Choose the x=0 and t=0 to be the location and time of the ball at its highest point, vertically downward direction to be the positive direction of X-axis, and give the signs of positive, velocity and acceleration of the ball during its upward, and downward motion.

(iv) To what height does the ball rise and after how long does the ball return to the player's hand?(Take g $= 9.8ms^{-2}$, and neglect air resistance).

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11. Read each staremnt below carefully and state with reasons and expamples if it is true or false ,

(a) with zero speed at an instant may have non-zero accelration at that instant

(b) with zero speed may have non-zero velocity

(c) with positive constant speed must have zero accleration

(d) with positive value of acceleration must be speeding up.

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12. A ball is dropped from a height of a height of 90 m on a floor. At each collsion with the floor , the ball loses one - tenth of its speed . Plot the speed -time graph of its motion between t 0 to 12 s.

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13. Explain clearly, with ezamples, the difference between :

(a) magnitude of displacemnt (sometimes called distance) overand

interval of time, and the total length of the path coverd by a particle over the same interval.

(b) magnitude of average velocity over an intercal of

time , and the average speed

over the same interval. [Average speed of a particle over an interval of time is defined as the toal path length

divided by the time intrval]. Show in both (a) and (b) that the second quantity is either greater than or equal to first.

When is the equality sing true ? [For simplocity, consider one- dimensional motion only]

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14. A man walks on a straight road from his home to a market 2.5 km away with a speed of $5kmh^{-1}$. Finding the market closed, he instantly turns and walks back

home with a speed of $7.5 kmh^{-1}$. What is the (a) magnitude of average velocity and (n) average speed of the man over the time interval 0 to 50 minutes?

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15. In abave questions $13 \text{ and } 14$, we have carefully distinguished between average speed and magnitude of average velocity. No such distainction is necessary when we considedr speed and magnitude of velocity. The instantneoud speed if alwary equal to the magnitude of nistantaneous velocity. Why ?

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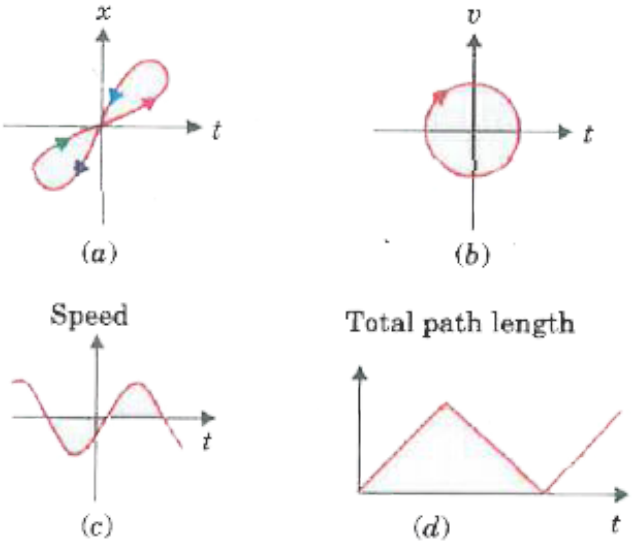
16. Look at the graphs (a) to (d) carefully and state, with reasons, which of these cannot possibly represent one-dimensional motion of a particle.



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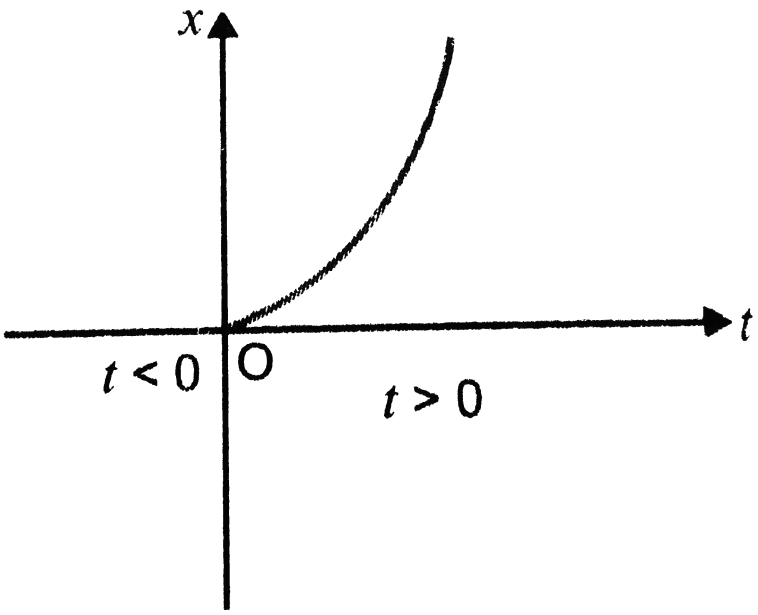
17. Fig. 2 (NCT). 6 shows $x - t$ plot of one dismensional motion a particle. Is it correct to say from the graph

that the particle moves in a straight line for $t < 0$and on a parabolic path form $t > 0$? If not, suggest a suitable physical contxt for this graph.



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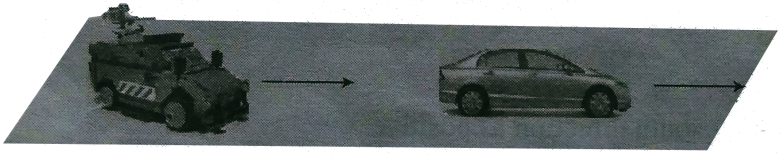
18. A police van moving on a highway with a speed of $30kmh^{-1}$ Fires a bullet at a thief's car speeding away

in a same direction with a speed of $192 kmh^{-1}$. If the muzzle speed of the buller is $150 ms^{-1}$, with what speed does the bullet hit thief's car? .



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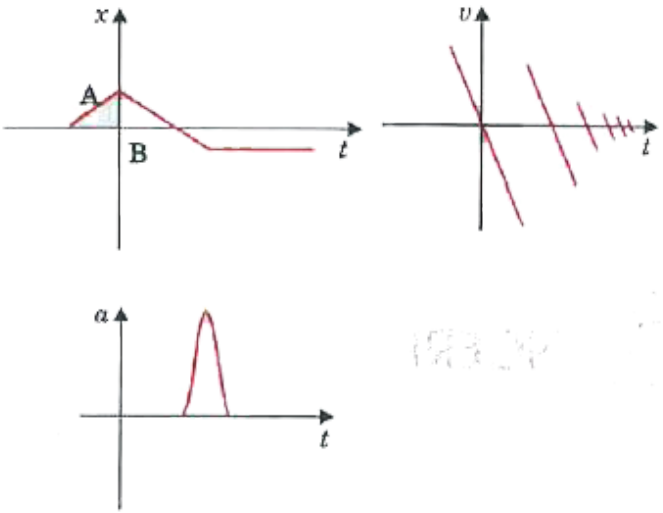
19. Suggest a suitable physical situation for each of the following graphs:



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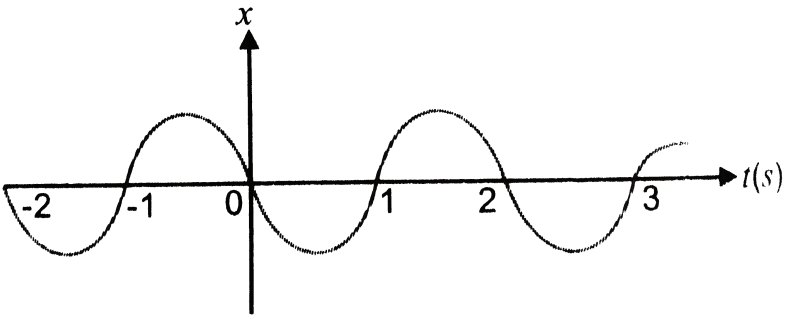
20. Fig 2 (NCT).8 gives the $x - t$ plot of a particle executing one dimensional simle harmonic motion. Give the signs of position, velocity and acceleration variables

of the particles at $t = 0.3s, 1.2s, -1.2s,$



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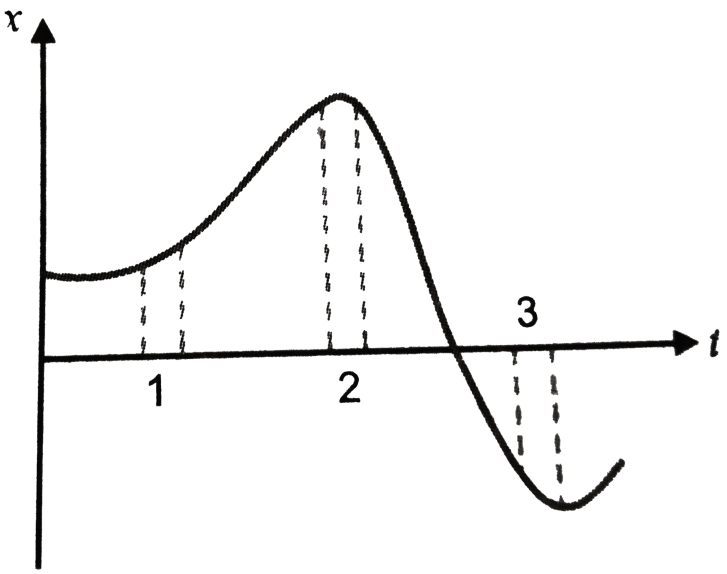
21. Fig. 2 (NCT).9 show the $x - t$ plot of a particle in one dimensional motion. Three different equal intervals of time are shown. In which interval the average speed is greatest and in which it is the least ? Give th sign of

average speed for each interval.



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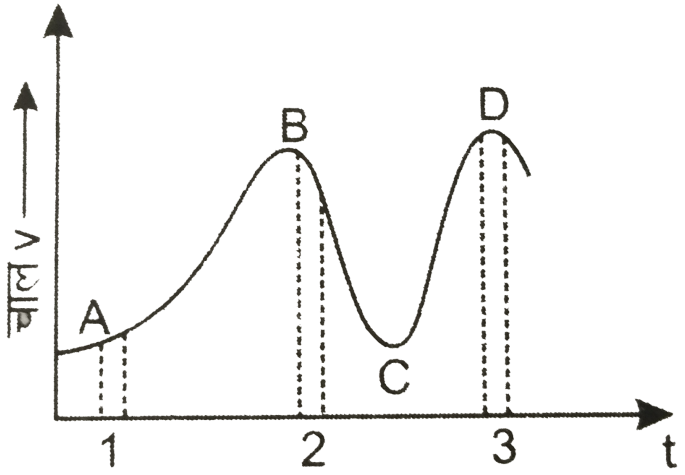
22. चित्र में किसी नियत (स्थिर) दिशा के अनुदिश चल रहे कण का चाल-समय ग्राफ दिखाया गया है। इसमें तीन समान समयान्तराल दिखाये गये हैं। किस अन्तराल में औसत त्वरण का परिमाण अधिकतम होगा? किस अन्तराल में औसत चाल अधिकतम होगी? धनात्मक दिशा को गति की

स्थिर दिशा चुनते हुए तीनों अन्तरालों में v तथा a के चिन्ह बताइए।

A,B,C, व D बिंदुओं पर त्वरण क्या होंगे?



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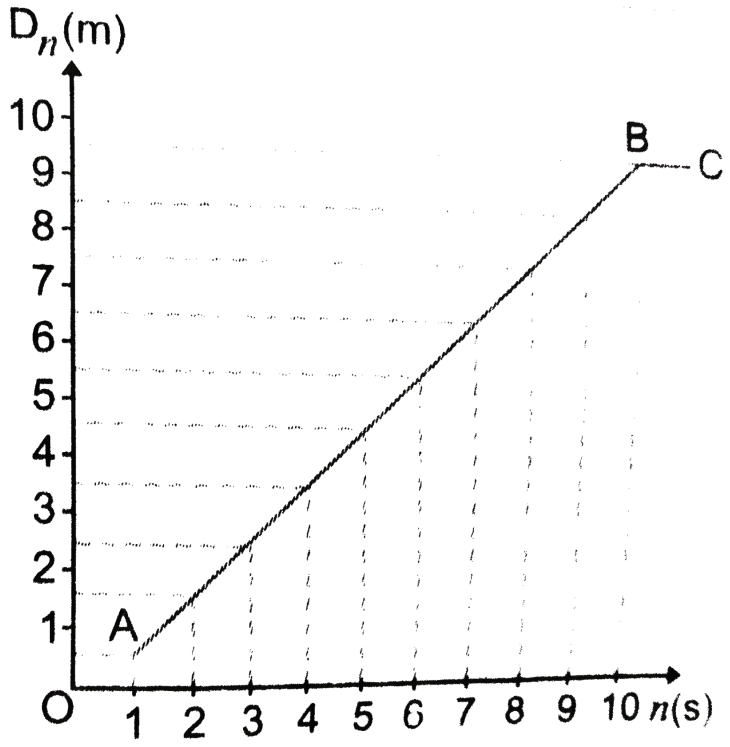
Ncert Additional Exercise

1. A three wheeler starts from rest, accelerates uniformly with $1ms^{-2}$ on a straight road for $10s$ and

then moves with uniform velocity . Plot a graph between the distance covered by the vehicle during the nth second (n = 1,2,3, ...) versus (n) What do you expect the plot to be during accelerated motion: a straight line or a parabola ?



