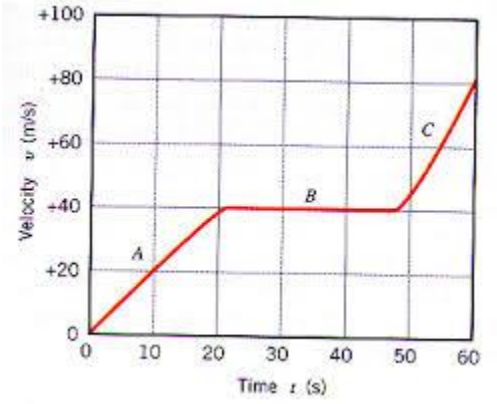
Part B Problems

1. While accelerating at 4.0 m/s^2, an object's velocity changes from 50 m/s to 80 m/s. How far (in meters) did it travel during this time?

2. A hiker travels 15 km due east, then travels north for 20 km. How far is she from her starting point?

3. The figure below shows the velocity of an object as a function of time. How far (in meters) does the object travel during journeys A, B, and C? (Use x = average velocity x time).



4. An automobile and a motorcycle are 600 meters apart. The automobile is moving at 30 m/s is chasing a motorcycle that's moving at 25 m/s. The automobile then begins to gain speed at rate of 2.0 m/s^2, while the motorcycle begins to lose speed at the rate of 1.0 m/s^2. After how many seconds will the automobile have caught up with the motorcycle?

5. An automobile's initial speed is 20 m/s. After traveling 300 meters, its speed is 40 m/s. What was the object's acceleration?

6. A ball is thrown downward at a speed 10 m/s from the top of a 9-meter cliff. What will be its speed when it strikes the ground?

7. An arrow is fired upward with initial velocity 40 m/s. (a) After how many seconds will its velocity be reduced to zero? (b) What average velocity did it have on the way up? (c) What maximum height does the arrow reach?

8. A ball is dropped over the edge of a cliff. (a) What will be its velocity three seconds later? (b) What average velocity did it have during this time? (c) How far did it travel?

9. A ball is thrown downward at speed 20 m/s from the top of a 70-meter building. After how many seconds will it strike the ground?

10. A bullet is fired straight upward. What will be its velocity one second before reaching

maximum height? (b) Two seconds after reaching maximum height?

11. A struck golf ball acquires an initial horizontal velocity of 45 m/s, and an initial vertical velocity of 19.6 m/s. (a) How many seconds does it take the ball to reach maximum height, i.e., what is the "rise time" ? (b) How many more seconds does it take to fall to the ground, i.e., what is the "fall time"? (c) What total time was ball in the air? (d) How far horizontally did the ball travel, ground to ground?

12. A kicked soccer ball leaves the ground with a vertical speed of 19.6 m/s and lands 20 meters away. What must have been the soccer ball's initial horizontal speed?

Part B Solutions

1. $80^2 = 50^2 + 2(4)\ x$
$x = 487.50$ m

2. $d = (15^2 + 20^2)^{1/2}$
$= 25$ km

3. A: $x = 400$ m
B: $x = 1200$ m
C: $x = 600$ m

4. Distance traveled by automobile equals the distance traveled by motorcycle, plus 600 m:

Auto Distance = $30t + \frac{1}{2}(2)\ t^2$
Cycle Distance = $25t - \frac{1}{2}(1)\ t^2$

$30t + \frac{1}{2}(2)\ t^2 = 25t - \frac{1}{2}(1)\ t^2 + 600$

$t = 18.4$ s

5.

$40^2 = 20^2 + 2a\ (300)$
$a = 2.0$ m/s^2

6. $\mathbf{v^2} = (-10)^2 + 2(-9.8)(-9)$
$v = \pm 16.63$ m/s
$v = -16.63$ m/s
We chose the negative answer above because the object is moving downward (in the negative direction) as it strikes the ground.

Speed = $|v|$
$= 16.63$ m/s

7.

(a) $v = v_o - gt$
$0 = 40 - 9.8\ t$
$t = 40/9.8$
$= 4.08$ s
(b) 20 m/s
(c) $x = \bar{v}\ t$
$= 20(4.08)$
$= 81.6$ m

8.

(a) $v = 0 - 9.8(3)$
$= -29.4$ m/s

(b) $\bar{v} = \frac{1}{2}(v_o + v)$
$= [0 + (-29.4)]/2$
$= -14.7$ m/s
(c) $x = \bar{v}\ t$
$= -14.7(3)$
$= -44.1$ m
Distance traveled:

44.1 m

9. $-70 = -20t + \frac{1}{2}(-9.8)t^2$
$t = 2.25$ s

10.

(a)) $v = v_o - gt$
$0 = v_o - 9.8\ (1)$
$v_o = 9.8$ m/s

Note: the same answer applies to the last one second of any projectile's upward travel, whether the object was fired upward at 100 m/s, 200 m/s, or 1000 m/s.

(b) For the two-second period of time beginning when the object has reached maximum height (when v = 0), the velocity at the end of 2.0 seconds of fall is

$v = v_o - gt$
$= 0 - (9.8)\ (2)$
$= -19.6$ m/s

11.

(a) $v = v_o - gt$
$0 = 19.6 - 9.8\ t$
$t = 2.0$ s

(b) fall time = rise time
$= 2.0$ s

(c) $2.0 + 2.0 = 4.0$ s

(d) $x = v_o t + \frac{1}{2}\ at^2$
$= 45(4.0) + 0$
$= 180$ m

12. $v = v_o - gt$
$0 = 19.6 - 9.8t$
$t = 2.0$ s (rise time)
Fall time = Rise time
$= 2.0$ s
Time in the air = rise time + fall time
$= 2.0$ s $+ 2.0$ s
$= 4.0$ s

$x = v_o t + \frac{1}{2}\ at^2$
$20 = v_o t + 0$
$= v_o\ (4.0)$

$v_o = 5.0$ m/s