PHYSICS

BOOKS - RESNICK AND HALLIDAY PHYSICS (HINGLISH)

MOTION ALONG A STRAIGHT LINE

Sample Problem 2 01

1. You drive a beat-up pickup truck along a straight road for 8.4 km at 70 km/h, at which

point the truck runs out of gasoline and stops. Over the next 30 min, you walk another 2.0 km farther along the road to a gasoline station.

(a) What is your overall displacement from the beginning of your drive to your arrival at the station ?

A.

B.

C.

D.

Answer:

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Sample Problem 2 02

1. You drive a beat-up pickup truck along a straight road for 8.4 km at 70 km/h, at which point the truck runs out of gasoline and stops. Over the next 30 min, you walk another 2.0 km farther along the road to a gasoline station.

(b) What is the time interval Δt from the beginning of your drive to your arrival at the station ?

A.

B.

C.

D.

Answer:

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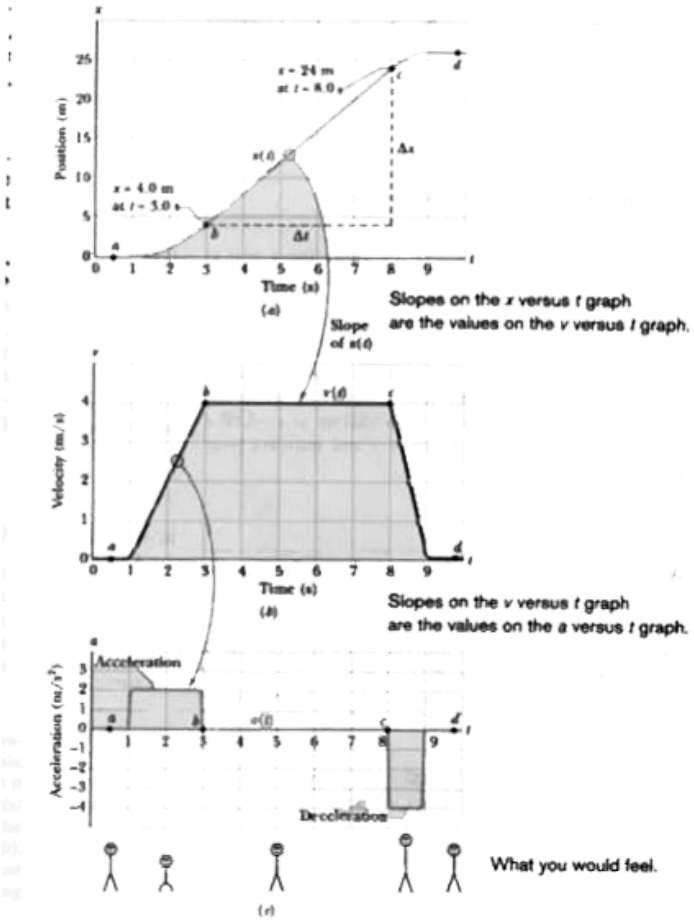
2. Figure 2-6a is an $x(t)$ plot for an elevator cab that is initially stationary, then moves upward (which we take to be the positive

direction of x), and then stops. Plot v(t).



A.

B.

C.

D.

Answer:

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Sample Problem 2 03

1. You drive a beat-up pickup truck along a straight road for 8.4 km at 70 km/h, at which point the truck runs out of gasoline and stops.

Over the next 30 min, you walk another 2.0 km farther along the road to a gasoline station.

(c) What is your average velocity v_{avg} from the beginning of your drive to your arrival at the station ? Find it both numerically and graphically.

A.

B.

C.

D.

Answer:

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2. The position of a particle moving along the x axis is given in centimeters by $x = 9.75 + 1.50t^3$, where t is in seconds. Calculate (a) the average velocity during the time interval $t = 2.00s$ to $t = 3.00s$, (b) the instantaneous velocity at $t = 2.00s$, (c) the instantaneous velocity at $t = 3.00s$, (d) the instantaneous velocity at $t = 2.50s$, and (e) the instantaneous velocity when the particle is midway between its positions at $t = 2.00s$

and $t = 3.00s$. (f) Graph x versus t and indicate your answers graphically

A.

B.

C.

D.

Answer:

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Sample Problem 2 04

1. (d) Suppose that to pump the gasoline, pay for it, and walk back to the truck takes you another 45 min. What is your average speed from the beginning of your drive to your return to the truck with the gasoline ?

A.

B.

C.

D.

Answer:

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2. A particle's position on the x axis is given by

$x = 4 - 27t + t^3,$

wth x in meters and t in seconds.

(a) Because position x depends on time t, the particle must be moving. Find the particle's velocity function $v(t)$ and acceleration function $a(t)$.

A.

B.

C.

D.

Answer:

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Sample Problem 2 05

1. An electric vehicle starts from rest and accelerates at a rate of $2.0m/s^2$ in a straight line until it reaches a speed of 20 m//s. The vehicle then slows at a constant rate of $1.0m/s^2$ until it stops. (a) How much time elapses from start to stop ? (b) How far does the vehicle travel from start to stop ?

A.

B.

C.

D.

Answer:

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Sample Problem 2 06

1. (a) If the maximum acceleration that is tolerable for passengers in a subway train is $1.34 m / s^2$ and subway stations are located 806 m apart, what is the maximum speed a

subway tran can attain between stations ? (b) What is the travel time between stations ? (c) If a subway train stops for 20 s at each station, what is the maximum average speed of the train, from one start-up to the next ? (d) Graph x, v, and a versus t for the interval from one start-up to the next.

A.

B.

C.

D.

Answer:

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Sample Problem 2 07

1. A popular web video shows a jet airplane, a car, and a motorcycle racing from rest along a runway (Fig 2-10). Initially the motorcycle takes the lead, but then the jet takes the lead, and finally the car blows past the motorcycle. Here let's focus on the car and motorcycle and

assign some reasonable values to the motion. The motorcycle first takes the lead because its (constant) acceleration $a_m = 8.40m/s^2$ is greater than the car's (constant) acceleration $a_c = 5.60m/s^2$, but it soon loses to the car because it reaches its greater speed $v_m = 58.8m/s$ before the car reaches the greatest speed $v_c = 106m/s$. How long does the car take to reach the motorcycle ?

A.

B.

C.

D.

Answer:

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Sample Problem 2 08

1. A hot-air balloon is ascending at the rate of 12 m/s and is 80 m above the ground when a package is dropped over the side. (a) How long

does the package take to reach the ground ?

(b) With what speed does it hit the ground ?

A.

B.

C.

D.

Answer:

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Sample Problem 2 09

1. In Fig. 2-13 , a pitcher tosses a baseball up along a y axis, with an initial speed of 12 m/s.

(a) How long does the ball take to reach its maximum height ?

A.

B.

C.

D.

Answer:

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Sample Problem 2 10

1. "Whiplash injury" commonly occurs in a rear-end collision where a front car is hit from behind by a second car. In the 1970s, researches concluded that the injury was due to the occupant's head being whipped back over the top of the seat as the car was slammed forward. As a result of this finding, head restraints were built into cars, yet neck

injuries in rarend collisions continued to occur.

In a recent test to study neck injury in rear-end collisions, a volunteer was strapped to a seat that was then moves abruptly to simulate a collision by a rear car moving at 10.5 km/h. Figure 2-15 a gives the accelerations of the volunteer's torso and head during the collision, which began at time $t = 0$. The torso acceleration was delayed by 40 ms because during that time interval the seat back had to compress against hte volunteer. The head acceleration was delayed by an aditional 70

ms. What was the torso when the head began to accelerate ?

A.

B.

C.

D.

Answer:

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Checkpoints

1. Here are three pairs of initial and final positions, respectively, along an x axis. Which pairs give a negative displacement : (a) -3 m, +5 m, (b) -3 m, - 7 m, (c) 7m, -3 m ?

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2. The following equations give the position $x(t)$ of a particle in four situations (in each equation, x is meters, t is in seconds, and $t > 0$): (1) $x = 3t - 2$, (2) $x = -4t^2 - 2$, (3)

$x = 2/t^2$, and (4) $x = -2$. (a) In which situation is the velocity v of the particle constant ? (b) In which is v in the negative x direction ?

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3. A wombat moves along an x axis. What is the sign of its acceleration if it is moving (a) in the positive direction with increasing speed. (b) in the positive direction with decreasing speed, (c) in the negative direction with

increasing speed, and (d) in the negative direction with decreasing speed ?

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4. The following equations give the position $x(t)$ of a particle in four situations : (1) $x = 3t - 4$, (2) $x = -5t^3 + 4t^2 + 6$, (3) $x = 2/t^2 - 4/t$, (4) $x = 5t^2 - 3$. To which of these situations do the equations of Table 2-1 apply ?

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5. (a) If you toss a ball straight up, what is the sign of the ball's displacement for the ascent, from the release point to the highest point ? (b) What is it for the descent, from the highest point back to the release point ? (c) What is the ball's acceleration at its highest point ?

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Problems

1. In 25 min, a man ran 2.40 km on a treadmill facing due east. Relative to the gym, what were his (a) displacement and (b) average velocity during this time interval ?

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2. Compute your average velocity in the following two cases, (a) You walk 73.2 m at a speed of 1.22 m/s and then run 73.2 m at a speed of 2.85m/s along a straight track. (b)

you walk for 1.00 min at a speed of 1.22 m/s and then run for 1.00 min at 3.05 m/s along a straight track. (c) Graph x versus t for both cases and indicate how the average velocity is found on the graph.

