Chapter 2—Motion in One Dimension

MULTIPLE CHOICE

1. The position of a particle moving along the x axis is given by $x = (21 + 22t - 6.0t^2)$m, where t is in s. What is the average velocity during the time interval $t = 1.0$ s to $t = 3.0$ s?
   a. –6.0 m/s
   b. –4.0 m/s
   c. –2.0 m/s
   d. –8.0 m/s
   e. 8.0 m/s

   ANS: C PTS: 2 DIF: Average

2. 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. –500 km/s^2
   b. –550 km/s^2
   c. –360 km/s^2
   d. –520 km/s^2
   e. –275 km/s^2

   ANS: B PTS: 3 DIF: Challenging

3. The position of a particle moving along the x axis is given by $x = 6.0t^2 - 1.0t^3$, where x is in meters and t in seconds. What is the position of the particle when it achieves its maximum speed in the positive x direction?
   a. 24 m
   b. 12 m
   c. 32 m
   d. 16 m
   e. 2.0 m

   ANS: D PTS: 3 DIF: Challenging

4. The velocity of a particle moving along the x axis is given for $t > 0$ by $v_x = (32.0t - 2.00t^3)$ m/s, where t is in s. What is the acceleration of the particle when (after $t = 0$) it achieves its maximum displacement in the positive x direction?
   a. –64.0 m/s^2
   b. zero
   c. 128 m/s^2
   d. 32.0 m/s^2
   e. –32.0 m/s^2

   ANS: A PTS: 3 DIF: Challenging

5. The position of a particle as it moves along the x axis is given for $t > 0$ by $x = (t^3 - 3t^2 + 6t)$ m, where t is in s. Where is the particle when it achieves its minimum speed (after $t = 0$)?
   a. 3 m
   b. 4 m
   c. 8 m
   d. 2 m

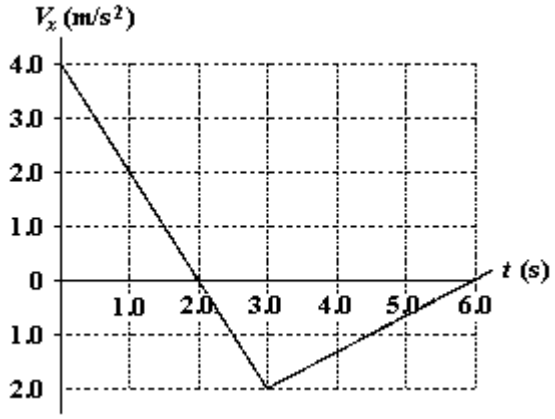
e. 7 m

ANS: B PTS: 2 DIF: Average

6. The position of a particle as it moves along the x axis is given by $x = 15e^{-2t}$ m, where t is in s. What is the acceleration of the particle at $t = 1.0$ s?
   a. 22 m/s
   b. 60 m/s
   c. 8.1 m/s
   d. 15 m/s
   e. 35 m/s

   ANS: C PTS: 2 DIF: Average

7. V_x is the velocity of a particle moving along the x axis as shown. If $x = 2.0$ m at $t = 1.0$ s, what is the position of the particle at $t = 6.0$ s?



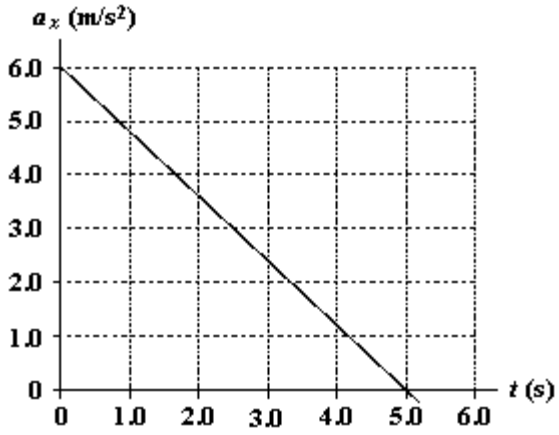
   a. –2.0 m
   b. +2.0 m
   c. +1.0 m
   d. –1.0 m
   e. 6.0 m

