22. • How long does it take for radiation from a cesium-133 atom to complete 1.5 million cycles?

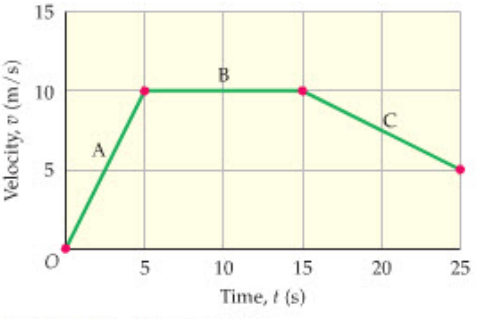
**(10)**

46. •• **IP** A Porsche sports car can accelerate at 14 $m/s^2$. **(a)** Is this acceleration greater than, less than, or equal to 14 $ft/s^2$? Explain. **(b)** Determine the acceleration of a Porsche in $ft/s^2$. **(c)** Determine its acceleration in $km/h^2$.

**(10)**

36. •• A motorcycle moves according to the velocity-versus-time graph shown in **Figure 2–28**. Find the average acceleration of the motorcycle during each of the following segments of the motion: **(a)** A, **(b)** B, and **(c)** C.

**(10)**




▲ **FIGURE 2–28** Problem 36

54. •• Two cars drive on a straight highway. At time $t = 0$, car 1 passes mile marker 0 traveling due east with a speed of 20.0 m/s. At the same time, car 2 is 1.0 km east of mile marker 0 traveling at 30.0 m/s due west. Car 1 is speeding up with an acceleration of magnitude 2.5 $m/s^2$, and car 2 is slowing down with an acceleration of magnitude 3.2 $m/s^2$. **(a)** Write $x$-versus-$t$ equations of motion for both cars, taking east as the positive direction. **(b)** At what time do the cars pass next to one another?

**(10)**

92. •• A model rocket blasts off and moves upward with an acceleration of 12 $m/s^2$ until it reaches a height of 26 m, at which point its engine shuts off and it continues its flight in free fall. **(a)** What is the maximum height attained by the rocket? **(b)** What is the speed of the rocket just before it hits the ground? **(c)** What is the total duration of the rocket's flight?

**(10)**

41. •• You drive a car 1500 ft to the east, then 2500 ft to the north. If the trip took 3.0 minutes, what were the direction and magnitude of your average velocity?

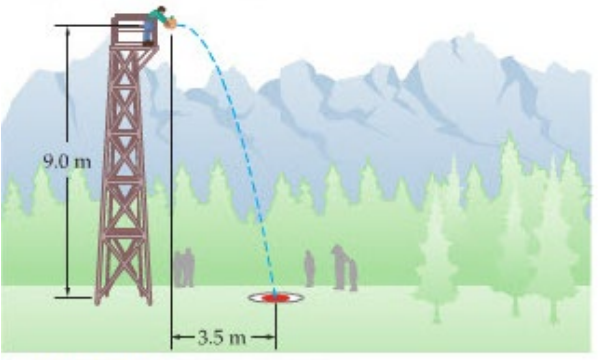
**(10)**

60. • You slide a box up a loading ramp that is 10.0 ft long. At the top of the ramp the box has risen a height of 3.00 ft. What is the angle of the ramp above the horizontal?

**(10)**

19. •• **Pumpkin Toss** In Denver, children bring their old jack-o-lanterns to the top of a tower and compete for accuracy in hitting a target on the ground (Figure 4–15). Suppose that the tower is 9.0 m high and that the bull's-eye is a horizontal distance of 3.5 m from the launch point. If the pumpkin is thrown horizontally, what is the launch speed needed to hit the bull's-eye?

**(10)**




▲ FIGURE 4–15 Problems 19 and 20

72. •• A ball thrown straight upward returns to its original level in 2.75 s. A second ball is thrown at an angle of 40.0° above the horizontal. What is the initial speed of the second ball if it also returns to its original level in 2.75 s?

**(10)**

81. ••• As discussed in Example 4–7, the archerfish hunts by dislodging an unsuspecting insect from its resting place with a stream of water expelled from the fish's mouth. Suppose the archerfish squirts water with a speed of 2.15 m/s at an angle of 52.0° above the horizontal, and aims for a beetle on a leaf 3.00 cm above the water's surface. **(a)** At what horizontal distance from the beetle should the archerfish fire if it is to hit its target in the least time? **(b)** How much time will the beetle have to react?

**(10)**

**Total= 100**

**Weight: 25%**