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3. Rachel walks on a straight road from her home to a gymnasium 2.80 km away with a speed of 6.00 km/h. As soon as she reaches the gymnasium, she immediately turns and

walks back home with a speed of 7.70 km/h as she finds the gymnasium closed. What are the (a) magnitude of average velocity and (b) average speed of Rechel over the interval of time 0.00-35.0 min ?

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4. A car travels up a hill at a constant speed of 35 km/h and returns down the hill at a constant speed of 60 km/h. Calculate the average speed for the round trip.

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5. The position of object moving along an x-axis is given by $x = 3t - 4t^2 + t^3$, where x is in meters and t in seconds. Find the position of the object at the following values of t : (i) 2s, (ii) 4s, (iii) What is the object's displacement between t = 0 s and t = 4 s ? and (iv) What is its average vvelocity for the time interval from t = 2 s to t = 4 ?

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6. A pigeon flies at 36 km/h to and for between two cars moving toward each other on a straight road, starting from the first car when the car separation is 40 km. The first car has speed of 16 km/h and the second one has a speed of 25 km/h. By the time the cars meet head on, what are the (a) total distance and (b) net displacement flown by the pigeon ?

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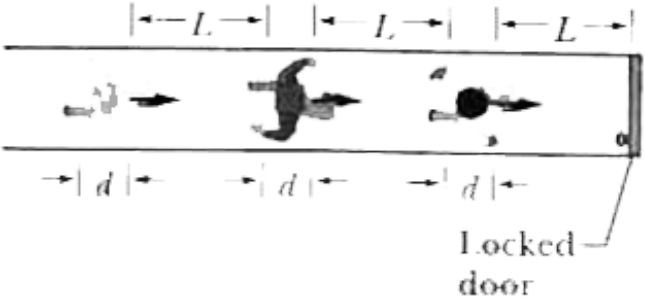
7. Panic escape . Figure 2-16 shows a general situation in which a stream of people attempt to escape through an exit door that turns out to be locked. The people move toward the door at speed $v_s = 3.50m/s$, are each $d = 0.25m$ in depth, and are separated by $L = 1.75m$. The arrangement in Fig. 2-16 occurs at time $t = 0$. (a) At what average rate does the layer of people at the door increase ? (b) At what time does the layer's depth reach 5.0m ? (The answers reveal how quickly such a

situation becomes dangerous.)



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8. To set a speed record in a measured (straight-line) distance d, a race car must be driven first in one direction (in time t_1) and then in the opposite direction (in time t_2). (a) To eliminate the effects of the wind and obtain

the car's speed v_c in a windless situation, should we find the average of d/t_1 and d/t_2 (method 1) or should we find divide d by the average of t_1 and t_2 ? (b) What is the fractional difference in the two methods when a steady wind blows along the car's route and the ratio of the wind speed v_w to the car's speed v_c is 0.0240 ?

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9. A pickup vehicle is moving with a speed of 15.00 m/s on a straight road. A scooterist wishes to overtake the pickup vehicle in 150.0s. If the pickup vehicle is at an initial distance of 1.500 km from the scooterist, with what constant speed should the scooterist chase the pickup vehicle ?

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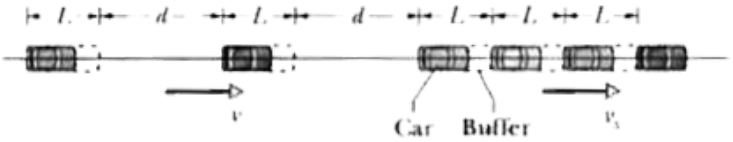
10. Traffic shock wave. An abrupt shlowdown in concentrated traffic can travel as a pulse, termed a shock wave, along the line of cars, either downstream (in the traffic direction) or upstream, or it can be stationary. Figure 2-17 shows a uniformly spaced line of cars moving at speed $v = 25.0$ m/s toward a uniformly spaced line of slow cars moving at speed $v_s = 5.00$ m/s. Assume that each faster car adds length $L = 12.0$ m (car length plus buffer zone) to the line of slow cars when it joins the line, and assume it slows abruptly at

the last instant. (a) For what separation distance d between the faster cars does the shock wave remain stationary ? It the separation is twice that amount, what are the (b) speed and (c) direction (upstream or downstream) of the shock wave ?



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11. The displacement of a particle moving along an x axis is given by $x = 18t + 5.0t^2$, where x is in meters and t is in seconds. Calculate (a) the instantaneous velocity at $t = 2.0s$ and (b) the average velocity between $t = 2.0s$ and $t = 3.0s$.

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12. The position function $x(t)$ of a particle moving along an x axis is $x = 4.0 - 6.0t^2$,

where x in meters and t in seconds. (a) At what time and (b) where does the particle (momentarily) stop ? At what (c) negative time and (d) positive time does the particle pass through the origin ?

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13. The position of a particle moving along an x axis is given by $x = 12t^2 - 2t^3$, where x is in meters and t is in seconds. Determine (a) the position, (b) the velocity, and (c) the

acceleration of the particle at $t = 3.5s$. (d) What is the maximum positive coordinate reached by the particle and (e) at what time is it reached ? (f) What is the maximum positive velocity reached by the particle and (g) at what time is it reached ? (h) What is the acceleration of the particle at the instant the particle is not moving (other than at $t = 0$) ? (i) Determine the average velocity of the particle between $t = 0$ and $t = 3$s .

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14. At a certain time a particle had a speed of 18 m/s in the positive x direction, and 2.4 s later its speed was 30 m/s in the opposite direction. What is the average acceleration of the particle during this 2.4 s interval ?

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15. (a) If the position of a particle is given by $x = 25t - 6.0t^3$, where x is in meters and t is in seconds, when, if ever, is the particle's velocity v zero ? (b) When is its acceleration a

zero ? For what time range (positive or negative) is a (c) negative and (d) positive ? (e) Graph $x(t)$, $v(t)$, and a(t).

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16. A long a straight road, a car moving with a speed of 130 km/h is brought to a stop in a distance of 210 m. (a) Find the magnitude of the deceleration of the car (assumed uniform). (b) How long does it take for the car to stop ?

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17. A body starting from rest moves with constant acceleration. What is the ratio of distance covered by the body during the fifth second of time to that covered in the first 5.00 s ?

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18. A particle confined to motion along an x axis moves with constant acceleration from

$x = 2.0m$ to $x = 8.0$ m during a 2.5 s time interval. The velocity of the particle at $x = 8.0m$ is 2.8 m/s. What is the constant acceleration during this time interval ?

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19. A muon (an elementary particle) enters a region with a speed of 6.00×10^6 m/s and then is slowed at the rate of $1.25 \times 10^{14} m / s^2$. (a) How far does the muon take to stop ? (b) Graph x versus t and v versus t for the muon .

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20. An electron, starting from rest and moving with a constant acceleration, travels 2.00 cm in 5.00 ms. What is the magnitude of this acceleration ?

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21. On a dry road, a car with good tires may be able to brake with a constant deceleration of $4.92 m / s^2$. (a) How long does such a car,

initially traveling at 27.2 m/s, take to stop ? (b) How far does it travel in this time ? (c) Graph x versus t and v versus t for the deceleration .

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22. A certain elevator cab has a total run of 190 m and a maximum speed of 305 m/min, and it accelerates from rest and then back to rest at $1.22m/s^2$. (a) How far does the cab move while accelerating to full speed from rest ? (b)

How long does it take to make the nonstop 190 m run, starting and ending at rest ?

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23. The brakes on your car can slow you at a rate of $5.2 m / s^2$. (a) If you are going 146 km/h and suddenly see a state trooper, what is the minimum time in which you can get your car under the 90 km/h speed limit ? (The answer reveals the futility of braking to keep your high speed from being detected with a radar

or loser gun.) (b) Graph x versus t and v versus t for such a slowing .

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24. A rocket, initially at rest, is fired vertically with an upward acceleration of $10.0 m / s^2$. At an altitude of 0.500 km, the engine of the rocket cuts off. What is the maximum altitude it achieves ?

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25. A world's land speed record was set by Colonel John P. Stapp when in March 1954 he rode a rocket-propelled sled that moved along a track at 1020 km/h. He and the sled were brought to a stop in 1.4s. (See Fig. 2-7.) In terms of g, what acceleration did he experience while stopping ?

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26. A stone is thrown from the top of a building with an initial velocity of 20 m/s

downward. The top of the building is 60 m above the ground. How much time elapses between the instant of release and the instant of impact with the ground ?

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27. In Fig. 2-18, a red car and a green car, identical except for the color, move toward each other in adjacent lanes and parallel to an x axis. At time $t = 0$, the red car is at $x_r = 0$ and the green car is at $x_k = 220m$. If the red

car has a constant velocity of 20 km/h, the cars pass each other at $x = 44.5$ m, and if it has a has a constant velocity of 40 km/h, they pass each other at $x = 77.9m$. What are (a) the initial velocity and (b) the constant acceleration of the green car ?

Figure 2-18 Problem 27

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28. In a particle accelerator , an electron enters a region in which it accelerates uniformly in a straight line from a speed of $4.00 \times 10^5 m/s$ to a speed of $6.00 \times 10^7 m/s$ in a distance of 3.00 cm. For what time interval does the electron accelerate ?

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29. A car moves along an x axis through a distance of 900 m, starting at rest (at $x = 0$)

and ending at rest (at $x = 900m$). Through the first $\frac{1}{4}$ of that distance, its acceleration is $+2.75m/s^2$. Through the rest of that distance, its acceleration is $-0.750m/s^2$. What are (a) its travel time through the 900 m and (b) its maximum speed ? (c) Graph position x, velocity v, and acceleration a versus time t for the trip.