   ANS: D PTS: 2 DIF: Average

8. A particle moving along the x axis has a position given by $x = (24t - 2.0t^3)$ m, where t is measured in s. What is the magnitude of the acceleration of the particle at the instant when its velocity is zero?
   a. 24 m/s^2
   b. zero
   c. 12 m/s^2
   d. 48 m/s^2
   e. 36 m/s^2

   ANS: A PTS: 2 DIF: Average

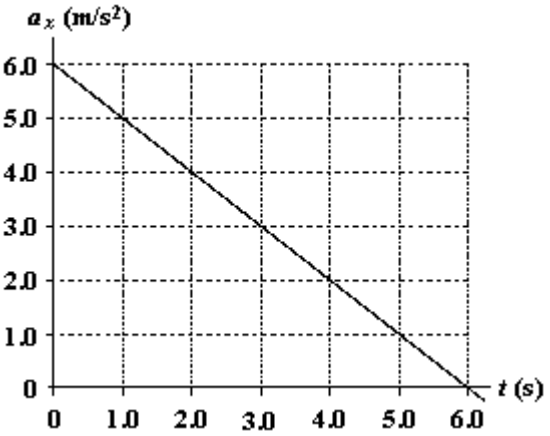
9. At $t = 0$, a particle is located at $x = 25$ m and has a velocity of 15 m/s in the positive x direction. The acceleration of the particle varies with time as shown in the diagram. What is the velocity of the particle at $t = 5.0$ s?



a. +15 m/s
b. –15 m/s
c. +30 m/s
d. 0
e. –1.2 m/s

ANS: C PTS: 2 DIF: Average

10. At $t = 0$, a particle is located at $x = 25$ m and has a velocity of 15 m/s in the positive x direction. The acceleration of the particle varies with time as shown in the diagram. What is the position of the particle at $t = 5.0$ s?



a. 175 m
b. 125 m
c. 138 m
d. 154 m
e. 165 m

ANS: D PTS: 3 DIF: Challenging

11. A particle confined to motion along the x axis moves with constant acceleration from $x = 2.0$ m to $x = 8.0$ m during a 2.5-s time interval. The velocity of the particle at $x = 8.0$ m is 2.8 m/s. What is the acceleration during this time interval?
a. 0.48 m/s^2
b. 0.32 m/s^2
c. 0.64 m/s^2

d. 0.80 m/s^2
e. 0.57 m/s^2

ANS: B PTS: 3 DIF: Challenging

12. A proton moving along the *x* axis has an initial velocity of 4.0×10^6 m/s and a constant acceleration of 6.0×10^{12} m/s^2. What is the velocity of the proton after it has traveled a distance of 80 cm?
a. 5.1×10^6 m/s
b. 6.3×10^6 m/s
c. 4.8×10^6 m/s
d. 3.9×10^6 m/s
e. 2.9×10^6 m/s

ANS: A PTS: 2 DIF: Average

13. A particle moving with a constant acceleration has a velocity of 20 cm/s when its position is $x = 10$ cm. Its position 7.0 s later is $x = -30$ cm. What is the acceleration of the particle?
a. -7.3 cm/s^2
b. -8.9 cm/s^2
c. -11 cm/s^2
d. -15 cm/s^2
e. -13 cm/s^2

ANS: A PTS: 2 DIF: Average

14. An automobile moving along a straight track changes its velocity from 40 m/s to 80 m/s in a distance of 200 m. What is the (constant) acceleration of the vehicle during this time?
a. 8.0 m/s
b. 9.6 m/s
c. 12 m/s
d. 6.9 m/s
e. 0.20 m/s

ANS: C PTS: 2 DIF: Average

15. In 2.0 s, a particle moving with constant acceleration along the *x* axis goes from $x = 10$ m to $x = 50$ m. The velocity at the end of this time interval is 10 m/s. What is the acceleration of the particle?
a. $+15$ m/s^2
b. $+20$ m/s^2
c. -20 m/s^2
d. -10 m/s^2
e. -15 m/s^2