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

Watch Video Solution

3. Ona long horizontally moving belt, a child runs to and fro with a speed 9 km h^{-1} (with respect to the belt) between his father and mother located 50m apart on the moving belt. The belt moves with a speed on the

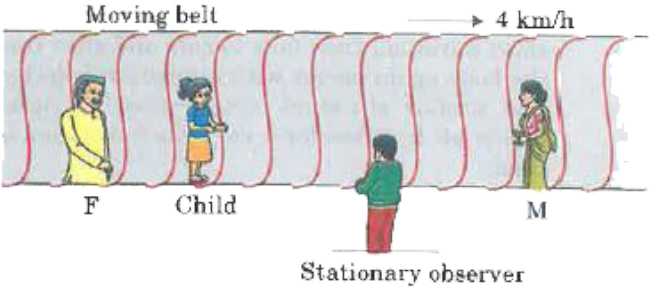
moving belt. The belt moves with a speed of 4 km h^{-1}. for an observer on a stationary platform outside, what is the

(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?

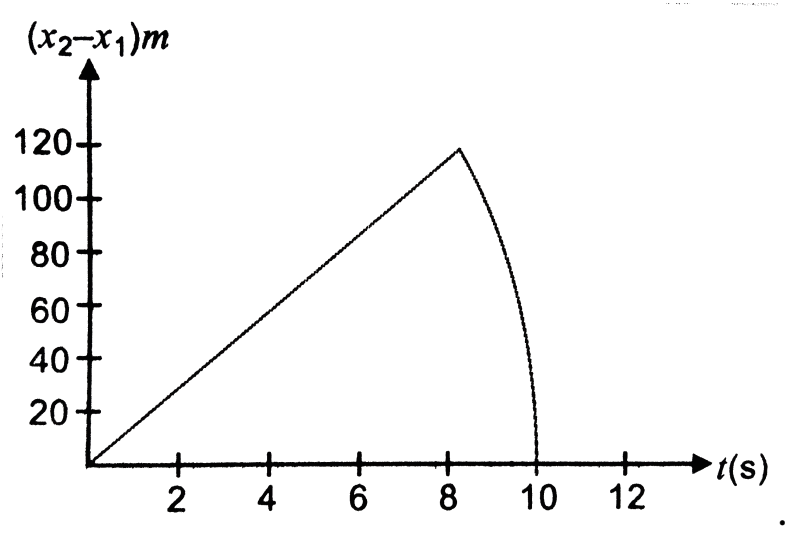
which of the answers after if motion is viewed by one of the parents?



Watch Video Solution

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

parts of the plot.



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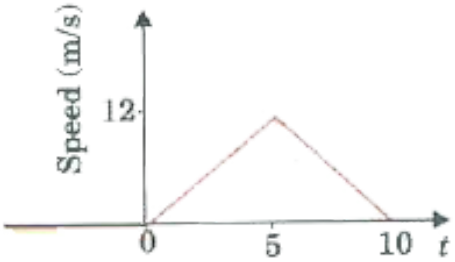
5. The speed-time graph of a particle moving along a fixed direction is shown in figure. Obtain the distance traversed by the particle between $(a)t = 0s$ to 10s(b)t=2s to 6s



What is the average speed of the particle over the intervals in a and b?

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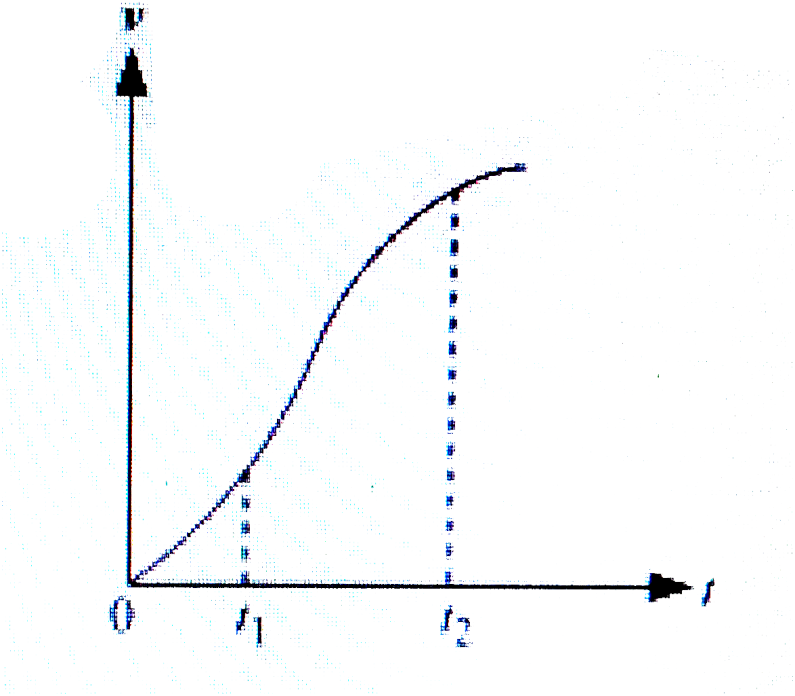
6. The velocity-time graph of a particle in one-dimensional motion is shown in Fig 3.29:



(a) Which of the following formylae are correct for describing the motion of the particle over the time - interval t_1 to t_2:

(a) $x(t_2) = x(t_1) + v(t_1)(t_2 - t_1) + (1/2)a(t_2 - t_1)^2$

(b) $v(t_2) = v(t_1) + a(t_2 - t_1)$

(c) $v_{\text{average}} = (x(t_2) - x(t_1))/(t_2 - t_1)$

(d) $a_{\text{average}} = (v(t_2) - v(t_1))/(t_2 - t_1)$

(e)

$x(t_2) = x(t_1) + v_{\text{average}}(t_2 - t_1) + (1/2)a_{\text{average}}(t_2 - t_1)^2$

(f) $x(t_2) - x(t_1)$ = area under the $v - t$ curve bounded by the t-axis and the dotted line shown.

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Ncert Very Short Answer Type Question

1. Refer to the graphs fig. 2 (EP).5 Match the following.

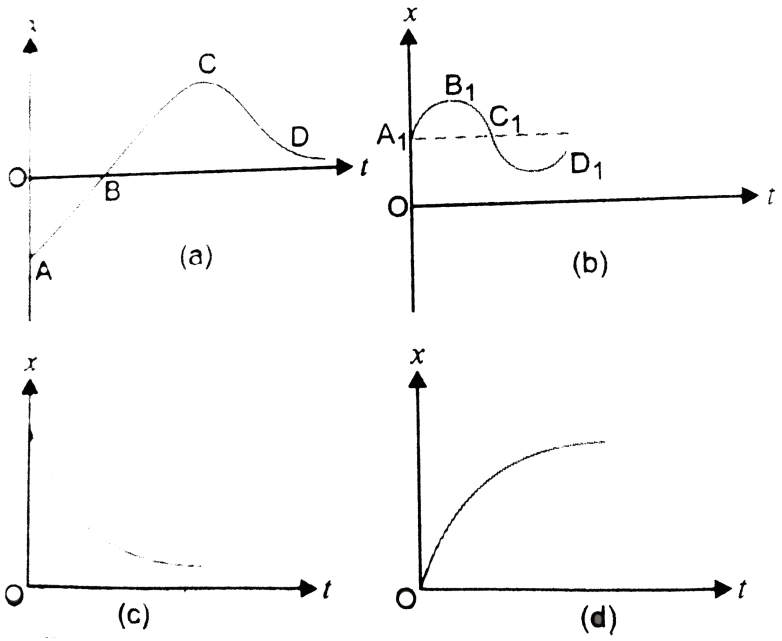
Graph Characteristic

(a) (i) has $v >$ and $a < o$ throughout.

(b) (ii) has $x > 0$ throughout and has a point with $v = 0$ and a point with $a = 0$.

(c) (ii) has a point with zero displacement for $t > 0$.

(d) (iv) has $v <$ and $a > 0$.



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2. A uniform moving cricket ball is turned back by hitting it with a bat for a very short time interval. Show

the variation of its acceleration with time. (Take acceleration in the back ward direction as positive).

Watch Video Solution

3. Give examples of a one-dimensional motion where

(a) the particle moving along positive x-direction comes to rest periodically and forward.

(b) the particle moving along positive x-direction comes to rest periodically and moves backward..

Watch Video Solution

4. Give example of a motion where $x > 0, v < 0, a >$ at a particular instant.

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5. An object falling through a fluid is observed to have acceleration given by $a = g - bv$ where ` g= gravitational acceleration and (b) is constant. After a long time of rlease. It is observed to fall with constant speed. What must be the value of constant speed ?

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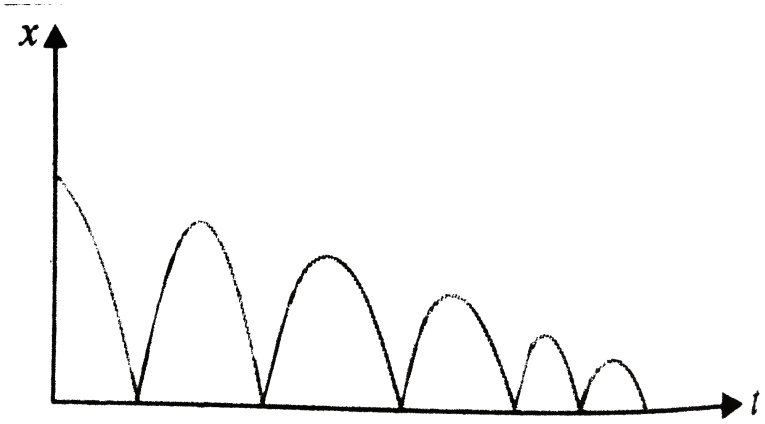
Ncert Short Answer Type Question

1. A ball is dropped and its displacement vs time graph is as shown in Fig. 2 (EP) .7 displacement (x) is from ground and all quantities are +ve upwards. (a) Plot qualitatively velocity vs time graph. (b) plot qualitatively acceleration vs time graph .



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2. A particle executes the motion described by

$x(t) = x_0\left(1 - e^{-\gamma t}\right), t \geq 0, x_0 > 0.$

The maximum and minimum values of $v(t)$ are

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3. A bird is tossing (flying to and fro) between two cars moving towards each other on a straight road. One car has a speed of $18km/h$ while the other has the speed of $27km/h$. The bird starts moving from first car towards the other and is moving with the speed of $36km/h$ and when the two cars were separated by $36km$. What is the total distance covered by the bird ? What is the total displacement of the bird ?

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4. A man runs across the roof-top of a tall building and jumps horizontally with hope of landing on the roof of the next building which is at a lower height than the first. If his speed is $9m/s$,the horizontal distance between the two buildings is $10m$ and height difference is $9m$, will he be able to land on the next building ? (take $g = 10m/s^2$).

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5. A ball A is dropped from a building of height $45m$. Simultaneously another ball B is thrown up with a

speed $40m/s$. Calculate the relative speed of the balls as a function of time.