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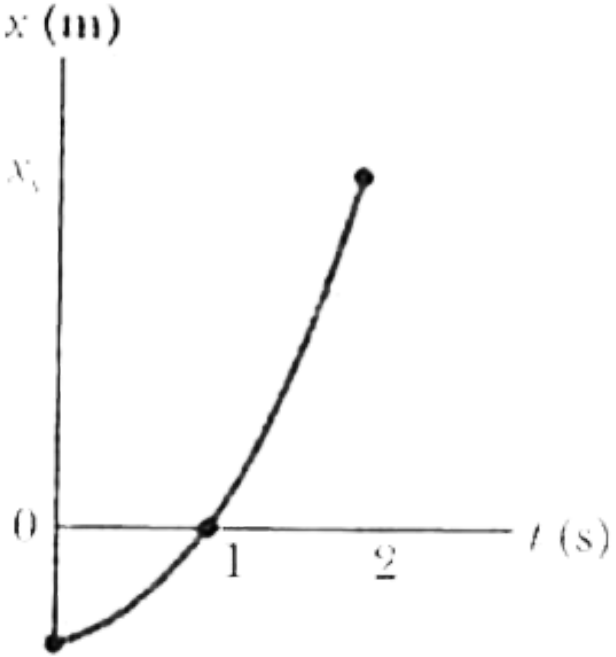
30. Figure $2-19$ depicts the motion of a particle moving along an x axis with a constant acceleration. The figure's vertical scaling is set by $x_s = 6.0m$. What are the (a) magnitude and (b) direction of the particle's

acceleration ?



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31. A car moving at a constant velocity of 46 m/s passes a traffic cop who is readily sitting

on his motorcycle. After a reaction time of 1.0s, the cop begins to chase the spoeding car with a constant acceleration of 4.0 m/s^2. How much time does the cop then need to overtake the speeding car ?

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32. You are driving toward a traffic signal when it turns yellow. Your speed is the legal speed limit of $v_0 = 55km/h$, your best deceleration rate has the magnitude $a = 5.18m/s^2$. Your

best reaction time to begin braking is $T = 0.75s$. To avoid having the front of your car enter the intersection after the light turns red, should you brake to a stop or continue to move at 55 km/h if the distance to the intersection and the duration of the yellow light are (a) 40 m and 2.8 s, and (b) 32 m and 1.8 s ? Give an answer of brake, continue, either (if either strategy works), or neither (if neither strategy works and the yellow duration is inappropriate) .

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33. On a defense aircraft carrier, a military jet lands at a speed of 64 m/s. (a) Assuming the acceleration to be constant, what is the acceleration of the jet if it stops in 3.0 s due to the arresting cable that snags it ? (b) If the jet first touches at position $x_i = 0$, what is its final position along an x axis lying under its landing path ?

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34. You are arguing over a cell phone while trailing an unmarked police car by 25 m, both your car and the police car are traveling at 120 km/hr. Your argument diverts your attention from the police car for 2.0 s (long enough for you to look at the phone and yell, " I won't do that ! "). At the beginning of that 2.0 s, the police officer begins braking suddenly at $5.0 m / s^2$. (a) What is the separation between the two cars when your attention finally returns ? Suppose that you take another 0.40 s to realize your danger and uegin braking . (b)

If you too brake at $5.0 m / s^2$, what is your speed when you hit the police car ?

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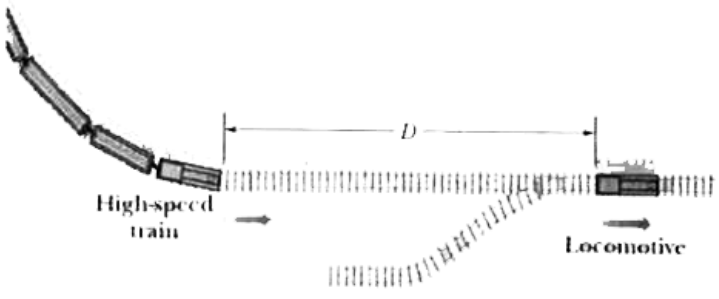
35. When a high-speed passenger train traveling at 161 km/h rounds a bend, the engineer is shocked to see that a locomotive has improperly entered onto the track from a siding and is a distance $D = 676$ m ahead (Fig. 2-20). The locomotive is moving at 29.0 km/h. The engineer of the high-speed train

immediately applies the brakes . (a) What must be the magnitude of the resulting constant deceleration if a collision is to be just avoided ? (b) Assume that the engineer is at $x = 0$ when , at $t = 0$, he first spots the locomotive. Sketch $x(t)$ curves for the locomotive and high-speed train for the cases in which a collision is just avoided and is not quite avoided.



Problem 35.

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36. A man releases a stone at the top edge of a tower. During the last second of its travel, the stone falls through a distance of (9/15) H, where H is the tower's height. Find H.

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37. Raindrops fall 1800 m from a cloud to the ground . (a) If they were not slowed by air

resistance, how fast would the drops be moving when they struck the ground ? (b) Would it be safe to walk outside during a rainstorm ?

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38. A hot-air balloon is ascending at a rate of 14 m/s at a height of 98 m above the ground when a packet is dropped from it. (a) With what speed does the packet reach the ground, and (b) how much time does the fall take ?

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39. A hoodlum throms a stone vertically downward with an initial speed of 15.0 m/s from the roof of a building, 30.0 m above the ground. (a) How long does it take the stone to reach the ground ? (b) What is the speed of the stone at impact ?

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40. A melon is dropped from a height of 39.2 m. After it crosses through half that distance , the acceleration due to gravity is reduced to zero by air drag. With what velocity does the melon hit the ground ?

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41. A key falls from a bridge that is 45 m above the water. It falls directly into a model boat, moving with constant velocity, that is 12 m

from the point of impact when the key is released . What is the speed of the boat ?

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42. A stone is dropped into a river from a bridge 53.6 m above the water. Another stone is thrown vertically down 1.00 s after the first is dropped. The stones strike the water at the same time. (a) What is the initial speed of the second stone ? (b) Plot velocity versus time on

a graph for each stone, taking zero time as the instant the first stone is released .

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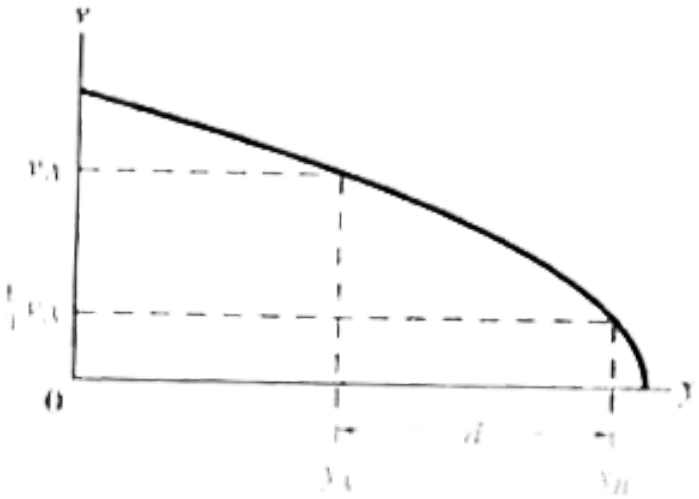
43. Figure 2-21 shows the speed v versus height y of a ball tossed directly upward , along a y axis. Distance d is 0.40 m. The speed at height y_A is v_A. The speed at height y_B is

$\frac{1}{3}v_A$. What is speed v_A ?



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44. To test the quality of a tennis ball, you drop it onto the floor from a height of 4.00 m. It rebounds to a height of 2.00 m. If the ball is in contact with the floor for 12.0 ms, what is its

average acceleration during that contact? Take $g = 98m/s^2$.

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45. Water drips from the nozzle of a shower onto the floor 200 cm below. The drops fall at regular (equal) intervals of time, the first drop striking the floor at the instant the fourth drop begins to fall. When the first drop strikes the floor, how far below the nozzle are the (a) second and (b) third drops ?

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46. A rock is thrown vertically upward from ground level at time $t = 0$. At $t = 1.5s$ it passes the top of a tall tower, and 1.0 s later it reaches its maximum height. What is the height of the tower ?

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47. A dog sees a flowerpot that sails first up and then down past an open window. The pot

is in view for a total of 0.50 s, and the top-to-bottom height of the window is 2.00 m. How high above the window top does the flowerpot go ?

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48. A rock is thrown downward from an unknown height above the ground with an initial speed of 10 m/s. It strikes the ground 3.0 s later. Determine the initial height of the rock above the ground .

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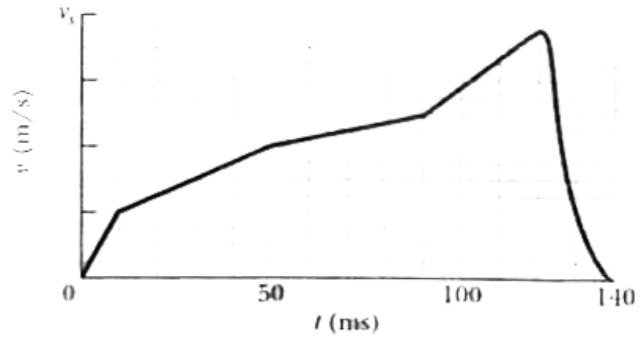
49. In a forward punch in karate, the fist begins at rest at the waist and is brought rapidly forward until the arm is fully extended. The speed v (t) of the fist is given in Fig. 2-22 for someone skilled in karate. The vertical scaling is set by $v_s = 8.0 m/s$. How far has the fist moved at (a) time $t = 50$ ms and (b) when

the speed of the fist is maximum ?