ANS: D PTS: 2 DIF: Average

16. An automobile manufacturer claims that its product will, starting from rest, travel 0.40 km in 9.0 s. What is the magnitude of the constant acceleration required to do this?
a. 9.9 m/s^2
b. 8.9 m/s^2
c. 6.6 m/s^2
d. 5.6 m/s^2
e. 4.6 m/s^2

ANS: A PTS: 2 DIF: Average

17. An automobile traveling along a straight road increases its speed from 30.0 m/s to 50.0 m/s in a distance of 180 m. If the acceleration is constant, how much time elapses while the auto moves this distance?
    a. 6.00 s
    b. 4.50 s
    c. 3.60 s
    d. 4.00 s
    e. 9.00 s

    ANS: B PTS: 2 DIF: Average

18. An object moving on the *x* axis with a constant acceleration increases its *x* coordinate by 80 m in a time of 5.0 s and has a velocity of +20 m/s at the end of this time. Determine the acceleration of the object during this motion.
    a. $-1.6\ \text{m/s}^2$
    b. $+6.4\ \text{m/s}^2$
    c. $+1.6\ \text{m/s}^2$
    d. $-2.0\ \text{m/s}^2$
    e. $-6.4\ \text{m/s}^2$

    ANS: C PTS: 2 DIF: Average

19. An electron, starting from rest and moving with a constant acceleration, travels 2.0 cm in 5.0 ms. What is the magnitude of this acceleration?
    a. $2.5\ \text{km/s}^2$
    b. $0.80\ \text{km/s}^2$
    c. $1.6\ \text{km/s}^2$
    d. $1.3\ \text{km/s}^2$
    e. $3.2\ \text{km/s}^2$

    ANS: C PTS: 1 DIF: Easy

20. A particle starts from rest at $x_i = 0$ and moves for 10 s with an acceleration of $+2.0\ \text{cm/s}^2$. For the next 20 s, the acceleration of the particle is $-1.0\ \text{cm/s}^2$. What is the position of the particle at the end of this motion?
    a. zero
    b. +3.0 m
    c. –1.0 m
    d. +2.0 m
    e. –3.0 m

    ANS: B PTS: 2 DIF: Average

21. A rocket, initially at rest, is fired vertically with an upward acceleration of $10\ \text{m/s}^2$. At an altitude of 0.50 km, the engine of the rocket cuts off. What is the maximum altitude it achieves?
    a. 1.9 km
    b. 1.3 km
    c. 1.6 km
    d. 1.0 km
    e. 2.1 km

    ANS: D PTS: 3 DIF: Challenging

22. A ball is thrown vertically upward with an initial speed of 20 m/s. Two seconds later, a stone is thrown vertically (from the same initial height as the ball) with an initial speed of 24 m/s. At what height above the release point will the ball and stone pass each other?
    a. 17 m
    b. 21 m
    c. 18 m
    d. 27 m
    e. 31 m

    ANS: A PTS: 3 DIF: Challenging

23. An object is thrown vertically and has an upward velocity of 18 m/s when it reaches one fourth of its maximum height above its launch point. What is the initial (launch) speed of the object?
    a. 35 m/s
    b. 25 m/s
    c. 30 m/s
    d. 21 m/s
    e. 17 m/s

    ANS: D PTS: 3 DIF: Challenging

24. 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?
    a. 2.0 s
    b. 6.1 s
    c. 3.5 s
    d. 1.6 s
    e. 1.0 s

    ANS: A PTS: 2 DIF: Average

25. An object is thrown downward with an initial ($t = 0$) speed of 10 m/s from a height of 60 m above the ground. At the same instant ($t = 0$), a second object is propelled vertically upward from ground level with a speed of 40 m/s. At what height above the ground will the two objects pass each other?
    a. 53 m
    b. 41 m
    c. 57 m
    d. 46 m
    e. 37 m