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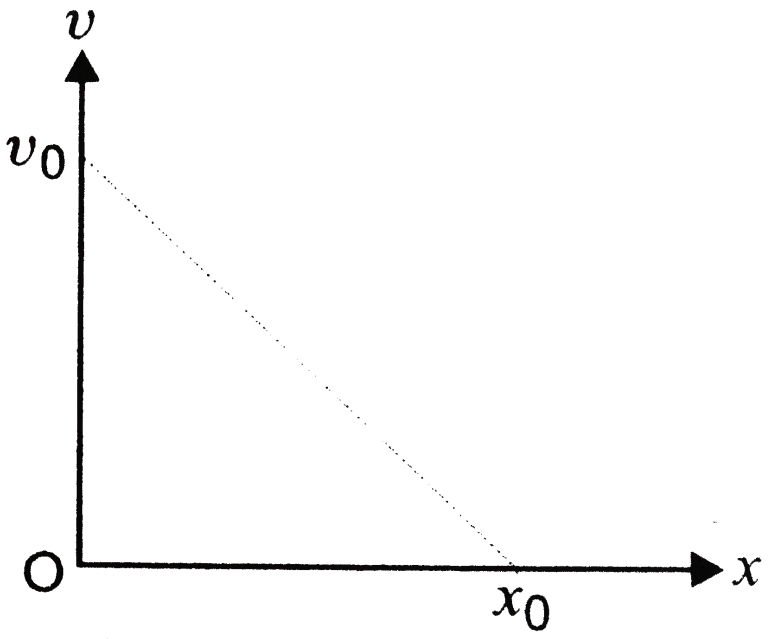
6. The velocity-displacement graph of a particle is shown in Fig . (a) Write the relation between (v) and (x). (b) Obtain the relation between acceleration and displacement and plot it .


v
v_0
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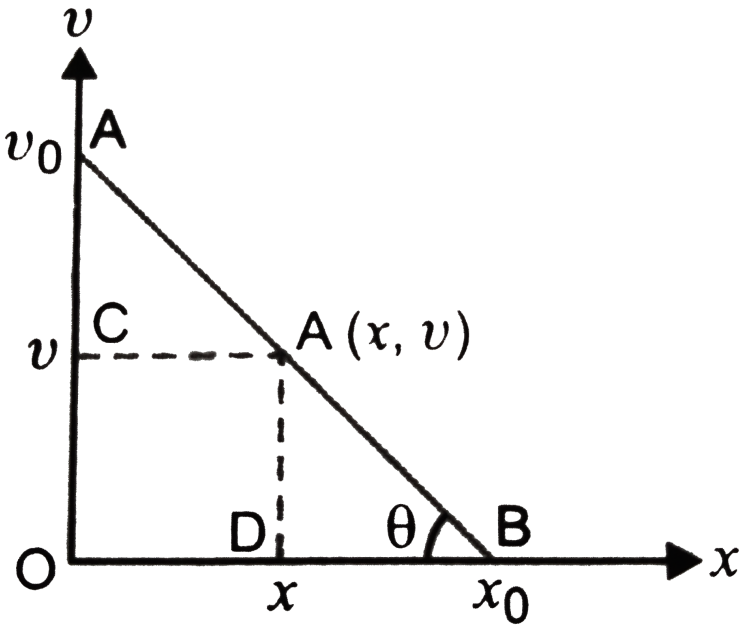
v
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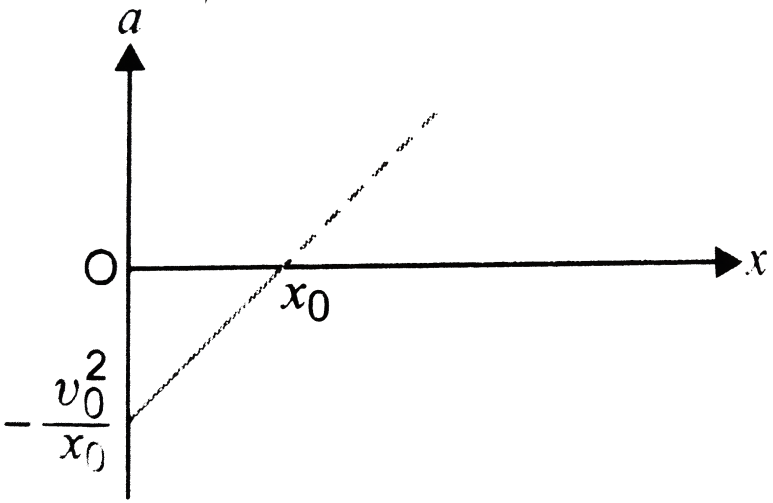

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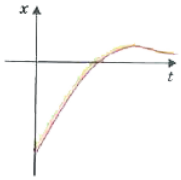
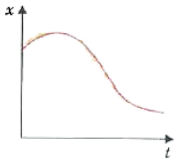
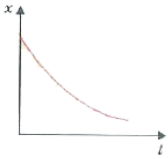
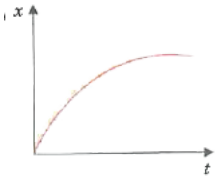
Ncert Multiple Choice Question Type I

1. Among the four graphs shown in the figure there is only one graph for which average velocity over the time interval (0,T) can vanish for a suitably chosen T. Which one is it ?

A. 

B. 

C. 

D. 

Answer: b

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2. 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: c

Watch Video Solution

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

A. The displacement in time T must always take non - negative values.

B. The displacement x in time T satisfies $-v_0T < x < v_0T$.

C. The acceleration is always L with speed V_1 and the other half with speed V_2, then its average speed is .

D. The motion has no turning points.

Answer: b

Watch Video Solution

4. A vehicle travels half the distance (L) with speed V_1 and the other half with speed V_2, then its average speed is .

A. $\frac{V_1 + V_2}{2}$

B. $\frac{2V_1 + V_2}{V_1 + V_2}$

C. $\frac{2V_1V_2}{V_1 + V_2}$

D. $\frac{V_1 + V_2}{V_1V_2}$

Answer: c

Watch Video Solution

5. The displacement of a particle is moving by $x = (t-2)^2$ where x is in metres and t in second. The distance covered by the particle in first 4 seconds is.

A. 4m

B. 8m

C. 12 m

D. 16m

Answer: b

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6. 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 the moving escalator will be.

A. $(t + t_2)/2$

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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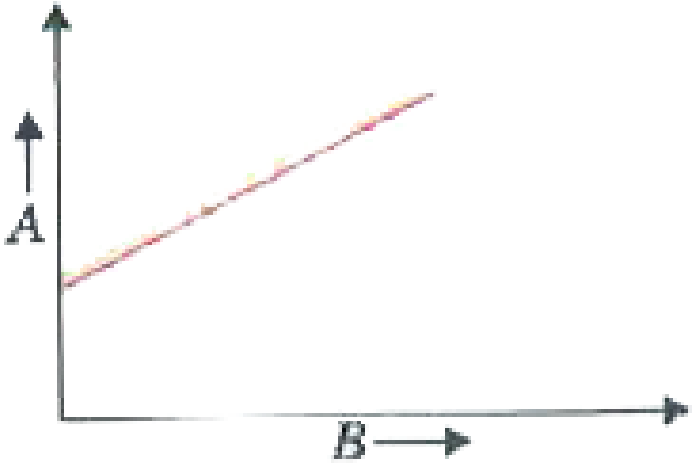
Ncert Multiple Choice Question Type Ii

1. The variation of quantity A with quantity B, plotted in the figure , describes the motion of a particle in a straight line.



A. Quantity B may represent time.

B. Quantity A is velocity if motion is uniform

C. Qunatity A is displacement if motion is unifrom

D. Quantity A is velocity if motion in unifromly

Answer: (a,c,d)

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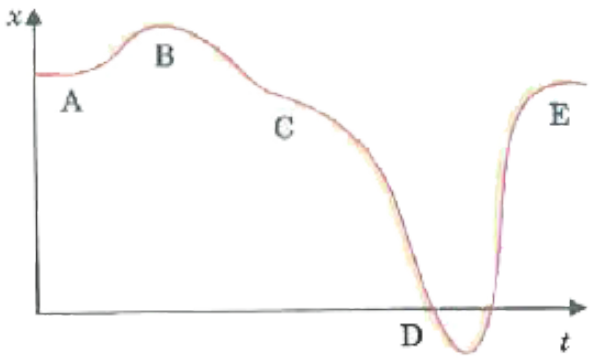
2. A graph of x verus t is shown in the figure given below. Choose correct alternatives from below.



A. The particle was released from rest at t = 0 .

B. At B, the acceleration $a > 0$.

C. At C, the velocity and the acceleration vanish .

D. Average velocity for the motion between A and D is positive .

Answer: (a,c,e)

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3. For the one dimensional motion, described by $x = t - \sin t$

A. $x(t) > 0$ for all $t > 0$

B. $v(t) > 0$ for all $t > 0$

C. $a(t) > -0$ for all $t > 0$

D. $v(t)$ lies between 0 and 2 .

Answer: (a,d)

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4. A spring with one end attached to a mass and the other to a right support is stretched and released

A. Magnitude of acceleration , when just released is maximum.

B. Magnitude of acceleraiton, when at equilibrium

C. Speed is maximum when mass is at equilibrium position.

D. Magnitude of displacement is always maximum wherever speed is minimum.

Answer: (a,c)

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5. A ball is bouncing elastically with a speed $1m/s$ between walls of a railway compartment of size $10m$ in a direction perpendicular to walls. The train is moving at a constant velocity of $10m/s$ parallel to the

direction of motion of the ball. As seen from the ground, choose the correct option

A. the direciton of motion of the ball changes every 10 second .

B. speed of ball changes every 10 seconds

C. average speed of ball over any 20 second interval is fixed

D. the acceleration of ball is the same as from the train.

Answer: (b,c,d)

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Higher Order Thinking Skill And Advanced Level Question With Answer

1. A horizontal conveyor belt is moving at a speed of 5m/s. A box of mass 20kg is gently placed on this belt. Box first slips on the belt and finally comes to rest with respect to belt. If box takes time 0.1 s to stop slipping on the belt, then what will be the distance travelled by the box during this interval?

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2. A police inspector in a jeep is chasing a pickpocket on a straight road. The jeep is going at its maximum speed

v (assumed uniform). The pickpocket rides on the motorcycle of a waiting friend when the jeep is at a distance of a waiting friend when the jeep is at a distance d away, and the motorcycle starts with a constant acceleration a. Show that the pickpocket will be caught it $v \geq \sqrt{2ad}$.

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3. Water drops are falling at a regular interval from a leaked pipe 18m above the floor. When first drop touches the ground, fourth drop is just leaving the pipe. What is the height of third drop at the given instant?

Watch Video Solution

4. A balloon is going upwards with uniform veloity of 10m/s. A stone attached to the balloon gets separated from it at a certain instant of time. Find the separation between stone and the balloon when stone has fallen through a height of 50m from the point where it got separated from balloons.

Watch Video Solution

5. P,Q,R and S are the points in a vertical line. It is given that PQ=QR=RS. A particle is released from rest from the point P. particle takes time t_{PQ}, t_{QR} and t_{RS} to cover

three equal distance, respectively. Find ratio $t_{PQ} : t_{QR} : t_{RS}$

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Revision Exercise Very Short Answer Question

1. When can we say that an object is in motion?

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2. How are rest and motion relative to each other. Explain with an example.

Watch Video Solution

3. How are rectilinear motion and translatory motion similar or different to each other?

Watch Video Solution

4. UNIFORM CIRCULAR MOTION

Watch Video Solution

5. When can we say that circular motion is periodic?

Watch Video Solution

6. When is the motion of an object categorised as oscillatory motion?

Watch Video Solution

7. How are vibratory motion and simple harmonic motion different?

View Text Solution

8. How are vibratory motion and simple harmonic motion different?

View Text Solution

9. Define inertial frame of reference.

Watch Video Solution

10. Earth revolving around the sun is an example of motion in how many dimensionns?

Watch Video Solution

11. Give an example of three-dimensional motion.

Watch Video Solution

12. Give some example of scalar quatities.

Watch Video Solution

13. Define scaler quantities and vector quntities. Give some examples.

Watch Video Solution

14. What do we measure using speedomter?

Watch Video Solution

15. What will be the distance and displacement of the object when it makes one complete round of a circular park of radius 5m?