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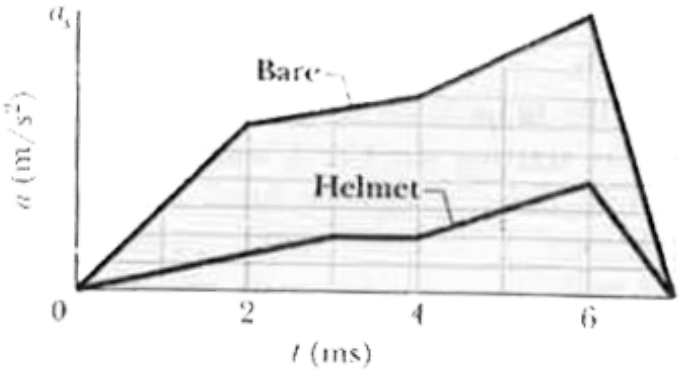
50. When a soccer ball is kicked toward a player and the player defiects the ball by " iteading" it, the acceleration of the head during the collision can be significant. Figure 2-23 gives the measured acceleration a(t) of a

soccer player's head for a bare head and a helmeted head, starting from rest. the scaling on the vertical axis is set by $a_s = 200m/s^2$. At time $t = 7.0$ ms, what is the difference in the speed acquired by the bare head and the speed acquired by the helmeted head ?



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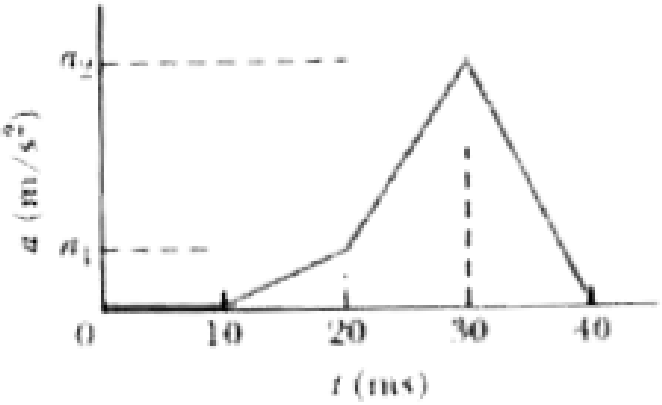
51. A salamander of the genus Hydromantes captures prey by launching its tongue as a projectile: The skeletal part of the tongue is shot forward, unfolding the rest of the tongue, until the outer portion lands on the prey, sticking to it. Figure 2-24 shows the acceleration magnitude a versus time t for the acceleration phase of the launch in a typical situation. The indicated accelerations are $a_2 = 400m/s^2$ and $a_1 = 100m/s^2$. What is the outward speed of the tongue at the end of

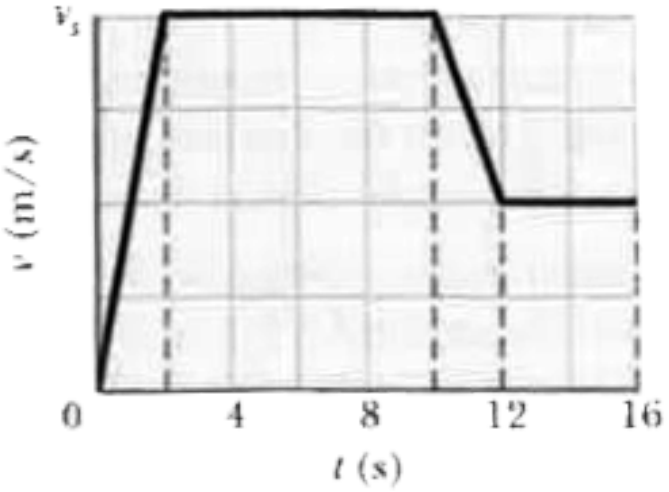
the acceleration phase ?



Watch Video Solution

52. How for does the runner whose velocity-time graph is shown in Fig. 2-25 travel in 16 s ? The figure's vertical scaling is set by

$v_s = 8.0m/s.$



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53. Two particles move along an x axis. The position of particle 1 is given by $x = 6.00t^2 + 3.00t + 2.00$ (in meters and

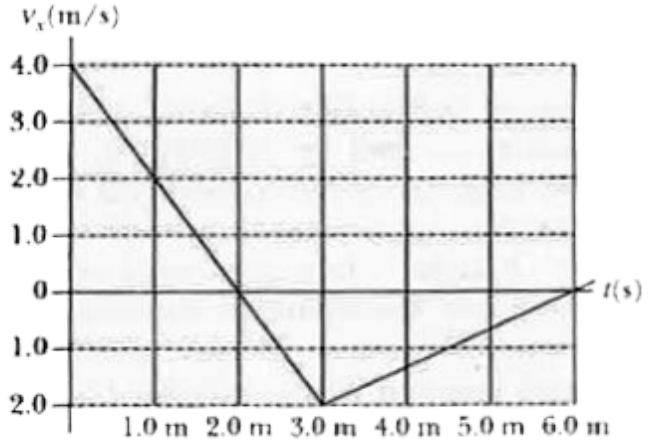
seconds) , the acceleration of particle 2 is given by $a = -8.00t$ (in meters per second squared and seconds) and , at $t = 0$, its velocity is . 15 m/s . When the velocities of the particles match, what is their velocity ?

Watch Video Solution

Practice Questions Single Correct Choice Type

1. v_x is the velocity of a particle moving along the x-axis as shown in the figure. If $x = 2.0m$

at $t = 1.0s$, what is the position of the particle at $t = 6.0s$?



A. -2.0 m

B. $+2.0$ m

C. $+1.0$ m

D. -1.0 m

Answer: D

Watch Video Solution

2. What is the magnitude of the average acceleration of a skier who, starting from rest, reaches a speed of 8.0 m/s when going down a slope for 5.0 s ?

A. $0.85m/s^2$

B. $1.1m/s^2$

C. $1.6m/s^2$

D. $1.9m/s^2$

Answer: C

Watch Video Solution

3. During the first $18\ \min$ of a $60\ \min$ trip, a car has an average speed of $11ms^{-1}$. What should be the average speed for remaining $42\ \min$ so that car is having an average speed of $21ms^{-1}$ for the entire trip?

A. 21 m/s

B. 25 m/s

C. 23 m/s

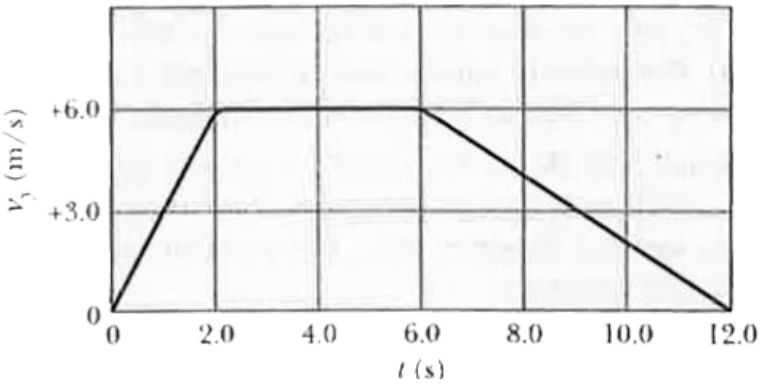
D. 27 m/s

Answer: B

Watch Video Solution

4. A helicopter is lifting off from the ground and is moving vertically upward. The graph shows its vertical velocity v_f versus time. How high is the helicopter after 12.0 s have elapsed

?



A. 6.0 m

B. 18 m

C. 48 m

D. 12 m

Answer: C

Watch Video Solution

5. A target is made of two plates, one of wood and the other of iron. The thickness of the wooden plate is 4 cm and that of iron plate is 2 cm. A bullet fired goes through the wood first and then penetrates 1 cm into iron. A similar bullet fired with the same velocity from opposite direction goes through iron first and then penetrates 2 cm into wood. If a_1 and a_2 be the retardations offered to the bullet by wood and iron plates, respectively, then

A. $a_1 = 2a_2$

B. $a_2 = 2a_1$

C. $a_1 = a_2$

D. Data insufficient

Answer: B

Watch Video Solution

6. At time $t = 0s$, an object is observed at $x = 0$ m , and its position along the x axis follows this expression : $x = -3t + t^3$,

where the units for distance and time are meter and second, respectively. What is the object's displacement Δx between $t = 1.0$ s and $t = 3.0$ s ?

A. $+20m$

B. $+10$m

C. $-20m$

D. $+2$ m

Answer: A

Watch Video Solution

7. A ball is thrown upward from the top of a 25.0 m tall building. The ball's initial speed is 12.0 m/s. At the same instant, a person is running on the ground at a distance of 31.0 m from the building. What must be the average speed of the person if he is to catch the ball at the bottom of the building ?

A. 8.18 m/s

B. 0.122 m/s

C. 7.20 m/s

D. 0.139 m/s

Answer: A

Watch Video Solution

8. An 18 year old runner can complete a 10.0 km course with an average speed of 4.39 m/s. A 50 year old runner can cover the same distance with an average speed of 4.27 m/s. How much later (in seconds) should the

younger runner start in order to finish the course at the same time as the older runner ?

A. 12 s

B. 48 s

C. 64 s

D. 24 s

Answer: C

Watch Video Solution

9. A body is dropped from a height of 39.2 m. After it crosses half distance, the acceleration due to gravity ceases to act. The body will hit the ground with velocity (Take $g = 10m/s^2$)

A. 19.6 m/s

B. 20 m/s

C. 1.96 m/s

D. 196 m/s

Answer: A

Watch Video Solution

Watch Video Solution

10. A drag racing car starts from rest at t=0 and moves along a straight line with velocity given by $v = bt^2$, where b is a constant. The expression for the distance traveled by this car from its position at t=0 is

A. bt^3

B. $bt^3/3$

C. $4bt^2$

D. $3bt^2$

Answer: B

Watch Video Solution

11. The velocity of a diver just before hitting the water is $-10.1m/s$, where the minus sign indicates that her motion is directly downward. What is her displacement during the last 1.20 s of the dive ?