    ANS: B PTS: 3 DIF: Challenging

26. A toy rocket, launched from the ground, rises vertically with an acceleration of 20 m/s^2 for 6.0 s until its motor stops. Disregarding any air resistance, what maximum height above the ground will the rocket achieve?
    a. 1.1 km
    b. 0.73 km
    c. 1.9 km
    d. 0.39 km
    e. 1.5 km

    ANS: A PTS: 3 DIF: Challenging

27. 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.
    a. 44 m
    b. 14 m
    c. 74 m
    d. 30 m
    e. 60 m

    ANS: C PTS: 2 DIF: Average

28. A ball thrown vertically from ground level is caught 3.0 s later when it is at its highest point by a person on a balcony which is 14 m above the ground. Determine the initial speed of the ball.
    a. 19 m/s
    b. 4.7 m/s
    c. 10 m/s
    d. 34 m/s
    e. 17 m/s

    ANS: A PTS: 2 DIF: Average

29. An object is thrown vertically upward such that it has a speed of 25 m/s when it reaches two thirds of its maximum height above the launch point. Determine this maximum height.
    a. 64 m
    b. 48 m
    c. 32 m
    d. 96 m
    e. 75 m

    ANS: D PTS: 2 DIF: Average

30. The velocity at the midway point of a ball able to reach a height y when thrown with velocity v_i at the origin is:
    a. $\frac{v_i}{2}$
    b. $\sqrt{v_i^2 2gy}$
    c. $\sqrt{\frac{v_i^2}{2}}$
    d. $\sqrt{v_i^2 + 2gy}$
    e. gy

    ANS: C PTS: 2 DIF: Average

31. When Jim and Rob ride bicycles, Jim can only accelerate at three quarters the acceleration of Rob. Both start from rest at the bottom of a long straight road with constant upward slope. If Rob takes 5.0 minutes to reach the top, how much earlier should Jim start to reach the top at the same time as Rob?
    a. 25 s
    b. 40 s
    c. 46 s
    d. 55 s
    e. 75 s

    ANS: C PTS: 3 DIF: Challenging

32. When starting from rest at the bottom of a straight road with constant upward slope, Joan bicycles to the top 50.0 s ahead of Sally, whose travel time is 5.00 minutes. What is the ratio of Joan's acceleration to Sally's acceleration?
    a. 0.694
    b. 0.833
    c. 1.20
    d. 1.44
    e. 6.00

    ANS: D PTS: 2 DIF: Average

33. To help Kim practice for the Special Olympics, Sally runs beside him for half the required distance. She runs the remaining distance at her regular speed and arrives 90 seconds ahead of Kim. What is the ratio of Sally's regular speed to Kim's speed? Use t_{Kim} for Kim's total time.
    a. $\dfrac{t_{Kim}}{90\ \text{s}}$
    b. $\dfrac{t_{Kim}}{t_{Kim} - 90\ \text{s}}$
    c. $\dfrac{t_{Kim}}{t_{Kim} - 180\ \text{s}}$
    d. $\dfrac{t_{Kim}}{180\ \text{s}}$
    e. $\dfrac{t_{Kim} - 90\ \text{s}}{t_{Kim} - 180\ \text{s}}$

    ANS: C PTS: 2 DIF: Average

34. The position of a particle moving along the *y* axis has a position given by

$$y = 0.20\text{m} + \left(8.0\,\frac{\text{m}}{\text{s}}\right)t - \left(10\,\frac{\text{m}}{\text{s}^2}\right)t^2$$

    Is there any time interval during which the particle is not moving?
    a. Yes, from 0.60 s to 1.00 s.
    b. Yes, from 0.795 s to 0.805 s.
    c. Yes, at the time $t = 0.80$ s.
    d. No, the velocity is never zero.
    e. No, an instant is not the same as a time interval.

    ANS: E PTS: 1 DIF: Easy

35. A particle moving along the *x* axis has a position given by $x = 54t - 2.0t^3$ m. At the time $t = 3.0$ s, the speed of the particle is zero. Which statement is correct?
    a. The particle remains at rest after $t = 3.0$ s.
    b. The particle no longer accelerates after $t = 3.0$ s.
    c. The particle can be found at positions $x < 0$ m only when $t < 0$ s.
    d. All of the above are correct.
    e. None of the above is correct.

