

19. A car accelerates uniformly from rest to a speed of 65 km/h (18 m/s) in 12 s. Find the distance the car travels during this time.

For problems 20–23, see Sample Problem D.

20. A car traveling at +7.0 m/s accelerates at the rate of $+0.80 \text{ m/s}^2$ for an interval of 2.0 s. Find v_f .
21. A car accelerates from rest at -3.00 m/s^2 .
- What is the velocity at the end of 5.0 s?
 - What is the displacement after 5.0 s?
22. A car starts from rest and travels for 5.0 s with a uniform acceleration of $+1.5 \text{ m/s}^2$. The driver then applies the brakes, causing a uniform acceleration of -2.0 m/s^2 . If the brakes are applied for 3.0 s, how fast is the car going at the end of the braking period, and how far has it gone from its start?
23. A boy sledding down a hill accelerates at 1.40 m/s^2 . If he started from rest, in what distance would he reach a speed of 7.00 m/s?

For problems 24–25, see Sample Problem E.

24. A sailboat starts from rest and accelerates at a rate of 0.21 m/s^2 over a distance of 280 m.
- Find the magnitude of the boat's final velocity.
 - Find the time it takes the boat to travel this distance.
25. An elevator is moving upward at 1.20 m/s when it experiences an acceleration of 0.31 m/s^2 downward, over a distance of 0.75 m. What will its final velocity be?

FALLING OBJECTS

Conceptual Questions

26. A ball is thrown vertically upward.
- What happens to the ball's velocity while the ball is in the air?
 - What is its velocity when it reaches its maximum altitude?
 - What is its acceleration when it reaches its maximum altitude?
 - What is its acceleration just before it hits the ground?
 - Does its acceleration increase, decrease, or remain constant?

27. The image at right is a strobe photograph of two falling balls released simultaneously. (This motion does not take place in a vacuum.) The ball on the left side is solid, and the ball on the right side is a hollow table-tennis ball. Analyze the motion of both balls in terms of velocity and acceleration.



28. A juggler throws a bowling pin into the air with an initial velocity v_i . Another juggler drops a pin at the same instant. Compare the accelerations of the two pins while they are in the air.
29. A bouquet is thrown upward.
- Will the value for the bouquet's displacement be the same no matter where you place the origin of the coordinate system?
 - Will the value for the bouquet's velocity be the same?
 - Will the value for the bouquet's acceleration be the same?

Practice Problems

For problems 30–32, see Sample Problem F.

30. A worker drops a wrench from the top of a tower 80.0 m tall. What is the velocity when the wrench strikes the ground?
31. A peregrine falcon dives at a pigeon. The falcon starts downward from rest with free-fall acceleration. If the pigeon is 76.0 m below the initial position of the falcon, how long does the falcon take to reach the pigeon? Assume that the pigeon remains at rest.
32. A ball is thrown upward from the ground with an initial speed of 25 m/s; at the same instant, a ball is dropped from rest from a building 15 m high. After how long will the balls be at the same height?

MIXED REVIEW

33. If the average speed of an orbiting space shuttle is 27 800 km/h, determine the time required for it to circle Earth. Assume that the shuttle is orbiting about 320.0 km above Earth's surface, and that Earth's radius is 6380 km.