A. $-5.06m$

B. $-7.06m$

C. -12.1m

D. $-4.27\ \text{m}$

Answer: A

 Watch Video Solution

12. The velocity at the midway point of a ball able to reach a height y when thrown with velocity v, at the origin is

A. $v_i / 2$

B. $\sqrt{v_1 2gy}$

C. $\sqrt{v_i^2 / 2}$

D. $\sqrt{v_i^2 / 2gy}$

Answer: C

Watch Video Solution

13. A car is initially travelling at 50.0 km/h. The brakes are applied and the car stops over a distance of 35 m. What was magnitude of the car's acceleration while it was braking ?

A. $2.8m/s^2$

B. $5.4m/s^2$

C. $36m/s^2$

D. $71m/s^2$

Answer: A

Watch Video Solution

14. The three-toed sloth is the slowest moving land mammal. On the ground, the sloth moves at an average speed of 0.037 m/s, considerably

slower than the giant tortoise, which walks at 0.076 m/s. After 12 minutes of walking, how much further would the tortoise have gone relative to the sloth ?

A. 11 m

B. 22 m

C. 14 m

D. 28 m

Answer: D

Watch Video Solution

15. Two cars travel along a level highway. It is observed that the distance between the cars is increasing . Which one of the following statements concerning this situation is necessarily true ?

A. The velocity of each car is inceasing.

B. At least one of the cars has non-zero acceleration.

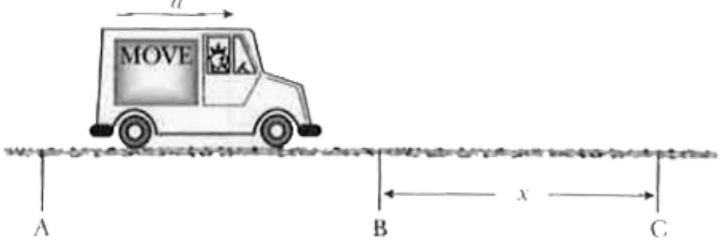
C. The trailing car has the smaller acceleration.

D. Both cars could be accelerating at the same rate.

Answer: D

Watch Video Solution

16. A truck accelerates from rest at point A with constant acceleration of magnitude a and subsequently , passes points B and C as shown in the figure.



The distance between points B and C is x, and the time required for the truck to travel from B to C is t. Which expression determines the average speed of the truck between the points B and C ?

A. $v^2 = 2ax$

B. $v = xt$

C. $v = \frac{x}{t}$

D. $v = \frac{1}{2}at^2$

Answer: C

Watch Video Solution

17. In reaching her destination, a backpacker walks an average velocity of 1.34 m/s, due west. This average velocity results because she hikes for 6.44 km with an average velocity of 2.68 m/s, due west, turns around, and hikes with an average velocity of 0.447 m/s, due east. How far east did she walk ?

A. 3.5 km

B. 1.8 km

C. 2.4 km

D. 0.81 km

Answer: D

Watch Video Solution

18. Water drops fall at regular intervals from a roof. At an instant when a drop is about to leave the roof, the separations between 3

successive drops below the roof are in the ratio

A. $1:2:3$

B. $1:4:9$

C. $1:3:5$

D. $1:5:13$

Answer: B

 Watch Video Solution

19. A golfer rides in a golf cart at an average speed of 3.10 m/s for 28.0 s. She then gets out of the cart and starts walking at an average speed of 1.30 m/s. For how long (in seconds) must she walk if her average speed for the entire trip, riding and walking, is 1.80 m/s ?

A. 73 s

B. 31 s

C. 57 s

D. 44 s

Answer: A

Watch Video Solution

20. A train approaches a small town with constant velocity of $+28.6$ m/s. The operator applies the brake, reducing the train's velocity to $+11.4$ m/s . If the average acceleration of the the train during braking is $-1.35m/s^2$, for what elapsed time does the operator apply the brake ?

A. 8.44 s

B. 3.38 s

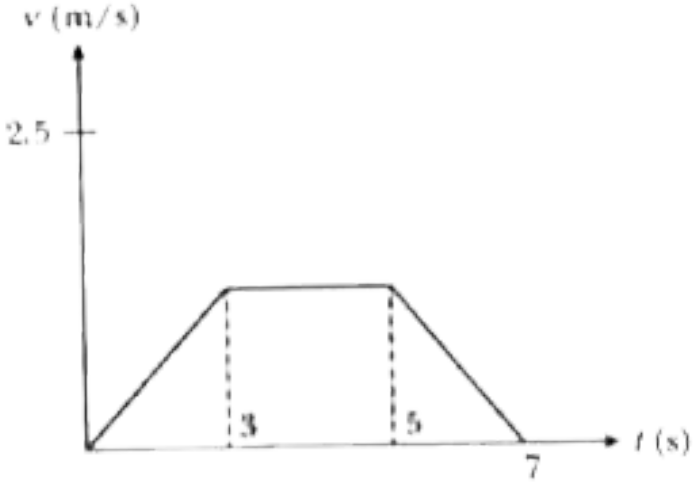
C. 12.7 s

D. 5.92 s

Answer: C

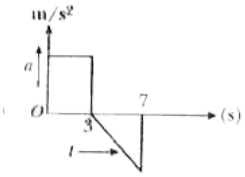
Watch Video Solution

21. The velocity - time graph of a body is given in figure below .

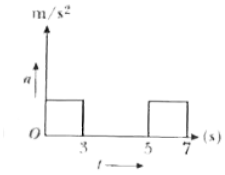


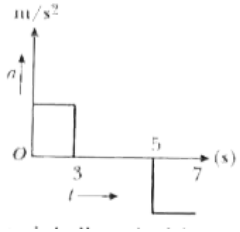
The acceleration-time graph of the motion of the body is

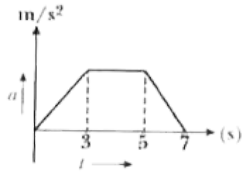
A.



B.



C. 

D. 

Answer: C

Watch Video Solution

22. A hot-air balloon is rising upward with a constant speed of 2.50 m/s. When the balloon is 3.00 m above the ground, the balloonist

accidentally drops a compass over the side of the balloon. How much time elapses before the compass hits the ground ?

A. 2.43 s

B. 0.568 s

C. 1.08 s

D. 0.410 s

Answer: C

Watch Video Solution

23. Starting from rest, a particle confined to move along a straight line is accelerated at a rate of 5.0 m/s^2. Which one of the following statements accurately describes the motion of this particle ?

A. The particle travels 5.0 m during each second.

B. The particle travels 5.0 m only during the first second.

C. The acceleration of the particle increases by 5.0 m / s^2 during each second.

D. The speed of the particle increases by 5.0 m/s during each second.

Answer: D

Watch Video Solution

24. An automobile starts from rest and accelerates to a final velocity in two stages along a straight road. Each stage occupies the

same amount of time. In stage 1, the magnitude of the car's acceleration is $3.0m/s^2$. The magnitude of the car's velocity at the end of stage 2 is 2.5 times greater than it is at the end of stage 1. Find the magnitude of the acceleration is stage 2.

A. $4.5m/s^2$

B. $3.0m/s^2$

C. $3.8m/s^2$

D. $2.2m/s^2$

Answer: A

Watch Video Solution

25. A point moving along the x- direction starts from rest at $x = 0$ and comes to rest at $x = 1$ after 1 s. Its acceleration at any point is denoted by α . Which of the following is not correct ?

A. α must change sign during the motion.

B. $|\alpha| \geq 4$ units at some or all points during the motion.

C. It is not possible to specify an upper limit for $|\alpha|$ from the given data.

D. $|\alpha|$ cannot be less than 1/2 during the motion.

Answer: D

View Text Solution

26. From the top of a cliff, a person uses a slingshot to fire a pebble straight downward, which is the negative direction. The initial

speed of the pebble is 9.0 m/s. What is the acceleration (magnitude and direction) of the pebble during the downward motion ?

A. zero m / s^2

B. $9.8 m / s^2$ downward

C. $9.8 m / s^2$, upward

D. $1.1 m / s^2$, upward

Answer: B

Watch Video Solution

27. A particle has a velocity u towards east at $t = 0$. Its acceleration is towards west and is constant. Let x_A and x_B be the magnitude of displacements in the first 10 seconds and the next 10 seconds

A. $x_A < x_B$

B. $x_A = x_B$

C. $x_A > x_B$

D. the information is insufficient to decide the relation of x_A with x_B

Answer: D

Watch Video Solution

28. Two motorcycles are travelling due east with different velocities. However, four seconds later, they have the same velocity, During this four-second iterval, motorcycle A has an average acceleration of $2.0m/s^2$ due east, while motorcycle B has an average acceleration of $4.0m/s^2$ due east. By how much did the speeds differ at the beginning of

the four-second interval, and which motorcycle was moving faster ?

A. -2.0 m/s

B. -6.0 m/s

C. $+8.0$ m/s

D. $+1.0$ m/s

Answer: C

Watch Video Solution

29. A bullet is fired through a board, 14.0 cm thick, with its line of motion perpendicular to the face of the board. If it enters with a speed of 450 m/s and emerges with a speed of 220 m/s, what is the bullet's acceleration as it passes through the board ?

A. $-500km/s^2$

B. $-550km/s^2$

C. $-360km/s^2$

D. $-520km/s^2$

Answer: B

Watch Video Solution

30. Ball A is dropped from rest from a window. At the same instant, ball B is thrown downward, and ball C is thrown upward from the same window. Which statement concerning the balls after their release is necessarily true if air resistance is neglected ?