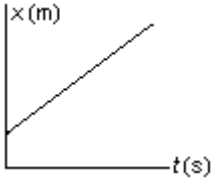
    ANS: E PTS: 2 DIF: Average

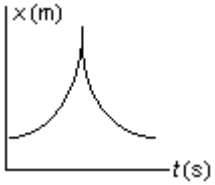
36. Two identical balls are at rest side by side at the bottom of a hill. Some time after ball A is kicked up the hill, ball B is given a kick up the hill. Ball A is headed downhill when it passes ball B headed up the hill. At the instant when ball A passes ball B,
    a. it has the same position and velocity as ball B.
    b. it has the same position and acceleration as ball B.
    c. it has the same velocity and acceleration as ball B.
    d. it has the same displacement and velocity as ball B.
    e. it has the same position, displacement and velocity as ball B.

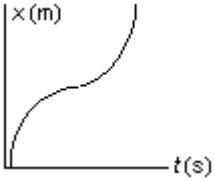
    ANS: B PTS: 1 DIF: Easy

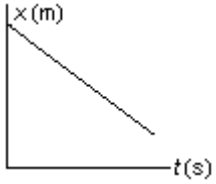
37. The position of an object at equal time intervals is shown below:

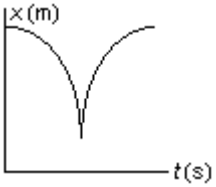
    Which graph below correctly represents position versus time for this object?

a. 

c. 

e. 

b. 

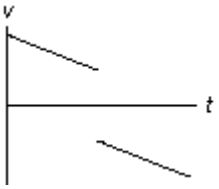
d. 

    ANS: E PTS: 1 DIF: Easy

38. Two identical balls are at rest and side by side at the top of a hill. You let one ball, A, start rolling down the hill. A little later you start the second ball, B, down the hill by giving it a shove. The second ball rolls down the hill along a line parallel to the path of the first ball and passes it. At the instant ball B passes ball A:
    a. it has the same position and the same velocity as A.
    b. it has the same position and the same acceleration as A.
    c. it has the same velocity and the same acceleration as A.
    d. it has the same displacement and the same velocity as A.
    e. it has the same position, displacement and velocity as A.

    ANS: B PTS: 2 DIF: Average

39. The graph below shows the velocity versus time graph for a ball. Which explanation best fits the motion of the ball as shown by the graph?



    a. The ball is falling, is caught, and is thrown down with greater velocity.
    b. The ball is rolling, stops, and then continues rolling.
    c. The ball is rising, hits the ceiling, and falls down.

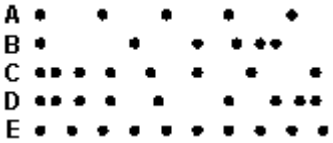
d. The ball is falling, hits the floor, and bounces up.
e. The ball is rising, is caught, and then is thrown down.

ANS: C PTS: 1 DIF: Easy

40. 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. 10 m/s; 9.8 m/s^2.
b. 9.0 m/s; 9.8 m/s^2.
c. 9.0 m/s; 9.0 m/s^2.
d. 1.0 m/s; 9.0 m/s^2.
e. 1.0 m/s; 9.8 m/s^2.

ANS: A PTS: 1 DIF: Easy

41. Five motion diagrams in which points represent the positions of an object at equal time intervals are shown below. Which statement is correct?



a. A has the greatest speed and the greatest acceleration.
b. C has decreasing speed.
c. D slows down and then speeds up.
d. D speeds up and then slows down.
e. E has a greater speed than A.

ANS: D PTS: 2 DIF: Average

42. Two children start at one end of a street, the origin, run to the other end, then head back. On the way back Joan is ahead of Mike. Which statement is correct about the distances run and the displacements from the origin?
a. Joan has run a greater distance and her displacement is greater than Mike's.
b. Mike has run a greater distance and his displacement is greater than Joan's.
c. Joan has run a greater distance, but her displacement is less than Mike's.
d. Mike has run a greater distance, but his displacement is less than Joan's.
e. Mike has run a shorter distance, and his displacement is less than Joan's.

