

## Acceleration PRACTICE Problems

1. Daniel Sheehan is running down the street at 10 meters per second. He sees a double-tall latte on the road ahead of him and starts sprinting. After 5 seconds have passed, Daniel is running at 15 meters per second. Assuming He does not change direction, what was Daniel's acceleration?
2. Traver Justessen's older brother Coddie is falling off a cliff. At the beginning of his fall, his velocity is 0 meters per second. After 10 seconds, his velocity is 98 meters per second. What was Coddie's acceleration? (Coddie was uninjured when he hit the ground because he landed on Mr. Thompson).
3. Rena Carr is riding her bike across a parking lot. She is heading east at 20 meters per second. She runs over Mr. Thompson, who is lying down in the parking lot looking at a new species of ant. Five seconds after running over Mr. Thompson, Rena is heading east at 15 meters per second. What was Rena's acceleration?
4. Gabe Condrea throws a pumpkin onto Mr. Loupe's car. At first, Gabe is holding the pumpkin motionless. 2 seconds later, the pumpkin leaves Gabe's hands traveling at 300 meters per second. Assuming it does not change direction, what was the acceleration of the pumpkin?
5. A car can accelerate at  $2 \text{ m/s}^2$ . How long will it take to speed up from  $1 \text{ m/s}$  to  $11 \text{ m/s}$ ?
6. A bicyclist accelerates at  $1 \text{ m/s}^2$  during a  $4.0 \text{ s}$  interval. What is the change in the speed of the bicyclist and the bicycle?
7. A freight train traveling with a speed of  $10.0 \text{ m/s}$  begins braking as it approaches a train yard. The train's acceleration while braking is  $0.5 \text{ m/s}^2$ . What is the train's speed after  $30 \text{ s}$ ?
8. An automobile accelerates  $2 \text{ m/s}^2$  over  $6.00 \text{ s}$  to reach freeway speed at the end of an entrance ramp. If the car's final speed is  $30.0 \text{ m/s}$ , what was its initial speed when it began accelerating?
9. The "street" automobile with the greatest acceleration is the Tempest. It has an acceleration of  $7 \text{ m/s}^2$ . Suppose the car accelerates from rest to a final speed of  $28 \text{ m/s}$ . How long does it take the Tempest to reach this speed?
10. The Impact is the first commercial electric car to be developed in over 60 years. During tests in 1994, the car reached a top speed of over  $80 \text{ m/s}$ . Suppose the car started at rest and then underwent a constant acceleration of  $1.5 \text{ m/s}^2$  until it reached its top speed. How long did it take the Impact to reach its top speed?
11. The gravitational force between Mars and an object near its surface is much lower than the force between an object on Earth's surface and Earth. If a dropped hammer's speed increases from  $0.0 \text{ m/s}$  to  $7.5 \text{ m/s}$  in  $2 \text{ s}$ , what is the acceleration due to the gravitational force on the surface of Mars?

### Extra Credit Problem Set

1. A runner whose initial speed is 29 km/h increases her speed to 31 km/h in order to win a race. If the runner takes 5.0 s to complete this increase in her speed, what is her acceleration?
2. A certain roller coaster accelerates its cars  $6.35 \text{ m/s}^2$  up the first incline. If this acceleration happens during the first 7.0 s of the ride, how much does the speed of the roller coaster cars increase?
3. The solid-fuel rocket boosters used to launch the space shuttle are able to lift the shuttle 45 km above Earth's surface. During that time, the shuttle undergoes a nearly constant total acceleration of  $6.25 \text{ m/s}^2$ , so that its speed increases from rest to about 750 m/s. How long does it take for the shuttle to reach this speed?
4. Bonnie Blair currently holds the world record for skating 500.0 m in 38.69 s, which she set in 1995. Suppose that after she crossed the finish line she coasted to a stop on the ice. If her initial speed was 13 m/s and her acceleration was  $.2.9 \text{ m/s}^2$ , how long did it take her to stop?
5. The elevators in the Landmark Tower, in Yokohama, Japan, are among the fastest in the world. They accelerate upward at  $3.125 \text{ m/s}^2$  for 4.00 s to reach their final speed. If these elevators start at rest, what is their final speed?
6. A ship with a mass of  $5.22 \times 10^7 \text{ kg}$  has engines capable of an acceleration equal to  $.0357 \text{ m/s}^2$ . Suppose the ship approaches the dock at a speed of 16.98 m/s. How much time does the ship need to stop?
7. A dog runs with an initial speed of 1.5 m/s on a waxed floor. It slides to a stop with an acceleration of  $.035 \text{ m/s}^2$ . How long does it take for the dog to stop?
8. A certain type of rocket sled is used to measure the effects of sudden, extreme deceleration. The sled reaches a top speed of 320 km/h, then comes to a complete stop in 0.18 s. What is the acceleration that takes place in this time?
9. The building with the highest occupiable floor is currently the Sears Tower in Chicago. The top floor of the Sears Tower is 110 stories (436 m) above street level, and the roof of the tower is 442 m above the street. Assume a golf ball is thrown downward from the roof of the Sears Tower. Neglecting air resistance, the golf ball accelerates at  $9.8 \text{ m/s}^2$  and lands on the pavement after 9.2 s. If the ball's final speed is 93.0 m/s, what was the speed with which the ball was initially thrown?
10. In the theory of plate tectonics, various segments of Earth's crust, called plates, move toward and away from each other. In one instance, the plate that consists of the Indian subcontinent drifted from southeastern Africa to its current position in Asia, traveling at a speed of 15 cm/y. This plate collided with Asia, forming the Himalayan mountain range in the process. Most of this formation occurred during the last  $1.00 \times 10^7$  years, during which time the Indian subcontinent's motion has slowed to about 5 cm/y. What has been the acceleration, in units of  $\text{cm/y}^2$ , of the Indian subcontinent during this time period?