A. At some instant after it is thrown, the acceleration of ball C is zero.

B. All three balls strike the ground at the same time.

C. All three balls have the same velocity at any instant.

D. All three balls have the same acceleration at any instant.

Answer: D

Watch Video Solution

31. A football player, starting from rest at the line of scrimmage, accelerates along a straight line for a time of 1.5 s. Then , during a negligible amount of time, he changes the magnitude of his acceleration to a value of $1.1 m / s^2$. With this acceleration, he continues in the same direction for another 1.2s, until he reaches a speed of 3.4 m/s. What is the value of his acceleration (assumed to be constant) during the initial 1.5 s period ?

A. $0.91m / s^2$

B. $1.1m / s^2$

C. $1.4m / s^2$

D. $2.2m / s^2$

Answer: C

Watch Video Solution

32. Water drips from rest from a leaf that is 20 meters above the ground. Neglecting air

resistance, what is the speed of each water drop when it hits the ground ?

A. 30 m/s

B. 40 m/s

C. 20 m/s

D. 15 m/s

Answer: C

Watch Video Solution

33. A proton moving along the x axis has an initial velocity of $4.0 \times 10^6 m/s$ and a constant acceleration of $6.0 \times 10^{12} m/s^2$. What is the velocity of the proton after it has traveled a distance of $80cm$?

A. $5.1 \times 10^6 m/s$

B. $6.3 \times 10^6 m/s$

C. $4.8 \times 10^6 m/s$

D. $3.9 \times 10^6 m/s$

Answer: A

Watch Video Solution

34. A sprinter accelerates from rest to a top speed with an acceleration whose magnitude is $3.80 m / s^2$. After achieving top speed, he runs the remainder of the race without speeding up or slowing down. The total race is fifty meters long. If the total race is run in 7.88 s, how far does the run during the acceleration phase ?

A. 6.85 m

B. 9.03 m

C. 7.62 m

D. 13.6 m

Answer: A

Watch Video Solution

35. A boy on a skate board skates off a horizontal bench at a velocity of 10 m/s . One tenth of a second after he leaves the bench, to

two significant figures, the magnitudes of his velocity and acceleration are :

A. $10m/s, 9.8m/s^2$

B. $9.0m/s, 9.8m/s^2$

C. $9.0m/s, 9.0m/s^2$

D. $1.0m/s, 9.0m/s^2$

Answer: A

Watch Video Solution

36. At the beginning of a basketball game, a referee tosses the ball straight up with a speed of 4.6 m/s. A player cannot touch the ball until after it reaches its maximum height and begains to fall down. What is the minimum time that a player must wait before touching the ball ?

A. 0.24 s

B. 0.66 s

C. 0.47 s

D. 0.94 s

Answer: C

Watch Video Solution

37. A car starts from rest and accelerates at a constant rate in a straight line. In the first second, the car covers a distance of 2.0 meters. How much additional distance will the car cover during the second second of its motion ?

A. 2.0 m

B. 6.0 m

C. 4.0 m

D. 8.0 m

Answer: B

Watch Video Solution

38. A pellet gun is fired straight downward from the edge of a cliff that is 15 m above the ground. The pallet strickes the ground with a

speed of 27 m/s. How far above the cliff edge would the pellet have gone had the gun been fired straight upward ?

A. 4.5 m

B. 22 m

C. 15 m

D. 29 m

Answer: B

Watch Video Solution

39. An auto travelling along a straight road increases its speed from $30.0ms^{-1}$ to $50.0ms^{-1}$ in a distance of 180 m. If the acceleration is constant, how much time elapse while the auto moves this distance?

A. 6.00 s

B. 4.50 s

C. 3.60 s

D. 4.00 s

Answer: B

Watch Video Solution

40. A landing airplane makes contact with the runway with a speed of 78.0 m/s and moves towards the south. After 18.5 seconds, the airplane comes to rest. What is the average acceleration of the airplane during the landing ?

A. $2.11 m / s^2$, north

B. $4.22\ m / s^2$, north

C. $2.11 m / s^2$, south

D. $4.22 m / s^2$, south

Answer: B

Watch Video Solution

41. While standing on a bridge 15.0 m above the ground, you drop a stone from rest. When the stone has fallen 3.20 m, you throw a second stone straight down. What initial velocity must you give the second stone if they are both to reach the ground at the same

instant ? Take the downward direction to be the negative direction .

A. $-4.9m/s$

B. $-9.8m/s$

C. $-8.4m/s$

D. -11 m/s

Answer: D

Watch Video Solution

42. An object starts from rest at the origin and moves along the x axis with a constant acceleration of $4m/s^2$. Its average velocity as it goes from $x = 2$ m to $x = 8$ m is :

A. 2 m/s

B. 3 m/s

C. 5 m/s

D. 6 m/s

Answer: D

Watch Video Solution

Watch Video Solution

43. A rock is dropped from rest from a height h above the ground. It falls and hits the ground with a speed of 11 m/s. From what height should the rock be dropped so that its speed on hitting the ground is 22 m/s ? Neglect air resistance.

A. 1.4 h

B. 3.0 h

C. 2.0 h

D. 4.0 h

Answer: D

Watch Video Solution

44. A car is travelling to the left, which is the negative direction. The direction of travel remains the same throughout this problem. The car's initial speed is 27.0 m/s, and during a 5.0 s interval, it changes to a final speed of 29.0 m/s. Find the acceleration (magnitude

and algebraic sign) and state whether or not the car is decelerating.

A. $-11m/s^2$

B. $-5.8m/s^2$

C. $-0.40m/s^2$

D. $+0.40m/s^2$

Answer: C

Watch Video Solution

45. A drag racer, starting from rest, speeds up for 402 m with an acceleration of $+17.0 m / s^2$. A parachute then opens, slowing the car down with an acceleration of $-6.10 m / s^2$. How fast is the racer moving 3.50×10^2 m after the parachute opens ?

A. 96.9 m/s

B. 65.4 m/s

C. 82.9 m/s

D. 20.1 m/s

Answer: A

Watch Video Solution

46. A baseball is hit straight up and is caught by the catcher 2.0 s later, at the same height at which it left the bat. The maximum height of the ball during this interval is :

A. 4.9 m

B. 7.4 m

C. 12.4 m

D. 19.6 m

Answer: A

View Text Solution

47. An object is thrown vertically upward with a certain initial velocity in a world where the acceleration due to gravity is $19.6m/s^2$. The height to which it rises is _____ that to which the object would rise if thrown upward with

the same initial velocity on the Earth. Neglect air resistance.

A. $1.77 m / s^2$

B. $3.60 m / s^2$

C. $2.98 m / s^2$

D. $7.36 m / s^2$

Answer: B

Watch Video Solution

48. A car is stopped at a red traffic light. When the light turns to green, the car has a constant acceleration and crosses the 9.10 m intersection in 2.47 s. What is the magnitude of the car's acceleration ?

A. 13 m, 37 m

B. 16 m, 41 m

C. 17 m, 44 m

D. 14 m, 28 m

Answer: C

Watch Video Solution

49. A hot air balloon is ascending straight up at a constant speed of 7.0 m/s. When the balloon is 12.0 m above the ground, a gun fires a pellet straight up from ground level with an initial speed of 30.0 m/s. Along the paths of the balloon and the same altitude at the same time. How far above ground level are these places ?

A. $1.5m/s^2$

B. $4.5m/s^2$

C. $3.0m/s^2$

D. $6.0m/s^2$

Answer: B

View Text Solution

50. The minimum takeoff speed for a certain airplane in 75 m/s. What minimum acceleration is requied if the plane must leave

a runway of length 950 m ? Assume the plane starts from rest at one end of the runway .

A. $2.0m/s^2$, upward

B. $5.3m/s^2$, upward

C. $2.0m/s^2$, downward

D. $5.3m/s^2$, downward

Answer: C

Watch Video Solution

51. An elevator is moving upward with a speed of 11 m/s. Three seconds later, the elevator is still moving upward, but its speed has been reduced to 5.0 m/s. What is the average acceleration of the elevator during the 3.0 s interval ?

A. The particle remains at rest after $t = 3.0$ s.

B. The particle no longer accelerates after $= 3.0$ s.

C. The particle can be found at positions $x < 0$ m only when $t < 0$ s.

D. None of the above is correct .

Answer: C

Watch Video Solution

52. A particle moving along the x axis has a position given by $x = 54t - 2.0t^3 m$. At the time $t = 3.0s$, the speed of the particle is zero. Which statement is correct ?

A. $4.3 \times 10^4 m/s^2$, south

B. $9.4 \times 10^4 m/s^2$, north

C. $5.1 \times 10^4 m/s^2$, north

D. $2.2 \times 10^3 m/s^2$, south

Answer: D

Watch Video Solution

53. A pitcher delivers a fast ball with a velocity of 43 m/s to the south. The batter hits the ball and gives it a velocity of 51 m/s to the north.

What was the average acceleration of the ball during the 1.0 ms when it was in contact with the bat ?

A. 1.5 m/s

B. $34m / s$

C. $7.0m / s$

D. $49m / s$

Answer: B

Watch Video Solution

54. A car travelling along a road begins accelerating with a constant acceleration of $1.5m/s^2$ in the direction of motion. After travelling 392 m at this acceleration, its speed is 35 m/s. Determine the speed of the car when it began accelerating.

A. 1.5 m/s

B. 34 m/s

C. 7.0 m/s

D. 49 m/s

Answer: C

Watch Video Solution

Practice Questions More Than One Correct Choice Type

1. Choose the correct statements :

A. When the total area of the acceleration-time graph is negative, it always means

that the final velocity of the particle is negative.

