

- 7.75 m/s in a time of 5.77 s. What is the car's average acceleration?
- 18 An airplane in straight-line flight changes speed from 460 km/h to 325 km/h in 52.5 s. Express the plane's average acceleration in  $\text{m/s}^2$ .
- 19 A car moving at 23.7 m/s skids to a stop in 10.8 s. Find the car's average acceleration and the distance it travels while stopping.
- 20 A drag racer claims to be able to go from rest to 200 mi/h in 5.0 s. What is the average acceleration of this car in  $\text{m/s}^2$ ? How far does the racer go in this time?
- 21 A certain drag racer covers a distance of one-quarter mile in 4.87 s, starting from rest. What is the average acceleration of this racer, and what is its speed at the quarter-mile mark?
- 22 A bullet traveling 220 m/s strikes a tree and penetrates 4.33 cm before stopping. Find the average acceleration of the bullet and the time it takes to stop.
- 23 In a television tube such as that mentioned in Prob. 3, electrons are accelerated from rest to  $1.25 \times 10^8$  m/s in a distance of 1.12 cm. How long does this take, and what is the average acceleration of the electrons?
- 24 A truck traveling at 22.5 m/s decelerates at  $2.27 \text{ m/s}^2$ .  
 (a) How much time does it take for the truck to stop?  
 (b) How far does it travel while stopping? (c) How far does it travel during the third second after the brakes are applied?
- 25 A bullet traveling 190 m/s strikes a piece of wood 2.54 cm thick and passes through, emerging with a speed of 80 m/s. Find the average acceleration of the bullet and the time it takes to pass through the wood.
- 26 A rubber ball traveling at a speed of 31.5 m/s strikes a concrete wall and bounces straight backward with a speed of 28.5 m/s. The collision with the wall took 0.15 s. Find the average acceleration the ball experienced during the collision.
- 27 A locomotive is pulling a train 580 m long, including the locomotive. The locomotive accelerates uniformly from rest and reaches a road crossing 1.35 km from its starting point in 9.66 min. (a) How long after the locomotive reaches the crossing does the caboose reach the crossing, assuming the train maintains its uniform acceleration? (b) How fast is the train going when the caboose reaches the crossing?
- 28 The first car of a stationary train is blocking a crossing. Just as the train begins to move, a waiting motorist notices that it takes 18.8 s for one railcar to move through a distance equal to its length  $L$ . Find the train's acceleration in terms of  $L$ . Assuming constant acceleration, how long after the train starts will the first 50 railcars have passed the waiting motorist?
- 29 A car is traveling at 27 m/s along a road parallel to a railroad track. How long does it take the car to pass a 920-m-long train traveling at 18.3 m/s (a) in the same direction as the car and (b) in the opposite direction?
- 30 Just as a car starts to accelerate from rest at a constant  $2.44 \text{ m/s}^2$ , a bus moving at a constant speed of 19.6 m/s passes the car in a parallel lane. How long before the car overtakes the bus? How fast is the car going then? How far has the car gone at that point?
- 31 Two cars, both traveling at 30.5 m/s, are headed toward each other in the same traffic lane. When they are 250 m apart they see each other and begin to decelerate at the same rate. What must be the magnitude of this deceleration if the cars are to barely avoid collision?

**Section 2.9** *acceleration*  $g = -10 \text{ m/s}^2$

- 32 A loose brick falls from a window ledge to the street 21.3 m below. How fast is the brick going just as it hits the street? How much time does it take the brick to fall?
- 33 A person falls off a plank which hangs over a stream. She hits the stream 1.32 s later. How far above the stream is the plank? How fast is the person going when she hits the water?
- 34 You throw a baseball straight upward with an initial speed of 23.9 m/s. How high above the point of release from your hand does the ball go before starting to fall? How much time does it take the ball to reach its maximum height?
- 35 A stone is thrown straight downward from the top of a building 26.0 m high with an initial speed of 18.6 m/s. How long does it take the stone to reach the ground? How fast is the stone moving just as it hits the ground?
- 36 A batter hits a popup where the baseball goes straight upward. The fielder catches the ball 9.3 s after it was hit, at the same level the ball left the bat. How high did the baseball go? How fast was the ball going just as it was caught?
- 37 A girl standing on top of a 22-m-high building throws a coin upward with a speed of 8.8 m/s. How long does it take the coin to hit the ground? How fast is the coin going just as it hits the ground?
- 38 A 1.9-m-tall burglar is running along a sidewalk at a constant speed of 3.77 m/s. Your apartment window is 17.8 m directly above this sidewalk. You drop a flowerpot from rest that hits the burglar on the head directly below you. How far away from the point of impact was the burglar at the time you released the flowerpot?
- 39 Two balls are dropped from different heights. One is dropped 0.85 s before the other, but both strike the ground at the same time, 6.25 s after the first ball was dropped. From what heights were the two balls released?
- 40 An elevator in which a woman is standing is moving upward at a constant speed of 3.35 m/s. The woman drops a coin from a height of 1.25 m above the elevator floor. How long does it take the coin to strike the elevator floor?
- 41 Repeat Prob. 40 if the elevator is at rest at the instant the coin is dropped, but is accelerating upward at  $3.5 \text{ m/s}^2$ .

**Section 2.10**

- 42 A marble rolls horizontally off a table at a speed of 3.7 m/s. A second marble is dropped vertically from the table at the same instant. If the table is 1.20 m high, how far apart do the marbles land? What difference is there in the times of impact of the two marbles?