Watch Video Solution

16. INSTANTANEOUS SPEED

Watch Video Solution

17. Define velocity of an object

Watch Video Solution

18. What can be deduced from the slope of a position-time graph of uniform motion?

Watch Video Solution

19. What parameter can be determined from velocity-time graph of uniform motion?

Watch Video Solution

20. How is non-uniform motion different from uniform motion?

Watch Video Solution

21. What do we measure by odometer installed in vehicles?

Watch Video Solution

22. How can we measure the instantaneously velocity graphically?

Watch Video Solution

23. What does negative slope of a position-time graph signify?

Watch Video Solution

24. What can be said about velocity of the object if its displacement-time graph is parallel to displacement axis?

Watch Video Solution

25. Can a body have a constant velocity but a varying speed ?

Watch Video Solution

26. Define acceleration.

Watch Video Solution

27. INSTANTANEOUS ACCELERATION

Watch Video Solution

28. Mention one use of velocity-time curve of an accelerating object.

Watch Video Solution

29. Write the three equations of uniformly acceleration motion. Give the meaning of each symbol in them.

Watch Video Solution

30. Can we use the equation $v = u +$ at in SHM or not ?

Watch Video Solution

31. Is it possible for a uniformly accelerating object to change its direction of velocity?

View Text Solution

32. What will be the instaneous acceleration of an object thrown upward, when it reaches maximum height?

Watch Video Solution

33. When is the acceleration of a bike larger, when it is suddenly stopped or when it is raced?

Watch Video Solution

34. How does the velocity of a ball thrown upwards change on its way?

Watch Video Solution

35. Give one example when the velocity of an object changes at a constant rate both in magnitude and direction.

Watch Video Solution

36. A girl dropped an orange in a moving bus with acceleration a, what will be the acceleration of the apple with respect to the bus?

Watch Video Solution

37. Find the acceleration of an orange fallen in a bus moving with acceleration a, with respect to the road.

Watch Video Solution

38. Give an example of an object moving with constant value of acceleration but in variable direction.

Watch Video Solution

39. Represent the motion of an object thrown upward with the help of velocity-time graph.

Watch Video Solution

40. Represent the variation of distance with time for an object under free fall.

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Revision Exercise Fill In The Blanks

1. __ speed is arithmetic mean of individual speeds.

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2. Path length is a _____ quantity.

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3. When a particle moves in a circle of radius r, the displacement covered in one complete revolution is _____

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4. Negative acceleration is also called _____

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5. When an object is moving with zero accleration, the velocity-time graph is a straight line _____ to the time

axis.

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6. _____ is the time a person takes to think and take some action.

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7. Time occurs _____ in the unit of acceleration.

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8. Average speed cannot be _____ than magnitude of average velocity.

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9. The acceleration of the light travelling in vacuum is _____

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10. If the tangent at any point to the position-time graph is parallel to time axis then instantaneous velocity is _____

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Revision Exercise Short Answer Questions

1. Differentiate between one, two and three dimensional motion.

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2. Distinguish between inertial and non-inertial frames of reference.

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3. Differentiate between scala and vector quantities.

Watch Video Solution

4. Write three difference between distance and displacement.

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5. Is magnitude of the displacement of an object and total distance covered by it in certain time intrval same ? Explain.

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6. Adil is running at speed of $2.5ms^{-1}$ for five minutes. He then completes the remaining distance by walking for another five minutes at speed of $1ms^{-1}$. Find the average speed of Adil.

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7. Write any three differences between speed and velocity.

Watch Video Solution

8. Explain that a particle can have zero average velcoity but not zero average speed.

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9. Write some uses of velocity-time graph of an object in uniform motion.

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10. Prove that average velocity of an object can never be greater than the average speed of an object over a given interval of time.

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11. A toy car is moving on a circular track of radius R and completes one rotation in 55 seconds Calculate the displacement of the car in 1 min 50sec.

1min and 50 sec=110 sec.

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12. Two cars are moving in same direction with speed of $40kmh^{-1}$ Find the relative velocity of first car with another.

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13. Define relative velocity of an object w.r.t. another. Draw position-time graph of two objects moving along a straight line, when their relative velocity is (i) zero and (ii) non-zero.

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14. Two stones are thrown from top of tower, one vertically upward and other downward with same speed. Ratio of velocity when they hit the ground is:

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

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16. What is the significance of a positive and b negative slope in velocity-time graph of an object in uniformly acclerated motion?

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17. Represent the velocity-time graph for a uniformly accelerated motion when acceleration is positive.

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18. How can one determine (i) the distance (ii) the displacement coverd by a uniformly accelerated body from its velocity-time graph ?

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19. Calculate the acceleration of an object if its velocity is given by $v = \frac{1}{2}\left(\sqrt{12x + 24}\right)$

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Revision Exercise Long Answer Questions

1. Write and derive all the three equations of motion analytically.

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2. Write a short note on velocity and speed. Differentiate between them with the help of examples and illustrations.

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3. Write a short note on acceleration, average acceleration, variable accleration and instantaneous acceleration Also show how instantaneous acceleration is related to average acceleration.

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4. Derive the equations of motion for an object in uniformly accelerated motion in one dimension using calculus.

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5. For an object under free fall, discuss the variation of acceleration with time, velocity with time and position of object with time. Also represent them graphically.

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Revision Exercise Numerical Problems

1. An ant is crawling on the rim of a circular plank of radius 7cm. Calculate the distance and displacement of ant in (a) completing one round, (b) in completing 2.5 round and (c) half around.

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2. A bus on a straight highway moves from stop A to C, 300m away in 20sec. It further moves from stop C to D, 180m away in 7 sec. calculate the average speed of bus from A to D

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3. A bike is moving on a straight road After covering a distance of 420m in 22 sec, it turns back and stops after 12sec midway. Calculate the average velocity of the bike in first 22 sec and in first 34sec.

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4. The instantaneous position of a moving drone is given by $y = m + nt^2$, where m=6m and n=3.2 ms^{-2} and t is time. Find the velocity, the average velocity of drone between t=0 sec and 4 sec. also calculate the velocity at t=3sec.

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5. A stone is thrown up with a velocity of $18ms^{-1}$ from a 25 m high deck, Calculate the total time taken by stone to reach the ground .

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6. A ball is dropped from a top of a 100 m high building. At the ssame time another ball is thrown up from the ground with a speed of $20ms^{-1}$. At what time will the balls meet?

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7. Two buses are running antiparallel in East-West. Direction. Calculate the velocity of Bus II with respect to Bus I. the speeds of Bus I and II are 60km h^{-1} and 90 $kmhr^{-1}$ respectively. Also calculate the velocity of road with respect to Bus I.

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Competition File A Multiple Choice Questions

1. A body in one dimensional motion has zero speed at an instant. At that instant, it must have

A. Zero acceleration

B. Non-zero acceleration

C. Zero velocity

D. Non-zero velocity

Answer: C

Watch Video Solution

2. Displacement of a particle moving in a straight line is represented as follows:

$x = at^3 + bt^2 + ct + d$ Ratio of initial velocity to initial acceleration depends.

A. Only on a and b

B. Only on b and c

C. Only on c and d

D. Only on d and a

Answer: b

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3. A particle thrown up vertically reaches its highest point in time t_1 and returns to the ground in a further time t_2. The air resistance exerts a constant force on the particle opposite to its direction of motion.

A. $t_1 = t_2$

B. $t_1 > t_2$

C. $t_1 < t_2$

D. Information is not sufficient to decide the relation between t_1 and t_2

Answer: c

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4. Magnitude of average velocity and speed are found to be the saame in an interval of time.

A. Particle must have zero acceleration.

B. Particle must have non-zero acceleration

C. Particle must be moving in a straight line without rebversing the direction of motion.

D. Particle must be in a state of rest.

Answer: c

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5. If a body is moving with constant speed, then its acceleration

A. must be non-zero

B. must be zero

C. may be non-zero and constant

D. may be non-zero and variable.

Answer: d

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6. A parrot flies in a straight line for 6s. Velocity of the parrot is given by v=$|t-3|$. Time (t) is measured in

seconds and velocity in m/s. displacement of the parrot in 6s is

A. 0

B. 5m

C. 6m

D. 9m

Answer: d

Watch Video Solution

7. Velocity of an object is variable, then

A. its acceleration may remain constant.

B. its speed may remain constant

C. its average acceleration may remain constant

D. all of these

Answer: d

Watch Video Solution

8. If speed of an object is variable, then

A. its acceleration may be zero

B. its velocity may be constant.

C. its velocity must be variable

D. its acceleration must be zero.

Answer: c

Watch Video Solution

9. An object is given an initial velocity of 11m/s towards the north and a constant acceleration of $2m/s^2$ towards the south. What will be the distance covered by the object in the sixth second of its motion

A. 0.25m

B. 0.5m

C. 0

D. 2m

Answer: c

Watch Video Solution

10. A ball projected from ground vertically upward is at same height at time t_1 and t_2. The speed of projection of ball is [Neglect the effect of air resistance]

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

B. $\frac{g(t_1-t_2)}{2}$

C. $g(t_1+t_2)$

D. $g(t_1-t_2)$

Answer: a

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11. The initial velocity given to a particle is u and accelration is given by $a = at^{\frac{3}{2}}$. What will be the velocity of particle after time t.

A. $u + at^{\frac{5}{2}}$

B. $u + \frac{2}{5}at^{\frac{5}{2}}$

C. $u + \frac{5}{2}at^{\frac{5}{2}}$

D. $u + at^{\frac{3}{2}}$

Answer: b

Watch Video Solution

12. A body is given an initial velocity towards the north and constant acceleration is applied on it towards the south. It s_1 and s_2 are the magnitude of displacements in first 5s and the next 5s respectively then

A. $s_1 = s_2$

B. $s_1 > s_2$

C. $s_1 < s_2$

D. Information is not sufficient to decide the relation between t_1 and s_2 and s_2

Answer: d

Watch Video Solution

13. A particle is thrown up with an initial velocity such that it takes more than one second to reach the top point. What is the distance travelled by the particle during the first second of its decent?

A. $g/2$

B. $g/4$

C. g

D. Information is insufficient to calculate the desired distance.

Answer: a

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14. A body is projected vertically upward direction from the surface of earth. If upward direction is taken as positive, then acceleration of body during its upward and downward journey are respectively

A. Positive, negative

B. Negative,positive

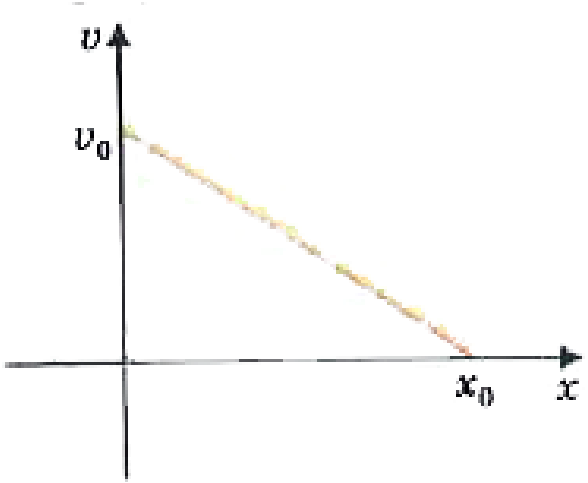
C. Positive,Positive

D. Negative,Negative.

Answer: D

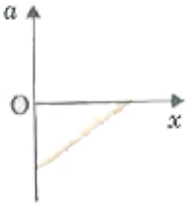
Watch Video Solution

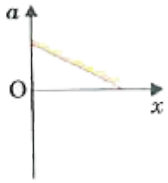
15. Graph between velocity and displacement is shown in the following figure:

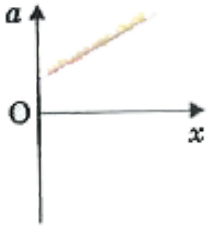


Which of the following graphes represents the correct variation of acceleration with displacement

A.



B. 

C. 

D. none

Answer: a

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16. Displacement x of a particle varies with time as $\sqrt{x} = t + 5$, where x is in metres and time t is in seconds, Select the correct option.

A. Acceleration of the particle is constant.

B. Velocity of the particle at t=0 is 10m/s.

C. Particle never reverses its direction of motion for

$t > 0$

D. All of the above.

Answer: d

Watch Video Solution

17. A small block slides without friction down an iclined plane starting form rest. Let S_n be the distance traveled from time $t = n - 1$ to $t = n$. Then $\frac{S_n}{S_{n+1}}$ is:

A. $\frac{n-1}{2n+1}$

B. $\frac{2n-1}{2n+1}$

C. $\frac{n+1}{2n+1}$

D. $\frac{2n-1}{2n}$

Answer: b

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18. A particle is dropped from rest from the top of a building of height 100m. At the same instant another particle is projected upward from the bottom of the building What should be the speed of projection of the particle projected from the bottom of building so that

the particle cross each other after 1s? Acceleration due to gravity is 10 m/s^2.

A. 100m/s

B. 95m/s

C. 90m/s

D. 105m/s

Answer: a

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19. Two card are moving in the same direction with the same speed of $30kmh^{-10}$ at a distance of $5km$ from

each other . A third car moving in the opposite direction meets these two card at an interval of 4 minutes. Find the speed of third car.