ANS: C PTS: 1 DIF: Easy

43. A juggler throws two balls to the same height so that one is at the halfway point going up when the other is at the halfway point coming down. At that point:
a. Their velocities and accelerations are equal.
b. Their velocities are equal but their accelerations are equal and opposite.
c. Their accelerations are equal but their velocities are equal and opposite.
d. Their velocities and accelerations are both equal and opposite.
e. Their velocities are equal to their accelerations.

ANS: C PTS: 1 DIF: Easy

44. A car travels north at 30 m/s for one half hour. It then travels south at 40 m/s for 15 minutes. The total distance the car has traveled and its displacement are:

a. 18 km; 18 km S.
b. 36 km; 36 km S.
c. 36 km; 36 km N.
d. 90 km; 18 km N.
e. 90 km; 36 km N.

ANS: D PTS: 2 DIF: Average

45. A skier leaves a ski jump with a horizontal velocity of 29.4 m/s. The instant before she lands three seconds later, the magnitudes of the horizontal and vertical components of her velocity are:
a. 0; 29.4 m/s.
b. 29.4 m/s; 0.
c. 29.4 m/s; 29.4 m/s.
d. 29.4 m/s; 41.6 m/s.
e. 41.6 m/s; 41.6 m/s.

ANS: C PTS: 2 DIF: Average

46. The equation that solves a problem is $\left(18\,\frac{\text{m}}{\text{s}}\right)^2 - \left(0\,\frac{\text{m}}{\text{s}}\right)^2 = 2\left(3.0\,\frac{\text{m}}{\text{s}^2}\right)(3.0\,\text{m})$. The problem is:
a. What is the initial velocity of a car that goes from rest to 18 m/s in 3.0 s?
b. What is the final velocity of a car that goes from rest to 18 m/s in 3.0 s?
c. What is the initial velocity of a car that accelerates at 18 m/s for 3.0 s?
d. What is the final velocity of a car that accelerates at 3.0 m/s^2 over a 6.0 m distance?
e. What is the final velocity of a car that accelerates at 3.0 m/s^2 over a 3.0 m distance?

ANS: E PTS: 2 DIF: Average

47. The equation that solves a problem is $6.4\,\text{m} = 20\,\text{m} + 3.0\,\frac{\text{m}}{\text{s}}(2.0\,\text{s}) - 4.9\,\frac{\text{m}}{\text{s}^2}(2.0\,\text{s})^2$. The problem is:
a. How far above its initial position does a rock travel in 2.0 s when thrown up from a point 40 m above the ground?
b. How far below its initial position does a rock travel in 2.0 s when thrown up from a point 40 m above the ground?
c. What is the position relative to the ground of a rock thrown up at 3.0 m/s from a roof 20 m above the ground 2.0 s after it is released?
d. What is the change in position relative to the ground of a rock thrown up at 3.0 m/s from a roof 20 m above the ground 2.0 s after it is released?
e. What is the position relative to the ground of a rock thrown up at 3.0 m/s from a roof 20 m above the ground if its maximum height is 33.6 m?

ANS: C PTS: 2 DIF: Average

48. Dallas says that any change in velocity is directly proportional to the time interval over which the change took place. Dana says that is true only when the acceleration is constant. Which one, if either, is correct?
a. Dana, because it *is* true only when the acceleration is constant.
b. Dallas, because we can define $a_{x,\,\text{avg}}$ so that $\Delta v_x = a_{x,\,\text{avg}}\Delta t$.
c. Dallas, because $a_{x,\,\text{avg}}$ always is equal to $\frac{a_{x,i} + a_{x,f}}{2}$.
d. All the above are correct.
e. Only (a) and (b) above are correct.

ANS: A PTS: 2 DIF: Average

49. The area under a graph of v_x vs. t from $t = t_i$ to $t = t_f$ represents
    a. x_i.
    b. x_f.
    c. $x_f - x_i$.
    d. $\frac{1}{2}(x_i + x_f)$.
    e. $x_i + x_f$.