B. When the total area of the velocity-time graph is negative, it always means that the final displacement of the particle is negative.

C. When the total area of the velocity-time graph is negative, it may happen that the particle returns to its original position.

D. When the total area of the acceleration-time graph is negative, it may happen that the final velocity of the particle is zero .

Answer: C::D

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2. Two bodies of masses (m_1) and (m_2) are dropped from heights h_1 and h_2, respectively. They reach the ground after time t_1 and t_2 and

strike the ground with v_1 and v_2, respectively

Choose the correct relations from the following.

A. $\frac{t_1}{t_2} = \sqrt{\frac{h_1}{h_2}}$

B. $\frac{t_1}{t_2} = \sqrt{\frac{h_2}{h_1}}$

C. $\frac{v_1}{v_2} = \sqrt{\frac{h_1}{h_2}}$

D. $\frac{v_1}{v_2} = \frac{h_2}{h_1}$

Answer: A::C

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3. A particle of mass m moves on the $x - a\xi s$ as follows : it starts from rest at $t = 0$, from the point $x = 0$, and comes to rest at $t = l$ at the point $x = 1$. No other information is available about its motion at intermediate times $(0 < t < l)$. If α denotes the instantaneous accelartion of the particle , then :

A. α cannot remain positive for all t in the interval $0 \leq t \leq 1$.

B. $|\alpha|$ cannot exceed 2 at any point in its path.

C. $|\alpha|$ must be ≥ 4 at some point or points in its path.

D. α must change sign during the motion, but no other assertion can be made with the information given.

Answer: A::C

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4. Mark the correct statement for a particle going on a straight line :

A. It the velocity and acceleration have opposite sign, the object is slowing down.

B. If the position and velocity have opposite sign, the particle is moving towards the origin.

C. If the velocity is zero at an instant, the acceleration should also be zero at that

instant.

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

Answer: A::B::D

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5. The acceleration a of α of a particle depends on displacements covered in a time t as

$a = S + 5$. It is given that initially $S = 0$ m and $v = 5m/s$. Then

A. $v = S + 5$

B. $v = \sqrt{S + 5}$

C. $t = \log_e\left(\frac{S + 5}{S}\right)$

D. $t = \log_e\left(\frac{S + 5}{5}\right)$

Answer: A::D

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6. Pick the correct statements :

A. Average speed of a particle in a given time is never less than the magnitude of the average velocity.

B. It is possible to have a situation in which $\left|\frac{d\bar{v}}{dt}\right| \neq 0$ but $\frac{d}{dt}|\bar{v}| = 0$

C. The average velocity of a particle is zero in a time interval. It is possible than the

instantaneous velocity is never zero in the interval.

D. The average velocity of a particle moving on a straight line is zero in a time interval. It is possible that the instantaneous velocity is never zero in the interval. (Infinite accelerations are not allowed)

Answer: A::B::C

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Practice Questions Linked Comprehension

1. A racecar, traveling at constant speed, makes one lap around a circular track of radius r in a time t .

When the car has traveled halfway around the track, what is the magnitude of its displacement from the starting point ?

A. r

B. 2r

C. π r

D. $2\pi r$

Answer: B

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2. A racecar, traveling at constant speed, makes one lap around a circular track of radius r in a time t .

What is the average speed of the car for one complete lap ?

A. $\frac{r}{t}$

B. $\frac{\pi r}{t}$

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

D. $\frac{2\pi r}{t}$

Answer: D

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3. A racecar, traveling at constant speed, makes one lap around a circular track of radius r in a time t .

Determine the magnitude of the average velocity of the car for one complete lap.

A. $\frac{r}{t}$ m/s

B. $\frac{\pi r}{t}$ m/s

C. zero m/s

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

Answer: C

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4. A racecar, traveling at constant speed, makes one lap around a circular track of radius r in a time t .

Which one of the following statements concerning this car is true ?

A. The displacement of the car does not change with time.

B. The instantaneous velocity of the car is constant.

C. The average speed of the car is same over any time interval.

D. The average velocity of the car is the same over any time interval.

Answer: C

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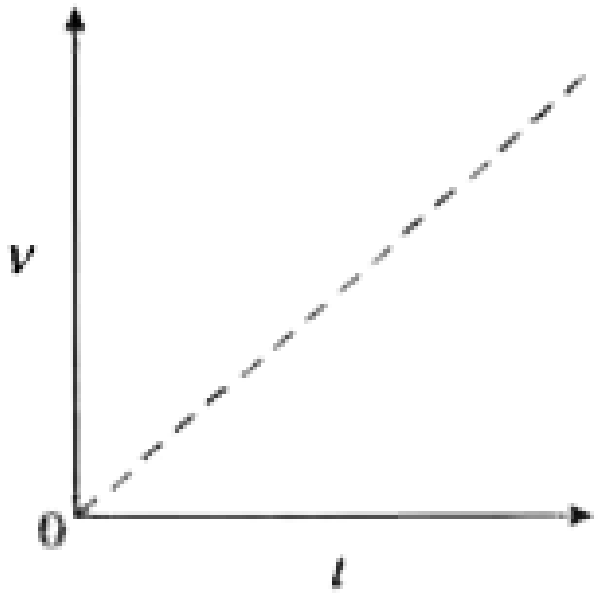
5. The figure shows the speed as a function of time for an object in free fall near the surface of the earth. The object was dropped from rest

in a long evacuated cylinder .



Which one of the following statements best explains why the graph goes through the origin ?

A. The object was in a vacuum.

B. All v vs t curves pass through the origin.

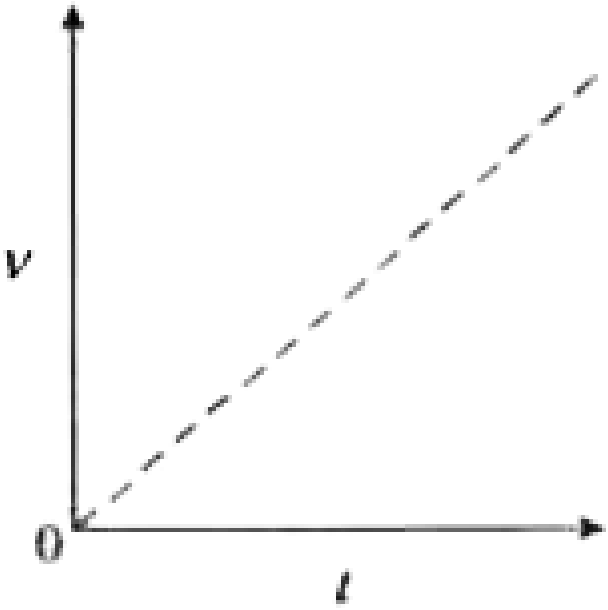
C. The object was dropped from rest.

D. The velocity of the object was constant.

Answer: C

Watch Video Solution

6. The figure shows the speed as a function of time for an object in free fall near the surface of the earth. The object was dropped from rest in a long evacuated cylinder .



What is the numerical value of the slope of the line ?

A. $1.0m/s^2$

B. $9.8m/s^2$

C. $2.0m/s^2$

D. $7.7m/s^2$

Answer: B

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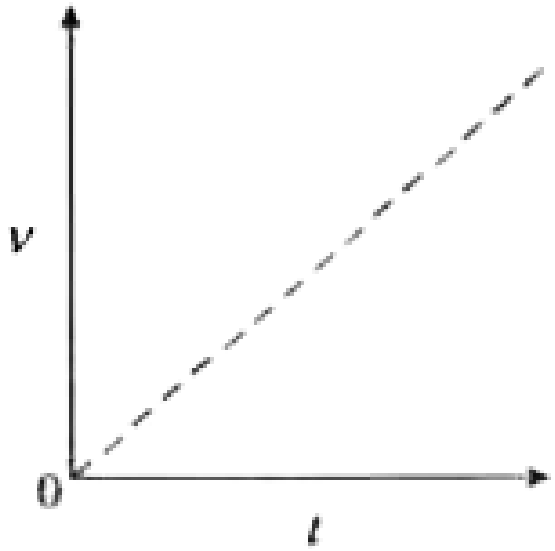
7. The figure shows the speed as a function of time for an object in free fall near the surface of the earth. The object was dropped from rest in a long evacuated cylinder .



What is the speed of the object 3.0 seconds after it is dropped ?

A. 3.0 m/s

B. 7.7 m/s

C. 9.8 m/s

D. 29 m/s

Answer: D

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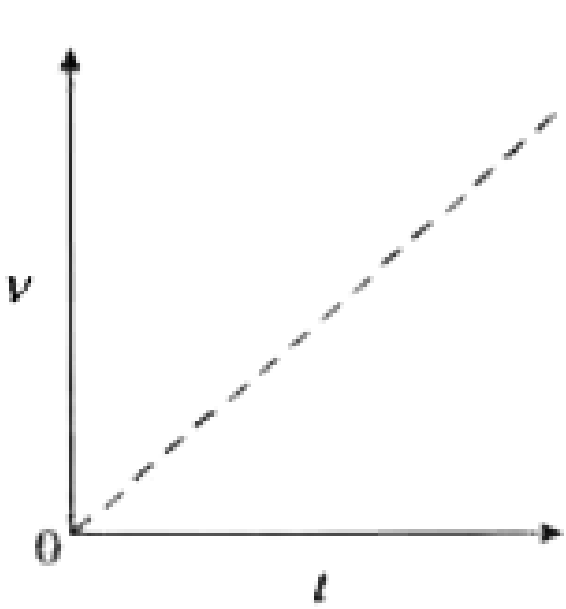
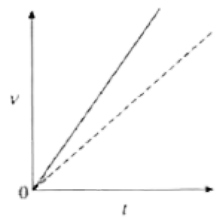
8. The figure shows the speed as a function of time for an object in free fall near the surface of the earth. The object was dropped from rest in a long evacuated cylinder .