A. 45km/h

B. 30km/h

C. 25km/h

D. 40km/h

Answer: a

Watch Video Solution

20. A particle moves in a straight line and its position x and time t are related as follows: $x = (2+t)^{1/2}$

Acceleration of the particle is given by

A. $\frac{1}{4x^2}$

B. $-\frac{1}{4x^{\left(\frac{3}{2}\right)}}$

C. $-\frac{1}{4x^3}$

D. $-\frac{1}{4x}$

Answer: c

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Competition File B Multiple Choice Questions

1. A bus begins to move with an accelaration of $1ms^{-1}$. A man who is $48m$ behind the bus starts running at $10ms^{-1}$ to catch the bus, the man will be able to catch the bus after .

A. 4s

B. 10s

C. 12s

D. 8s

Answer: d

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2. A particle is thrown vertically upward. Its velocity at half of the height is 10 m/s. Then the maximum height attained by it : -

$\left(g = 10m/s^2\right)$

A. 16m

B. 10m

C. 8m

D. 18m

Answer: b

Watch Video Solution

3. A stone is dropped from rest from the top of a tower 19.6m high. The distance travelled during the last second of its fall is (given $g = 9.8m/s^2$):

A. 9.8m

B. 14.7m

C. 4.9m

D. 19.6m

Answer: b

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4. A 120 m long train is moving towards west with a speed of 10 m/s. A bird flying towards east with a speed of 5 m/s crosses the train. The time taken by the bird to cross the train will be

A. 16sec

B. 12sec

C. 10sec

D. 8sec.

Answer: d

Watch Video Solution

5. A stone dropped from a building of height h and it reaches after t second on the earth. From the same building if two stones are thrown (one upwards and other downwards) with the same speed and they reach the earth surface after t_1 and t_2 seconds, respectively, then

A. $t = t_1 - t_2$

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

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

D. $t = \sqrt{t_1^2 - t_1^2}$

Answer: c

Watch Video Solution

6. If a ball is thrown vertically upwards with speed u, the distance covered during the last t second of its ascent is

A. $\frac{1}{2} >^2$

B. $ut - \frac{1}{2}at^2$

C. $(u + \ >)x$

D. ut

Answer: a

Watch Video Solution

7. A body is moving with uniform acceleration describes 40 m in the first 5 sec and 65 m in next 5 sec. Its initial velocity will be

A. 4m/s

B. 2.5m/s

C. 5.5m/s

D. 11m/s

Answer: C

Watch Video Solution

8. A man throws balls with the same speed vertically upwards one after the other at an interval of 2s. What should be the speed of the throw so that more than two balls are in the sky at any time ? (Given $g = 9.8m / s^2$)

A. At least 9.8m/s

B. Any speed less than 19.6m/s

C. Only with speed 19.6m/s

D. More than 19.6m/s

Answer: d

Watch Video Solution

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

A. 6

B. 9

C. 11

D. 13

Answer: b

Watch Video Solution

10. The displacement x of a particle varies with time as $x = ae^{\alpha t} + be^{\beta t}$ where a,b,a, β are constants and are positives. The velocity of the particle will:

A. Drop to zero when $\alpha = \beta$

B. be independnent of α and β

C. go on increasng with time

D. go on descreasing with time.

Answer: C

Watch Video Solution

11. A particle moves in a straight line with a constant acceleration. It changes its velocity from $10ms^{-1}$ to $20ms^{-1}$ while passing through a distance $135m$ in t seconds. The value of t is.

A. 1.8

B. 12

C. 9

D. 10

Answer: C

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12. The distance travelled by a particle starting from rest and moving with an acceleration $\frac{4}{3}ms^{-2}$, in the third second is.

A. 4m

B. $\frac{10}{3}m$

C. $\frac{19}{3}m$

D. 6m

Answer: b

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13. A particle moves along a straight line OX. At a time t (in seconds) the distance x (in metre) of the particle is given by $x = 40 + 12t - t^3$. How long would the particle travel before coming to rest ?

A. 16m

B. 21m

C. 40m

D. 56m

Answer: D

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14. Two bodies are dropped from two different building, one at a height 200m and another at a height of 150m above the ground. What will be difference in height of the bodies after they have fallen for 2s? $\left(g = 10m/s^2\right)$

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15. The position x of a particle with respect to time t along x-axis is given by $x = 9t^2 - t^3$ where x is in metres and t is in seconds. What will be the position of this pariticle when it achieves maximum speed along the + x direction ?

A. 54m

B. 81m

C. 24m

D. 22m

Answer: a

Watch Video Solution

16. A car accelerates from rest at constant rate for the first 10 s and covers a distance x. It covers a distance y in the next 10 s at the same acceleration. Which of the following is true?

A. x=3y

B. y=3x

C. x=y

D. y=2x

Answer: b

Watch Video Solution

17. A car moves from X to Y with a uniform speed v_u and returns to Y with a uniform speed v_d. The average speed for this round trip is :

A. $\sqrt{v_u v_d}$

B. $\frac{2v_d v_u}{v_d + v_u}$

C. $\frac{v_u + v_d}{2}$

D. $\frac{v_d v_u}{v_d + v_u}$

Answer: b

Watch Video Solution

18. 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 constant.

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. $\frac{1}{2} f_0 T^2$

B. $\frac{1}{2} f_0 T$

C. $f_0 T^2$

D. $f_0 T$

Answer: b

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19. A paricle starting from the origin (0,0) moves in a straight line in (x, y) plane. Its coordinates at a later time are $\left(\sqrt{3}, 3\right)$. The path of the particle makes with the x-axis an angle of

A. 45°

B. 60°

C. 0°

D. 30°

Answer: b

Watch Video Solution

20. A particle starts its motion from rest under the action of a constant force. If the distance covered in first $10s$ is s_1 and the covered in the first $20s$ is s_2, then.

A. $S_2 = 3S_1$

B. $S_2 = 4S_1$

C. $S_2 = S_1$

D. $S_2 = 2S_1$

Answer: b

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21. A bus is moving with a speed of $10ms^{-1}$ on a straight road. A scooterist wishes to overtake the bus in 100 s. If the bus is at a distance of 1 km from the scooteritst with what speed should the scooterist chase the bus?

A. $40ms^{-1}$

B. $25ms^{-1}$

C. $10ms^{-1}$

D. $20ms^{-1}$

Answer: d

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22. A ball is droped from a high rise platform $t = 0$ starting from rest. After $6s$ another ball is thrown downwards from the same platform with a speed v. The two balls meet at $t = 18s$. What is the value of v ?

A. 40m/s

B. 60m/s

C. 75m/s

D. 55m/s

Answer: c

Watch Video Solution

23. A particle move a distance x in time t according to equation $x = (t+5)^{-1}$. The acceleration of particle is alphaortional to.

A. $(\text{distance})^{-2}$

B. $(\text{velocity})^{\frac{2}{3}}$

C. $(\text{velocity})^{(3/2)}$

D. $(\text{distance})^2$

Answer: C

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24. A body A starts from rest with an acceleration a_1. After 2 seconds, another body B starts from rest with an acceleration a_2. If they travel equal distances in the $5th$ second, after the start of A, then the ratio $a_1 : a_2$ is equal to :

A. $\frac{5}{9}$

B. $\frac{5}{7}$

C. $\frac{9}{5}$

D. $\frac{9}{7}$

Answer: a

Watch Video Solution

25. A ball dropped from 9th stair of multi storied building reaches the ground in 3 sec. In the first second of its free fall, it passes through n stairs then n equal to

A. 1

B. 2

C. 3

D. 4

Answer: a

Watch Video Solution

26. One car moving on a staright road covers one-third of the distance with 20 $\frac{km}{hr}$ and the rest with 60 $\frac{km}{hr}$. The average speed is

A. $40kmh^{-1}$

B. $80kmh^{-1}$

C. $46\frac{2}{3}kmh^{-1}$

D. $36kmh^{-1}$

Answer: d

Watch Video Solution

27. A particles starts from rest and has an acceleration of $2m/s^2$ for 10 sec. After that , it travels for 30 sec with constant speed and then undergoes a retardation of $4m/s^2$ and comes back to rest. The total distance covered by the particle is

A. 650m

B. 700m

C. 750m

D. 800m

Answer: c

Watch Video Solution

28. A very large number of balls are thrown vertically upwards in quick successions in such a way that the next ball is thrown when the previous one is at the maximum height. If the maximum height is 5m, then number of balls thrown per minute is (take $g = 10m/s^2$)

A. 82

B. 120

C. 40

D. 60

Answer: d

Watch Video Solution

29. The position x of a particle varies with time t as $x = at^2 - b$. For what value of t acceleration is zero?

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

B. a/b

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

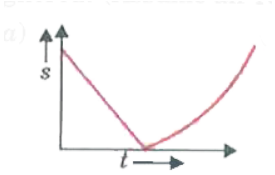
D. never

Answer: d

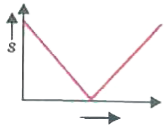
Watch Video Solution

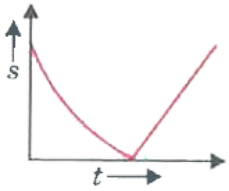
30. A ball is thrown vertically upwards. Which of the following plots represents the speed-time graph of the ball during its height if the air resistance is ignored ?

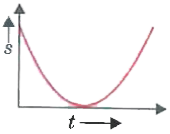
A.



B.



C. 

D. 

Answer: B

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31. A body falls from a height $h = 200m$ (at New Delhi). The ratio of distance travelled in each $2\sec$ during $t = 0$ to $t = 6$ seconds of the journey is.

A. $1:4:9$

B. $1:2:4$

C. $1:3:5$

D. $1:2:3$

Answer: c

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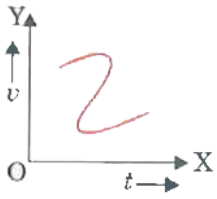
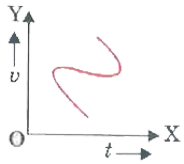
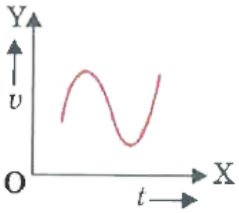
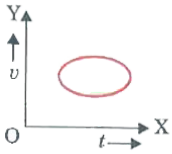
32. Which of the following velocity-time graphs shows a realistic situation for a body in motion ?

A. 

B. 

C. 

D. 

Answer: C

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33. When a ball is thrown up vertically with velocity v_0, it reaches a maximum height of h. If one wishes to

triple the maximum height then the ball should be thrown with velocity

A. $3v_0$

B. $9v_0$

C. $\sqrt{2}v_0$

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

Answer: c

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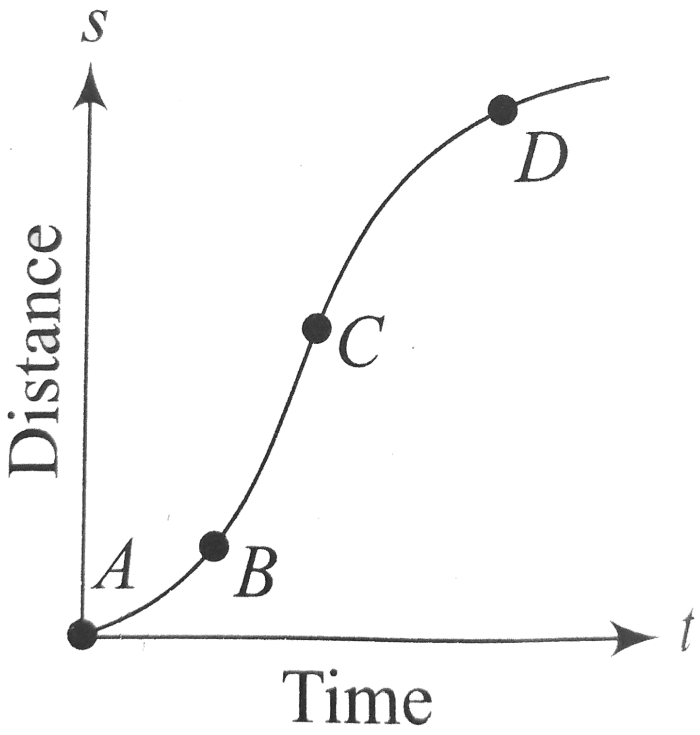
34. A particle shows distance-time curve as given in this figure. The maximum instantaneous velocity of the

particle is around the point.