    ANS: C PTS: 1 DIF: Easy

50. The area under a graph of a_x vs. t from $t = t_i$ to $t = t_f$ represents
    a. $x_f - x_i$.
    b. $v_f - v_i$.
    c. x_{avg}.
    d. v_{avg}.
    e. a_{avg}.

    ANS: B PTS: 1 DIF: Easy

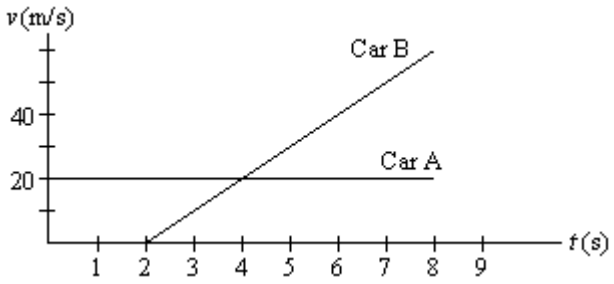
51. In 20 minutes, Kara ran 2.40 km on a treadmill facing due east. Relative to the gym, what were her displacement and average velocity during this time interval?
    a. 0; 0
    b. 0; 2.00 m/s
    c. 2.40 km, east; 0
    d. 2.40 km, east; 2.00 m/s, east
    e. 2.40 km, west; 2.00 m/s, west

    ANS: A PTS: 1 DIF: Easy

52. A swimmer swims 20 laps in a north-south facing pool in 7.00 minutes. Her first lap is toward the north. Her displacement and average velocity are
    a. 0; 0.
    b. 0; 2.38 m/s, south.
    c. 0; 2.38 m/s, north.
    d. 1 000 m, south; 2.38 m/s, south.
    e. 1 000 m, north; 2.38 m/s, north.

    ANS: A PTS: 1 DIF: Easy

53. Driver A is cruising along enjoying the fall colors. Driver B starts her car at the instant he passes her. Their velocities are shown as functions of time in the graph below. At what instants in time on the graph are drivers A and B side by side?



    a. 0 s, 2 s

b. 0 s, 4 s
c. 2 s, 4 s
d. 2 s, 6 s
e. 4 s, 6 s

ANS: D PTS: 2 DIF: Average

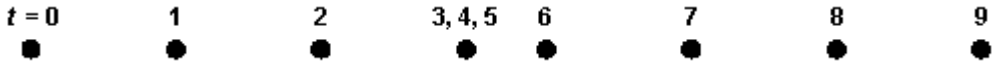
54. Cart A, of mass *m*, starts from rest and travels in a straight line with acceleration *a*. It traverses a distance *x* in time *t*. Cart B, of mass 4*m*, starts from rest and travels in a straight line with acceleration $\frac{a}{2}$. At time *t* it has traversed the distance
a. $\frac{x}{4}$.
b. $\frac{x}{2}$.
c. *x*.
d. 2*x*.
e. 4*x*.

ANS: B PTS: 2 DIF: Average

55. Cart A, of mass *m*, starts from rest and travels in a straight line with acceleration *a*. It reaches velocity *v* in time *t*. Cart B, of mass 4*m*, starts from rest and travels in a straight line with acceleration $\frac{a}{2}$. At time *t* it has reached velocity
a. $\frac{v}{4}$.
b. $\frac{v}{2}$.
c. *v*.
d. 2*v*.
e. 4*v*.

ANS: B PTS: 2 DIF: Average

56. The small circles in the diagram below represent the positions along the *x* axis of a body at equal time intervals. Assume the body moves in a straight line.



This diagram is most likely to describe
a. a swimmer swimming laps.
b. an exercise on a rowing machine.
c. a person on a treadmill.
d. a tennis ball during a volley.
e. a runner who tripped, fell, rose, and continued racing.