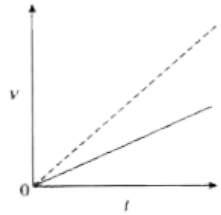
If the same object were released in air, the magnitude of its acceleration would begin at the free-fall value, but it would decrease continuously is zero as the object continued to fall. For which one of the choices given does the solid line best represent the speed of the object as a function of time when it is dropped

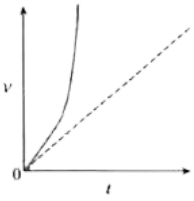
from rest in air ?

Note: The dashed line shows the free-fall under vacuum graph for comparison.

A. 

B. 

C. 

D. 

Answer: B

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9. A rock, dropped from rest near the surface of an atmosphere-free planet, attains a speed of 20.0 m/s after falling 8.0 m.

What is the magnitude of the acceleration due to gravity on the surface of this planet ?

A. $0.40m/s^2$

B. $2.5m/s^2$

C. $1.3m/s^2$

D. $25m/s^2$

Answer: D

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10. A rock, dropped from rest near the surface of an atmosphere-free planet, attains a speed of 20.0 m/s after falling 8.0 m.

How long did it take the object to fall the 8.0 m mentioned ?

A. 0.40 s

B. 1.3 s

C. 0.80 s

D. 2.5 s

Answer: C

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11. A rock, dropped from rest near the surface of an atmosphere-free planet, attains a speed of 20.0 m/s after falling 8.0 m.

How long would it take the object, falling from rest, to fall 16 m on this planet ?

A. 0.8 s

B. 2.5 s

C. 1.1 s

D. 3.5 s

Answer: C

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12. A rock, dropped from rest near the surface of an atmosphere-free planet, attains a speed of 20.0 m/s after falling 8.0 m.

Determine the speed of the object after falling from rest through 16 m on this planet .

A. 28 m/s

B. 32 m/s

C. 56 m/s

D. 64 m/s

Answer: A

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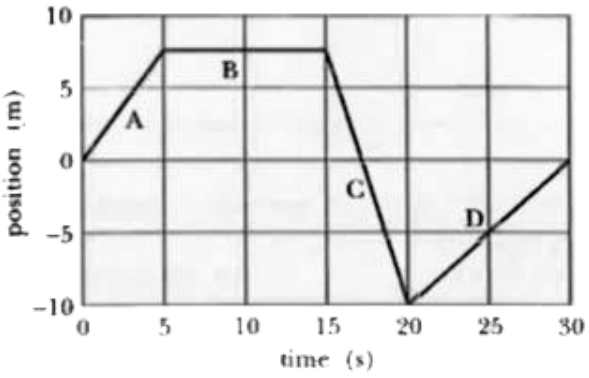
13. An object is moving along a straight line in the positive x direction. The graph shows its position from the starting point as a function of time. Various segments of the graph are identified by the letters A, B, C, and D.



Which segment(s) of the graph represent(s) a constant velocity of +1.0 m/s ?

A. A

B. C

C. B

D. D

Answer: D

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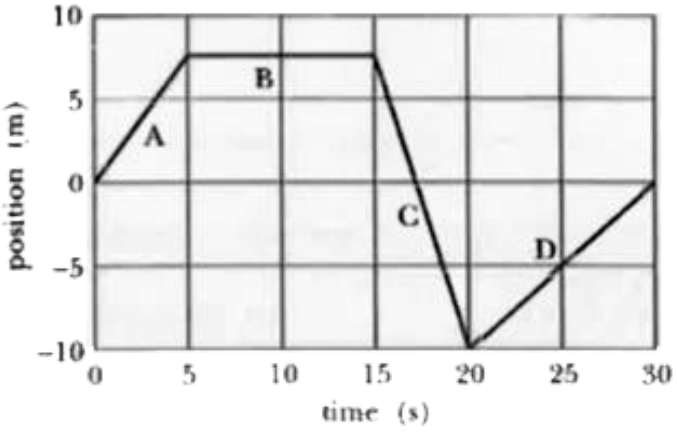
14. An object is moving along a straight line in the positive x direction. The graph shows its position from the starting point as a function of time. Various segments of the graph are identified by the letters A, B, C, and D.



What was the instantaneous velocity of the object at the end of the eighth second ?

A. $+7.5$ m/s

B. $+9.4$ m/s

C. 0 m/s

D. $+9.0$ m/s

Answer: C

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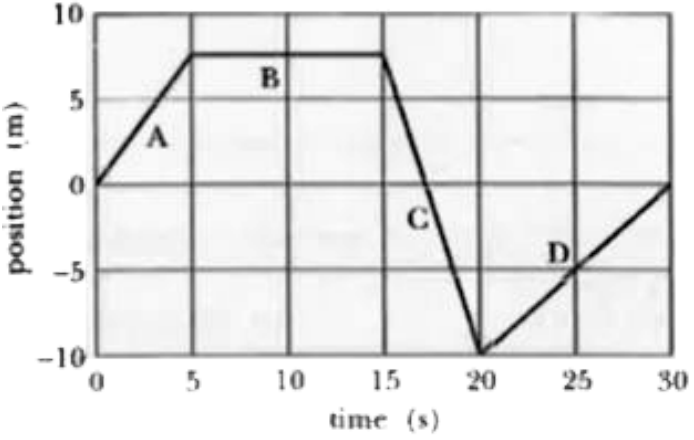
15. An object is moving along a straight line in the positive x direction. The graph shows its position from the starting point as a function

of time. Various segments of the graph are identified by the letters A, B, C, and D.



During which interval(s) did the object move in the negative x direction ?

A. Only during interval B.

B. During both intervals C and D.

C. Only during interval C.

D. Only during interval D.

Answer: C

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Practice Questions Matrix Match

1. A particle of mass 10 kg is moving in a straight line. If its displacement, x with time t is given by $x = \left(at^3 + bt + c\right)$m, the force acting on it at the end of 4 s is 240 N. Its

displacement at $t = 0$ is -10 m and its velocity at $t = 0$ is -2 m/s. Here, values of a, b, c and acceleration are in the proper SI units :

Column I	Column II
(a) Value of c is	(p) -2
(b) Value of b is	(q) 1
(c) Value of a is	(r) 24
(d) Acceleration at $t = 4$ s is	(s) -10

A.

B.

C.

D.

Answer:

$(a) \rightarrow (s); (b) \rightarrow (p); (c) \rightarrow (q); (d) \rightarrow (r)$

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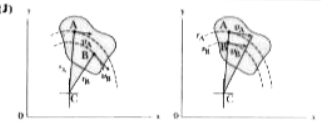
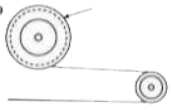
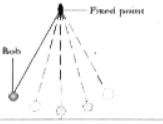
2. In the given table, Columns I and II given statements regarding different types of motion of particle along straight line and Column III shows figures depicting the motion.

Column I	Column II	Column III
(I) When it moves in such a way that the linear distance covered by each particle is	(i) repeats its motion about a fixed point	(J) 
(II) A particle covering	(ii) the same during the motion	(K) 
(III) The kind of movement when an object	(iii) undergoes the same angular displacement about a particular axis of rotation	(L) 
(IV) Every particle of the body	(iv) equal displacements in equal intervals of time	(M) 

(1) Which combination of statements is characteristic of oscillatory motion ?

A. (I) (ii) (J)

B. (III) (i) (M)

C. (II) (i) (M)

D. (I) (iii) (J)

Answer: $(1) \rightarrow (b); (2) \rightarrow (d); (3) \rightarrow (c)$

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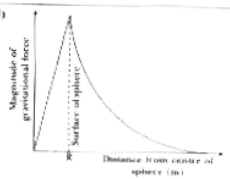
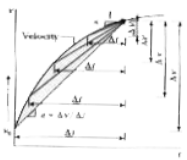
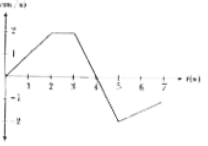
3. In the given table, Columns I and II give statements regarding the velocity and acceleration of particle in different types of motion along a straight line and Column III shows figures depicting the motion.

Column I	Column II	Column III
(I) Ratio of the total change in velocity to the	(i) velocity at any point of time	(J) 
(II) The rate of change of	(ii) total time taken in which this velocity change takes place	(K) 
(III) Acceleration on an object caused	(iii) with respect to time	(L) 
(IV) The rate of change of angular velocity	(iv) by gravity, irrespective of the mass or composition of the body	(M) 

(1) Which combination of statements explains

about instantaneous acceleration ?

(a) (III) (iv) (J) (b) (I) (i) (K) (c) (III) (iii) (K) (d) (I) (ii) (L)

A. (I) (iii) (L)

B. (IV) (iii) (M)

C. (IV) (i) (M)

D. (II) (i) (K)

Answer: $(1) \rightarrow (d); (2) \rightarrow (b); (3) \rightarrow (a)$

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Practice Questions Integer Type

1. A particle is dropped from a height h and at the same instant another particle is projected vertically up from the ground. They meet when the upper one has descended a height h/3. Find the ratio of their velocities at this instant.

A.

B.

C.

D.

Answer: 2

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2. A key falls from a bridge that is 45 m above the water. It falls directly into a model boat, moving with constant velocity, that is 12 m from the point of impact when the key is released . What is the speed of the boat ?

A.

B.

C.

D.

Answer: 4

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3. A bullet loses $1/20$ of its velocity on passing through a plank. What is the least number of planks that are required to stop the bullet ?

A.

B.

C.

D.

Answer: 11

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