A. C

B. D

C. A

D. B

Answer: a

Watch Video Solution

35. A car accelerates from rest at a constant rate 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. $\frac{abt}{a+b}$

B. $\frac{a^2t}{a+b}$

C. $\frac{at}{a+b}$

D. $\frac{b^2t}{a+b}$

Answer: a

Watch Video Solution

36. A boy standing at the top of a tower of 20m of height drops a stone. Assuming $g = 10ms^{-2}$, the velocity with which it hits the ground is :-

A. $10.0m/s$

B. $20.0m/s$

C. $40.0m/s$

D. $5.0m/s$

Answer: b

Watch Video Solution

37. The motion of a particle along a straight line is described by equation : $x = 8 + 12t - t^3$ where x is in metre and t in second. The retardation of the particle when its velocity becomes zero is.

A. $12ms^{-2}$

B. $24ms^{-2}$

C. zero

D. $6ms^{-2}$

Answer: a

Watch Video Solution

38. A stone falls freely under gravity. It covered distances h_1, h_2 and h_3 in the first 5 seconds. The next 5 seconds and the next 5 seconds respectively. The relation between h_1, h_2 and h_3 is :

A. $h_1 = \frac{h_2}{3} = \frac{h_2}{5}$

B. $h_2 = 3h_1$ and $h_3 = 3h_2$

C. $h_1 = h_2 = h_3$

D. $h_1 = 2h_2 = 3h_3$

Answer: a

Watch Video Solution

39. A particle of unit mass undergoes one-dimensional motion such that its velocity varies according to

$v(x) = \beta x^{-2n}$

where β and n are constant and x is the position of the particle. The acceleration of the particle as a function of x is given by.

A. $-2n\beta^2 x^{-2n-1}$

B. $-2n\beta^2 x^{-4n-1}$

C. $-2\beta^2 x^{-2n+1}$

D. $-2n\beta^2 e^{-4n+1}$

Answer: b

Watch Video Solution

40. 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. $\frac{3}{2}A + \frac{7}{3}B$

B. $\frac{A}{2} + \frac{B}{3}$

C. $\frac{3}{2}A + 4B$

D. $3A + 7B$

Answer: a

Watch Video Solution

41. A car moves a distance of $200m$. It covers the first half of the distance at speed of $40km/h$ and second half of the distance at a speed (v). The average speed is $48km/h$. Find the value of (v) .

A. $56kmh^{-1}$

B. $60kmh^{-1}$

C. $50kmh^{-1}$

D. $48kmh^{-1}$

Answer: b

Watch Video Solution

42. A body travels such that square of time is proportional to the displacement. Its acceleration is:

A. zero

B. infinite

C. constant

D. variable

Answer: C

Watch Video Solution

43. A body is vertically projected at 100 ms^{-1}. It returns after ($g = 10ms^{-2}$)

A. 10s

B. 20s

C. 8s

D. 16s

Answer: b

Watch Video Solution

44. A bo walks to his school at a distance of 6 km with constant speed of $2.5kmh^{-1}$ and walks back with a constant speed of $4kmh^{-1}$. His average speed for round trip expressed in kmh^{-1}, is

A. $\frac{24}{13} kmh^{-1}$

B. $\frac{40}{13} kmh^{-1}$

C. $3kmh^{-1}$

D. $4.8kmh^{-1}$

Answer: b

Watch Video Solution

45. A ball of mass m_1 and another ball of mass m_2 are dropped from equal height. If the time taken by the balls are t_1 and t_2, respectively, then

A. $t_1 = \frac{t_2}{2}$

B. $t_1 = t_2$

C. $t_1 = 4t_2$

D. $t_1 = \frac{t_2}{4}$

Answer: b

Watch Video Solution

46. A ball is dropped on the floor from a height of 10m. It rebounds to a height of 2.5 m if the ball is in contact with floor for 0.01 s then the average acceleration during contact is nearly

A. $1400ms^{-2}$

B. $2100ms^{-2}$

C. $700ms^{-2}$

D. $2800ms^{-2}$

Answer: b

Watch Video Solution

47. A cyclist acceleration from rest to a velocity of $72kmhr^{-1}$ in 10sec. If the cyclist is in straight track the acceleration of the cyclist is:

A. $7.2ms^{-2}$

B. $120ms^{-2}$

C. $2ms^{-2}$

D. $0.2ms^{-2}$

Answer: c

Watch Video Solution

48. A car has speed of 40km/h. on applying brakes it stops after 15m. If its speed was 80 kmh^{-1} it would have stopped after

A. 15M

B. 30M

C. 45M

D. 60M

Answer: d

Watch Video Solution

49. A particle is moving such that its position coordinates (x, y) are $(2m, 3m)$ at time $t = 0$, $(6m, 7m)$ at time $t = 2s$, and $(13m, 14m)$ at time $t = 5s$.

Average velocity vector $\left(\vec{V}_{av}\right)$ from $t = 0$ to $t = 5s$ is

A. $\frac{1}{5}\left(13\vec{i} + 14\hat{j}\right)$

B. $\frac{7}{3}\left(\hat{i} + \hat{j}\right)$

C. $2\left(\hat{i}+\hat{j}\right)$

D. $\frac{11}{5}\left(\hat{i}+\hat{j}\right)$

Answer: d

Watch Video Solution

50. Preeti reached the metro station and found that the escalator was not working. She walked up the stationary escalator in time t_1. On other days, if the remains stationary on the moving escalator, then the escalator takes her up in time t_2. The time taken by her to walk up on the moving escalator will be :

A. $\frac{t_1+t_2}{2}$

B. $\frac{t_1 t_2}{t_2 - t_1}$

C. $\frac{t_1 t_2}{t_2 + t_1}$

D. $t_1 - t_2$

Answer: c

Watch Video Solution

51. The x and y coordinates of the particle at any time are $x = 5t - 2t^2$ and $y = 10t$ respectively, where x and y are in meters and t in seconds. The acceleration of the particle at t=2s is:

A. 0

B. $5m/s^2$

C. $-4m/s^2$

D. $-8m/s^2$

Answer: C

Watch Video Solution

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

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

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

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

Answer: c

Watch Video Solution

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

A. 191m

B. 182m

C. 293m

D. 111m

Answer: c

Watch Video Solution

54. 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 $v = \sqrt{a_1 a_2} t.$

A. $\frac{2a_1a_2}{a_1+a_2}t$

B. $t\sqrt{2a_1a_2}$

C. $\frac{a_1+a_2}{2}t$

D. $t\sqrt{a_1a_2}$

Answer: d

Watch Video Solution

55. An automobile travellingat $40km/h$, can be stopped at distance of 40 m by applying brakes. If the same autombile is travelling at$80km/h$, the minimum stopping distance, in metres is (assume no skidding) :

A. 150m

B. 100m

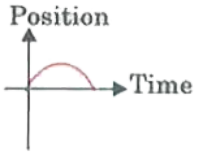
C. 75m

D. 160m

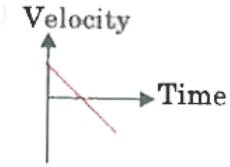
Answer: D

Watch Video Solution

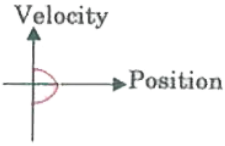
56. All the graphs below are intended to represent the same motion. One of them does it incorrectly. Pick it up.

A. 

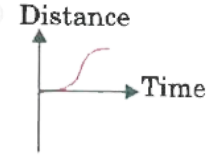
B.



C.



D.



Answer: D

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57. The velocity of particle is $v = v_0 + \mathrm{gt} + ft^2$. If its position is $x = 0$ at $t = 0$ then its displacement after unit time $(t = 1)$ is

A. $v + g/2 + f/3$

B. $v + g + f$

C. $v + g/2 + f$

D. $v + 2g + 3f$

Answer: a

Watch Video Solution

58. An object , moving with a speed of $6.25m/s$, is decelerated at a rate given by : $\frac{dv}{dt} = -2.5\sqrt{v}$ where v is the instantaneous speed . The time taken by the object , to come to rest , would be :

A. 2s

B. 4s

C. 8s

D. 1s

Answer: a

Watch Video Solution

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

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

B. $\frac{7h}{9}$ metres from the ground

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

D. $\frac{17h}{18}$ metres from the ground.

Answer: c

Watch Video Solution

60. A particle of mass m is acted upon by a force F given by the emprical law $F = \frac{R}{t^2}v(t)$

If this law is to be tested experimentally by observing the motion starting from rest, the best way is to plot :

A. v(t) against t^2

B. log v(t) against $\frac{1}{t^2}$

C. log v(t) against t

D. log v(t) against $\frac{1}{t}$

Answer: D

Watch Video Solution

61. From a tower of height H, a particle is thrown vertically upwards with a speed u. The time taken by the particle, to hit the ground, is n times that taken by it to reach the highest point of its path. The relation between H, u and n is

A. $2gH = n^2u^2$

B. $gH = (n-2)^2u^2$

C. $2gH = \nu^2(n-2)$

D. $gH = (n-2)u^2$

Answer: c

Watch Video Solution

62. A person climbs up a stalled escalator in 60s. If standing on the same but escalator running with constant velocity, he takes 40 s. How much time is taken by the person to walk up the moving escalator?

A. 37s

B. 27s

C. 24s

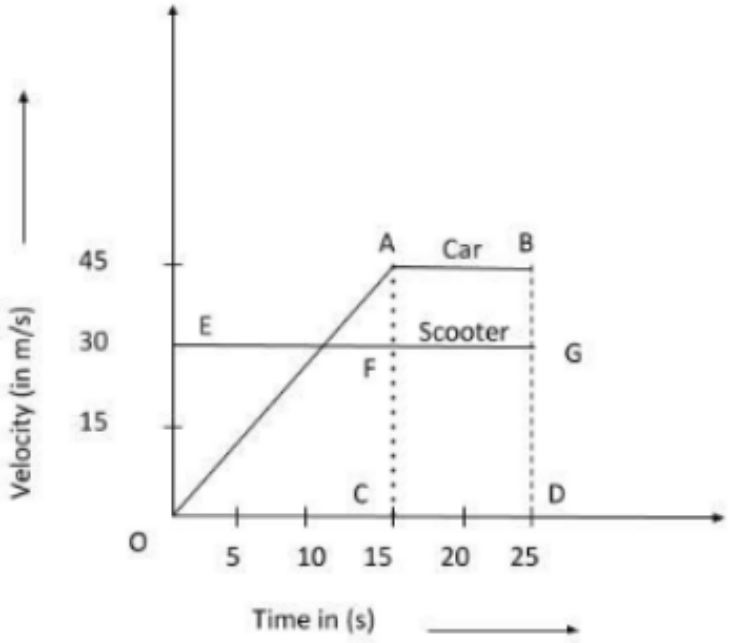
D. 45s

Answer: c

Watch Video Solution

63. The velocity-time graphsof 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 and (ii) the time at which the car will catch up with the

scooter are, respectively.



A. 112.5m and 22.5s

B. 337.5 m and 25s

C. 225.5m and 10s

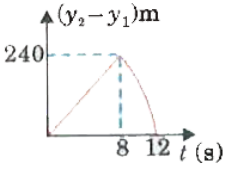
D. 112.5m and 15s

Answer: a

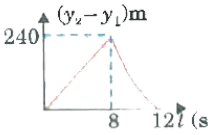
Watch Video Solution

64. 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)

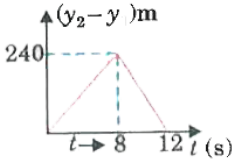
A.



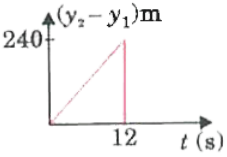
B.



C.



D.



Answer: a

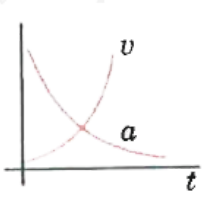
Watch Video Solution

65. Which of the following option correctly describes the variation of the speed and acceleration $'a'$ of a point mass falling vertically in a viscous medium that

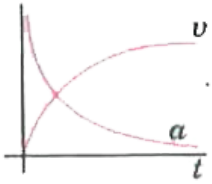
applies a force $F = -kv$, where $'k'$ is constant, on the body?

(Graphs are schematic and drawn to scale)

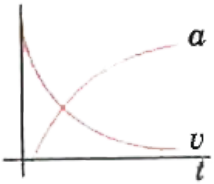
A.