ANS: E PTS: 2 DIF: Average

57. A problem may be solved more easily when alternative representations are used. The best strategy is to formulate representations in an order that assists in understanding the physical principles involved. Of the orders given below, the one that will work best most often is
a. pictorial representation, mathematical representation, tabular representation, mental

representation.
b. pictorial representation, mental representation, mathematical representation, tabular representation.
c. mathematical representation, pictorial representation, tabular representation, mental representation.
d. mathematical representation, tabular representation, mental representation, pictorial representation.
e. mental representation, pictorial representation, tabular representation, mathematical representation.

ANS: E PTS: 1 DIF: Easy

58. The speed of an object is given by $v = 5.00t^2 + 4.00t$ where v is in m/s and t is in s.What is the acceleration of the object at t = 2.00 s?
a. 5.00 m/s^2
b. 9.00 m/s^2
c. 10.0 m/s^2
d. 14.0 m/s^2
e. 20.0 m/s^2

ANS: E PTS: 2 DIF: Average

59. A particle is moving at constant velocity. Its position at t = 1.0 s is 3.0 m and its position at t = 4.0 s is 15.0 m. What is the slope of the position-time graph for this particle?
a. 0, since this is a constant velocity situation.
b. 4.0 m/s
c. 4.0 m/s^2
d. 9.0 m/s
e. 12 m/s^2

ANS: B PTS: 2 DIF: Average

60. A particle is moving with a constant acceleration of 4.0 m/s^2. Its speed at t = 1.0 s is 4.0 m/s and at t = 3.0 s it is 12.0 m/s. What is the area under the position-time graph for the interval from t = 1.0 s to t = 3.0 s?
a. 8.0 m/s
b. 8.0 m
c. 12 m
d. 16 m
e. 16 m/s^2

ANS: D PTS: 2 DIF: Average

PROBLEM

61. A 50-gram superball traveling at 25.0 m/s is bounced off a brick wall and rebounds at 22.0 m/s. A high-speed camera records this event. If the ball is in contact with the wall for 3.50 ms, what is the average acceleration of the ball during this time interval?

ANS:
13 400 m/s^2

PTS: 2 DIF: Average

62. A boat moves at 10.0 m/s relative to the water. If the boat is in a river where the current is 2.0 m/s, how long does it take the boat to make a complete round trip of 1.00 km upstream followed by a 1.00 km trip downstream?

ANS:
208 s

PTS: 2 DIF: Average

63. A bicyclist starts down a hill with an initial speed of 2.0 m/s. She moves down the hill with a constant acceleration, arriving at the bottom of the hill with a speed of 8.0 m/s. If the hill is 12 m long, how long did it take the bicyclist to travel down the hill?

ANS:
2.4 s

PTS: 2 DIF: Average

64. A helicopter descends from a height of 600 m with uniform negative acceleration, reaching the ground at rest in 5.00 minutes. Determine the acceleration of the helicopter and its initial velocity.

ANS:
$-0.013\ 3\ m/s^2$, –4.0 m/s

PTS: 2 DIF: Average

65. A speedy tortoise can run with a velocity of 10.0 cm/s and a hare can run 20.0 times as fast. In a race, they both start at the same time, but the hare stops to rest for 2.00 minutes. The tortoise wins by a shell (20.0 cm). What was the length of the race?

ANS:
12.6 m

PTS: 3 DIF: Challenging

66. A peregrine falcon dives at a pigeon. The falcon starts with zero downward velocity and falls with the acceleration of gravity. If the pigeon is 76.0 m below the initial height of the falcon, how long does it take the falcon to intercept the pigeon?

ANS:
3.94 s

PTS: 2 DIF: Average

67. Starting from rest, a car travels 1 350 meters in 1.00 minute. It accelerated at $1.0\ m/s^2$ until it reached its cruising speed. Then it drove the remaining distance at constant velocity. What was its cruising speed?

ANS:
30 m/s

PTS: 3 DIF: Challenging

68. A car originally traveling at 30 m/s manages to brake for 5.0 seconds while traveling 125 m downhill. At that point the brakes fail. After an additional 5.0 seconds it travels an additional 150 m down the hill. What was the acceleration of the car after the brakes failed?

ANS:
4.0 m/s^2

PTS: 2 DIF: Average