3 REVIEW

55. **a.** 32.5 m
b. 1.78 s

56. **a.** 5.0×10^1 m/s
b. 4.0×10^1 m

57. **a.** 57.7 km/h at 60.0° west of the vertical
b. 28.8 km/h straight down

58. 12.0 s

59. 18 m; 7.9 m

60. 15.3 m

61. 6.19 m/s downfield

62. **a.** 2.4×10^4 m
b. 152 s
c. 6.0×10^4 m

55. A car is parked on a cliff overlooking the ocean on an incline that makes an angle of 24.0° below the horizontal. The negligent driver leaves the car in neutral, and the emergency brakes are defective. The car rolls from rest down the incline with a constant acceleration of 4.00 m/s^2 and travels 50.0 m to the edge of the cliff. The cliff is 30.0 m above the ocean.

a. What is the car's position relative to the base of the cliff when the car lands in the ocean?
b. How long is the car in the air?

56. A golf ball with an initial angle of 34° lands exactly 240 m down the range on a level course.

a. Neglecting air friction, what initial speed would achieve this result?
b. Using the speed determined in item (a), find the maximum height reached by the ball.

57. A car travels due east with a speed of 50.0 km/h. Rain is falling vertically with respect to Earth. The traces of the rain on the side windows of the car make an angle of 60.0° with the vertical. Find the velocity of the rain with respect to the following:

a. the car
b. Earth

58. A shopper in a department store can walk up a stationary (stalled) escalator in 30.0 s. If the normally functioning escalator can carry the standing shopper to the next floor in 20.0 s, how long would it take the shopper to walk up the moving escalator? Assume the same walking effort for the shopper whether the escalator is stalled or moving.

59. If a person can jump a horizontal distance of 3.0 m on Earth, how far could the person jump on the moon, where the free-fall acceleration is $g/6$ and $g = 9.81$ m/s^2? How far could the person jump on Mars, where the acceleration due to gravity is $0.38g$?

60. A science student riding on a flatcar of a train moving at a constant speed of 10.0 m/s throws a ball toward the caboose along a path that the student judges as making an initial angle of 60.0° with the horizontal. The teacher, who is standing on the ground nearby, observes the ball rising vertically. How high does the ball rise?

61. A football is thrown directly toward a receiver with an initial speed of 18.0 m/s at an angle of 35.0° above the horizontal. At that instant, the receiver is 18.0 m from the quarterback. In what direction and with what constant speed should the receiver run to catch the football at the level at which it was thrown?

62. A rocket is launched at an angle of 53° above the horizontal with an initial speed of 75 m/s, as shown below. It moves for 25 s along its initial line of motion with an acceleration of 25 m/s^2. At this time, its engines fail and the rocket proceeds to move as a free body.

a. What is the rocket's maximum altitude?
b. What is the rocket's total time of flight?
c. What is the rocket's horizontal range?