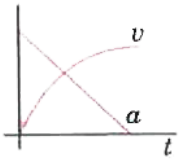
B.



C.



D.



Answer: b

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66. A car moving with a velocity of $20ms^{-1}$ is stopped in a distance of 40m. If the same car is travelling at double the velocity, the distance travelled by it for same retardation is

A. 640m

B. 320m

C. 160m

D. 1280m

Answer: c

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67. A car is standing 200m behind a bus , which is also at rest . The two. Start moving at the same instant but with different forward accelerations. The bus has acceleration $2ms^{-2}$ and The car has acceleration $4ms^{-2}$ The car will catch up will the bus after time :

A. $\sqrt{100}s$

B. $\sqrt{120}s$

C. $10\sqrt{2}S$

D. $15s$

Answer: c

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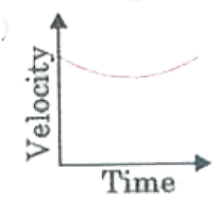
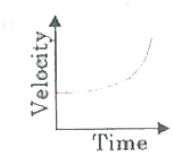
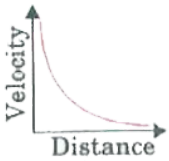
68. Which graph corresponds to an object moving with a constant negative acceleration and a positive velocity ?

A. 

B. 

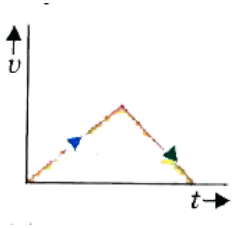
C. 

D. 

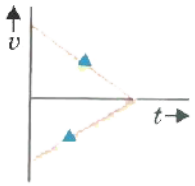
Answer: c

Watch Video Solution

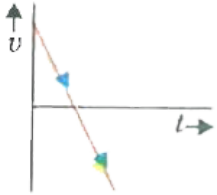
69. A body is thrown vertically upwards. Which one of the following graphs correctly represent the velocity vs time?

A. 

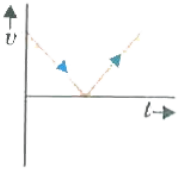
B.



C.



D.



Answer: c

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70. Displacement (x) of a particle is related to time (t) as

$x = at + bt^2 - ct^3$

where a,b and c are constant of the motion. The velocity of the particle when its acceleration is zero is given by:

A. $a + \frac{b^2}{C}$

B. $a + \frac{b^2}{4c}$

C. $a + \frac{b^2}{3c}$

D. $a + \frac{b^2}{2c}$

Answer: c

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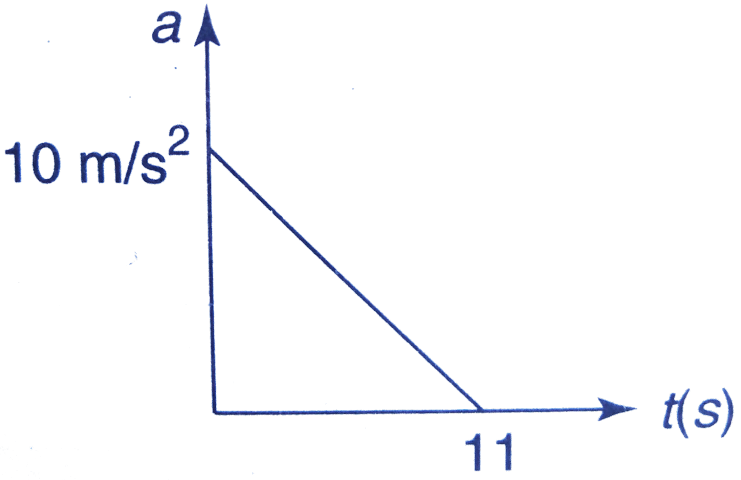
71. A particle starting from rest. Its acceleration (a) versus time (t) is as shown in the figure.

The maximum speed of the particle will be.



A. 110 m/s

B. 55m/s

C. 550m/s

D. 660m/s

Answer: b

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72. A small block slides without friction down an iclined plane starting form rest. Let S_n be the distance traveled from time $t = n - 1$ to $t = n$. Then $\frac{S_n}{S_{n+1}}$ is:

A. $\frac{2n-1}{2n}$

B. $\frac{2n+1}{2n-1}$

C. $\frac{2n-1}{2n+1}$

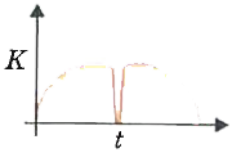
D. $\frac{2n}{2n+1}$

Answer: c

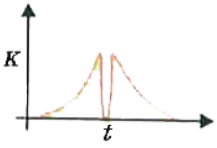
Watch Video Solution

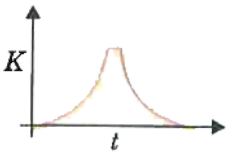
73. A tennis ball dropped on a barizoontal smooth surface , it because back to its original postion after hiting the surface the force on the bell during the collision is propertional to the length of compression of the bell . Which one of the following skethes desches discribe the variation of its kinetic energy K with time 1 mass apporiandly ? The figure as only illistrative and not to the scale .

A.



B.



C. 

D. 

Answer: b

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74. Consider an expanding sphere of instantaneous radius ? whose total mass remains constant. The expansion is such that the instantaneous density ρ remains uniform throughout the volume. The rate of fractional change in density $\left(\frac{dp}{\rho dt}\right)$ is constant. The

velocity v of any point on the surface of the expanding sphere is proportional to

A. R

B. R^3

C. $\frac{1}{R}$

D. $R^{2/3}$

Answer: a

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Competition File C Multiple Choice Questions

1. A particle is moving along X-axis according to the following equation: $x = u(t-4) + a(t-3)^2$

All terms in above equation are measured in MKS system

A. Acceleration of the particle is a.

B. Acceleration of the particle is 2a.

C. Velocity of particle at t=3 s is u.

D. At t=0 particle is at the origin.

Answer: b,c

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2. Let v and a represent instantaneous velocity and acceleration of a particle respectively.

A. Acceleration a can be zero when velocity $v = \not{0}$

B. Acceleration a can be nonzero when velocity v=0

C. Acceleration a can be zero when velocity v=0

D. Acceleration a must be zero when velocity v=0.

Answer: a,b,c

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3. A particle may have

A. variable velocity without variable speed.

B. variable speed without variable velocity.

C. zero acceleration with variable velocity

D. nonzero acceleration with constant speed.

Answer: a,d

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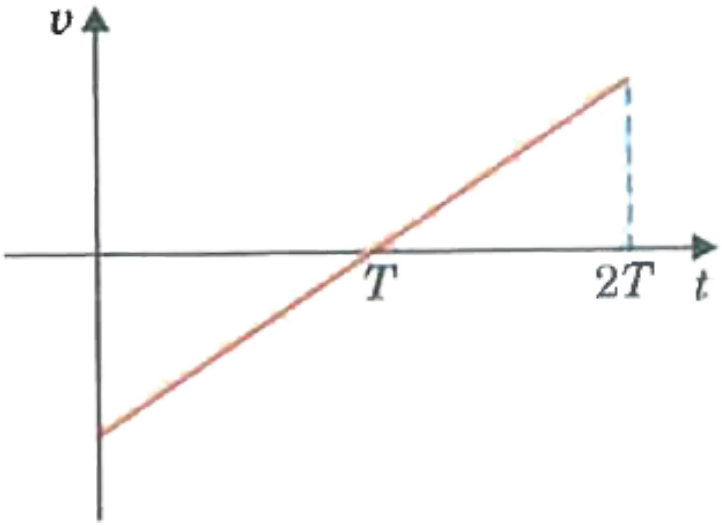
4. Velocity-time graph for a particle is shown in following figure for time interval 0 to 2T.



A. During the motion, particle reverse its direction of motion.

B. Particle is moving with constant acceleration

C. Net displacement in time interval 0 to 2T is zero.

D. Speeds of particle at t=0 and t=2T are same.

Answer: a,b,c,d

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5. An observer moves with a constant speed along the line joining two stationary objects. He will observe that the two objects

A. move with same speed.

B. move with the same velocity

C. move in the same direction.

D. move along the opposite direction.

Answer: a,b,c

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6. If a particle moving in a vertical straight line is

A. moving up and speeding up then its acceleration must be upward.

B. moving up and slowing down then its acceleration must be downward.

C. moving down and speeding up then its acceleration must be downward.

D. moving down and slowing down then its acceleration must be upward.

Answer: a,b,c,d

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7. Select the correct statement. For a particle moving on a straight line

A. magnitude of velocity is equal to the speed of the particle

B. if position and velocity have same sign then particle is moving away from the origin.

C. magnitude of average velocity is equal to the average speed for a given interval.

D. If speed of the particle femains zero in a time interval then acceleration is equal to zero at any instant of the time during that interval

Answer: a,b,d

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8. For a particle moving in a straight line

A. If velocity is negative and acceleration is positive then speed increases.

B. if velocity is positive and acceleration is negative then speed decreases.

C. if velocity is zero at an instant then acceleration must also be zero at that instant.

D. it is possible that speed of a particle is never zero in an interval of time, but average speed is zero.

Answer: b

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9. Displacement of a particle moving along X-axis is given by $x = at^2 - bt^3$.

A. Particle starts from rest and again comes to rest after time a/3b.

B. Particle starts from origin and again returns to origin after time t=3a/b.

C. Particle starts with zero acceleration and acceleration again becomes zero after time t=a/3b.

D. Acceletration of the particle becomes zero at t=a/3b.

Answer: D

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10. Select the correct statements for a particle in a state of motion.

A. If speed of the particle changes then velocity of the particle must change and it must have non-zero acceleration.

B. If velocity of the particle change then its speed must also change and particle must have non-zero acceleration.

C. When particle moves in a straight line with changing speed then its velocity may remain constant.

D. When velocity of the particle changes then its speed may or not change but particle must have some acceleration.

Answer: a,d

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11. A particle is moving on a straight line and its average velocity is found to be zero in an interval of time.

A. Average speed of the particle may also be zero for a given interval of time.

B. Velocity of the particle can never be zero in given interval of time.

C. Velocity of the particle must be zero at a particular instant.

D. Acceleration of particle may be zero.

Answer: c

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12. A particle is projected upwards with initial velocity u. assume acceleration due to gravity is $10m/s^2$. It is found that particle covers 5m in last second before reaching the maximum height. What can be the possible value of u?

A. 20m/s

B. 35m/s

C. 5m/s

D. 40m/s

Answer: a,b,d

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13. Displacement of a particle moving in a straight line is written as follows:

$$x = \frac{t^3}{3} - \frac{5t^2}{2} + 6t + 7$$

what is the possible acceleration of particle when particle is in a state of rest?

A. $1m/s^2$

B. $-1m/s^2$

C. $-5m/s^2$

D. $+5m/s^2$

Answer: a,b

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Competition File D Multiple Choice Questions

1. A particle starts moving in a straight line with initial velocity v_0 Applied forces cases a retardation of av, where v is magnitude of instantaneous velocity and α is

a constant.

How long the particle will take to come to rest.

A. $\frac{\text{in}2}{\alpha}$

B. α In 2

C. $\frac{1}{\alpha}$

D. infinite

Answer: d

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2. A particle starts moving in a straight line with initial velocity v_0 Applied forces cases a retardation of av,

where v is magnitude of instantaneous velocity and α is a constant.

How long the particle will take to reduce its speed to half of its initial value?

A. $\frac{\text{in}2}{\alpha}$

B. α In 2

C. $\frac{1}{\alpha}$

D. infinite

Answer: a

Watch Video Solution

3. A particle starts moving in a straight line with initial velocity v_0 Applied forces cases a retardation of av, where v is magnitude of instantaneous velocity and α is a constant.

Total distance covered by the particle is

A. infinity

B. $v_0\alpha$

C. v_0 / α

D. $v_0 / e\alpha$

Answer: c

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4. There is a tower of height 20m and a particle is projected up from top of the tower with an initial speed 20m//s. Top of the tower is marked as point A, from where particle is projected. Point of maximum height a denoted as B. When particle reaches the point A during downward journey then we call the same point as C. Point at the bottom of tower is marked as D where particle finally strikes. Acceleration due to gravity $g = 10m/s^2$

How much time the particle takes to cross the point C after being projected from point A.

A. 1s

B. 2s

C. 3s

D. 4s

Answer: d

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5. There is a tower of height 20m and a particle is projected up from top of the tower with an initial speed 20m//s. Top of the tower is marked as point A, from where particle is projected. Point of maximum height a denoted as B. When particle reaches the point A during downward journey then we call the same point as C. Point at the bottom of tower is marked as Dwhere

particle finally strikes. Acceleration due to gravity $g = 10m/s^2$

Maximum height above the ground attained by particle is

A. 20m

B. 30m

C. 40m

D. 60m

Answer: c

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6. There is a tower of height 20m and a particle is projected up from top of the tower with an initial speed 20m//s. Top of the tower is marked as point A, from where particle is projected. Point of maximum height a denoted as B. When particle reaches the point A during downward journey then we call the same point as C. Point at the bottom of tower is marked as D where particle finally strikes. Acceleration due to gravity $g = 10m/s^2$

Time taken by the particle to reach the ground is

A. 2s

B. 4s

C. $2\sqrt{2s}$

D. $\left(2+2\sqrt{2}\right)s$

Answer: d

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7. A particle is travelling along X-axis and its x-coordinate is related to time as follows:

$x = 5t^2 - 20$

Here x is measured in metres and time t in seconds.

When does the particle cross the origin?

A. 2s

B. 3s

C. 1s

D. never

Answer: a

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8. A particle is travelling along X-axis and its x-coordinate is related to time as follows:

$x = 5t^2 - 20$

Here x is measured in metres and time t in seconds.

When does the particle reverse its direction of motion?

A. 2s

B. 3s

C. 1s

D. never

Answer: D

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9. A particle is travelling along X-axis and its x-coordinate is related to time as follows:

$x = 5t^2 - 20$

Here x is measured in metres and time t in seconds.

When does the magnitude of velocity become equal to that of acceleration?

A. 2s

B. 3s

C. 1s

D. never

Answer: c

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Competition File Assertion Reason

1. Assertion: When an object is accelerating, it is either speeding up or slowing down.

Reason: When an object moves on a circular path with uniform speed, the object accelerates.

A. both assertion and reason are correct and reason is a correct explanation of the assertion.

B. both assertion and reason are correct but reason is not the correct explanation of assertion.

C. assertion is correct but reason is incorrect

D. assertion is incorrect but reason is correct.

Answer: d

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2. A : In the presence of air resistance, if the ball is thrown vertically upwards then time of ascent is less than the time of descent.

R : Force due to air friction always acts opposite to the motion of the body.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If assertion is incorrect but reason is correct.

Answer: a

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3. Assertion: If velocity of a particle at a certain instant is zero then its acceleration must also be zero at the same instant.

Reason: When a particle is projected upward under gravity then at the top point its instantaneous velocity becomes zero.

A. both assertion and reason are correct and reason is a correct explanation of the assertion.

B. both assertion and reason are correct but reason is not the correct explanation of assertion.

C. assertion is correct but reason is incorrect

D. assertion is incorrect but reason is correct.

Answer: D

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4. A : If speed of a particle is never zero than it may have zero averag speed.

R : The average speed of a moving object in a closed path is zero.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If assertion is incorrect but reason is correct.

Answer: d

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5. A : It is not possible to have constant velocity and variable acceleration.

R : Accelerated body cannot have constant velocity.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If assertion is incorrect but reason is correct.

Answer: a

 Watch Video Solution

6. Assertion: Average speed of a particle in a given time interval is never less than the magnitude of the average velocity.

Reason: The magnitude of the velocity (instantaneous velocity) of a particle is equal to its speed.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If assertion is incorrect but reason is correct.

Answer: b

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7. Assertion: Average speed in an interval cannot be less than the magnitude of average velocity in the same interval

Reason: For a particle in motion distance travelled is always greater than or equal to the magnitude of the displacement.

A. both assertion and reason are correct and reason is a correct explanation of the assertion.

B. both assertion and reason are correct but reason is not the correct explanation of assertion.

C. assertion is correct but reason is incorrect

D. assertion is incorrect but reason is correct.

Answer: A

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8. A : Average velocity can be zero, but average speed of a moving body can not be zero in any finite time interval.

R : For a moving body displacement can be zero but distance can never be zero.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If assertion is incorrect but reason is correct.

Answer: a

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9. STATEMENT -1 : For an observer looking out through the window of a fast moving train , the nearby objects

appear to move in the opposite direction to the train , while the distant objects appear to be stationary .

STATEMENT - 2 : If the observer and the object are moving at velocities $\overrightarrow{v}_1$ and $\overrightarrow{v}_2$ respecttively with refrence to a laboratory frame , the velocity of the object with respect to a laboratory frame , the velocity of the object with respect to the observer is $\overrightarrow{v}_2 - \overrightarrow{v}(1)$.

(a) Statement -1 is True, statement -2 is true , statement -2 is a correct explanation for statement -1

(b) Statement 1 is True , Statement -2 is True , statement -2 is NOT a correct explanation for statement -1

(c) Statement - 1 is True , Statement -2 is False

(d) Statement -1 is False, Statement -2 is True

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason are correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect

D. If assertion is incorrect but reason is correct.

Answer: b

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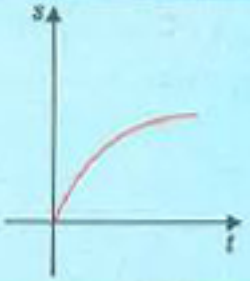
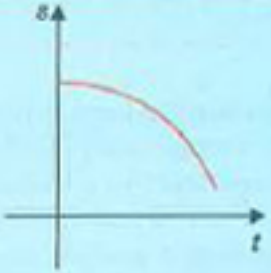
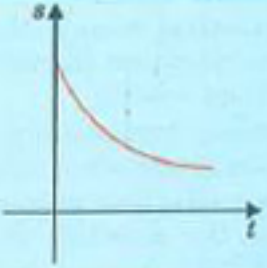
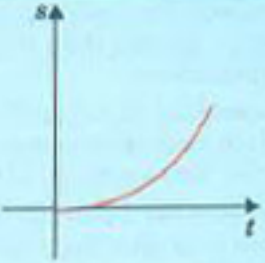
Competition File Matching Type Questions

1. For a particle moving in a straight line assume s,v,a and t represents displacement, velocity, acceleration

and time respectively.

List-I		List-II
P	v: positive a: positive	1 
Q	v: positive a: negative	2 
R	v: negative a: positive	3 
S	v: negative a: negative	4 

A.
P	Q	R	S
3	2	4	1

B.
P	Q	R	S
1	3	2	4

C.
P	Q	R	S
2	1	3	4

D.
P	Q	R	S
4	1	3	2

Answer: d

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2. For a particle moving along the vertical direction, assume s,v,a and t represent displacement, velocity, acceleration and time respectively. Assume the vertical

upward direction as the positive direction.

	List-I		List-II
P	v: positive a: positive	1	Particle is moving down and slowing down
Q	v: positive a: negative	2	Particle is moving up and speeding up
R	v: negative a: positive	3	Particle is moving down and speeding up
S	v: negative a: negative	4	Particle is moving up and slowing down

A. $\begin{matrix} P & Q & R & S \\ 3 & 2 & 4 & 1 \end{matrix}$

B. $\begin{matrix} P & Q & R & S \\ 1 & 3 & 2 & 4 \end{matrix}$

C. $\begin{matrix} P & Q & R & S \\ 2 & 1 & 3 & 4 \end{matrix}$

D. $\begin{matrix} P & Q & R & S \\ 4 & 1 & 3 & 2 \end{matrix}$

Answer: c

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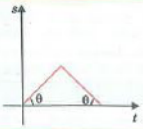
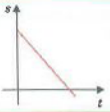
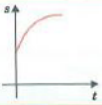
Competition File Matrix Match Type Questions

1. Match the Column-I with Column-II:

Column-I		Column-II	
(A)	Constant speed	(p)	
(B)	Constant velocity	(q)	
(C)	Increasing speed	(r)	
(D)	Negative acceleration	(s)	

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Competition File Integer Type Questions

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

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2. A particle is projected vertically upwards from an elevated point. Magnitude of the velocity at height h above the starting point is found to be half of the magnitude of velocity at h height below the starting point. If maximum height reached by the particle above its initial point is mh/n then find (m-n).

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3. Particle is moving in a straight line. Distance x is related to the time t by the equation $t = \sqrt{x} + 3$. Distance x is measured in metres and time t is seconds. After how many seconds will the particle come to the rest?

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4. A particle is moving in a straight line. All the physical quantities are to be measured in MKS system. Square of the magnitude of its instantaneous velocity is found to

be ten times its instantaneous displacement . What is the acceleration of the particle?

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5. A particle is moving in a straight line and its velocity varies with its displacement as $v = \sqrt{4 + 4s}$ m/s. Assume s=0 at t=0. find the displacement of the particle in metres at t=1s.

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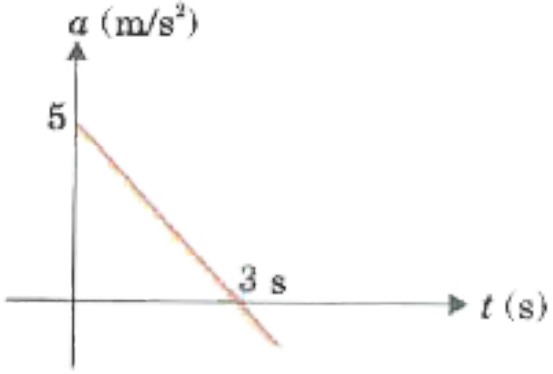
6. A particle is given an initial velocity of 20m/s. acceleration of the particle changes with time and its

variation is shown in the following figure.



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7. A particle is moving in a straight line and relationn between time and displacement is $t = ax^2 + \beta x$. If retardation is found to be proportional to the v^n, where v is instantaneous velocity, find the value of n.

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8. A balloon starts from the state of rest from the ground with constant acceleration g/n. after time T, a stone is dropped from the balloon. If stone takes time T to reach the ground then calculate value of n.

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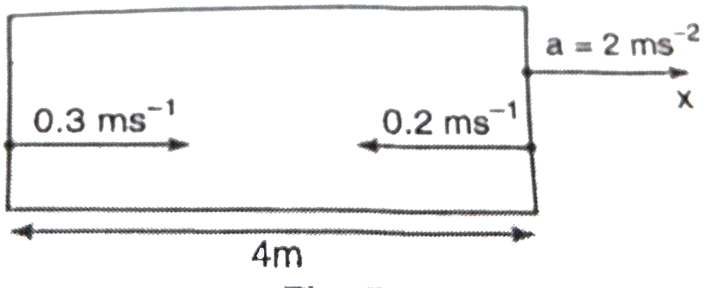
9. A rocket is moving in a gravity free space with a constnat acceleration of $2ms^{-1}$ along +x direction (see Fig.5.126). The length of a chamber inside the rocket is 4m. A ball is thrown from th left end of the chamber in +x direction with a speed of 0.3 ms^{-1} relaitve to the rocket. At the same time , another ball is thrown in -x direction with a speed of 0.2ms^(-1)` from its right and

relative to the rocket. the time in seconds when the two balls hit each other is:



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Chapter Practice Test

1. When can say that circular motion is periodic ?

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2. Define scaler quantities and vector quntities. Give some examples.

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3. What is the use of speedometer ?

Watch Video Solution

4. What does negative slope of a position - time graph signify ?

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5. Is it possible for a uniformly accelerating object to change its direction of velocity ?

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6. Define instantaneous acceleration with example.

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7. How are rest and motion relative ? Exaplain with an example.

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8. What parameters can be determined from velocity - time graph of motion?

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9. Calculate the acceleration of an object if its velocity is given by $v = \left(\sqrt{12t - 2}\right)$.

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10. A stone is dropped form 100 m high cliff. Another stone is thrown upward from ground with a velocity 10m/s. At what time both the stones will meet each other ?

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11. A car is moving on a straight road. After covering a distance of 420 m in 18s, it turns back and stops after 8s half the way. Calculate the average velocity of the car in first 20s.

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12. What is significance of (a) positive and (b) negative slope in distance - time graph of an object ?

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13. Obtain equations of motion for constant a acceleration using the method of calculus.

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14. Differentiate between (a) distance and displacement (b) speed and velocity .

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15. For anobject moving along X - axis the position , is given by $S = a + bt^2$. Calculate its velocity at time t = 0 and t = 3 s, if value of a = 8 m and $b = 3ms^{-2}$. Also

calucate the average velocity between time interval t = 3 and t = 6s.

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16. Define relative velocity of an object w.r.t. another. Draw position-time graph of two objects moving along a straight line, when their relative velocity is (i) zero and (ii) non-zero.

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