Kinematics in One Dimension Chapter Test Review

1. A car approaches a stoplight, slowing down. However, before it reaches the intersection, the light turns green and the driver takes his foot off the brake. The car enters the intersection with a speed of 8.30 m/s, speeding up at the rate of 1.50 m/s^2 and maintaining this acceleration until it reaches the speed limit, 13.9 m/s.

   (a) Sketch a graph of the car's velocity against time up to the instant when it reaches the speed limit, starting with the instant it enters the intersection. What is the y-intercept of your graph? What is its slope? What is its equation?

   (b) What is the speed of the car 2.0 s after it enters the intersection?

   (c) How far does the car travel during the 2.0 s after it enters the intersection?

   (d) How far does the car travel during the 3.0 s after entering the intersection?

   (e) How far does the car travel before reaching the speed limit?

   (f) How long after it enters the intersection does the car reach a speed of 9.0 m/s?

2. A tennis ball is dropped (that is, allowed to fall, not thrown) to the ground from a roof, a height of 5.74 m. Once it has been released, like all objects close to the Earth's surface with no force on them but the force of gravity, it has a constant acceleration of 9.8 m/s^2 downward.

   (a) Sketch a graph of the ball's velocity against time, starting with the instant when it is dropped and ending 1.50 s later. What is the y-intercept of your graph? What is its slope? What is its equation?

   (b) What is the speed of the ball 0.15 s after it is dropped?

   (c) How far does the ball fall during the 0.15 s after it is dropped?

   (d) How far does the ball fall during the 0.50 s after it is dropped?

   (e) What is the speed of the ball when it reaches the ground?

   (f) How long does it take the ball to reach the ground?

Solve Problem 3 again, this time assuming that the height of the roof above the ground is 3.54 m.

3. A car begins to speed up at a constant rate. 5.0 s later,. it has reached a speed of 14.0 m/s and has travelled 55 m. What was its speed when it started to accelerate?

4. A car travelling at 13.9 m/s accelerates up to 15.0 m/s in 0.50 s. What is its acceleration?

5. A bus accelerating at a constant rate covers 250 m while its speed changes from 8.2 m/s to 21 m/s What is its acceleration?

6. A car is travelling at the speed limit, 22.2 m/s. However, the driver sees a red light ahead and puts on the brakes, slowing down at a constant rate of 2.00 m/s^2 until the car stops.

(a) Sketch a graph of the car's velocity against time, starting with the instant when the driver puts on the brakes and ending when the car stops. What is the y-intercept of your graph? What is its slope? What is its equation?

(b) What is the speed of the car 5.0 s after the driver brakes?

(c) How far does the car travel during the first 5.0 s after the driver brakes?

(d) How far does the car travel during the first 7.0 s after the driver brakes?

(e) How far does the car go before stopping?

(f) How long after the driver brakes does the car's velocity reach 10.0 m/s?

7. A stone is thrown upward into the air with an initial velocity of 15.6 m/s. Once it has been released, like all objects close to the Earth which have no force on them but the force of gravity, it has a constant acceleration equal to 9.8 m/s^2 downward, whether the object is rising or falling.

(a) Sketch a graph of the stone's velocity against time, starting with the instant it is released from the thrower's hand and ending 5.0 s later. What is the y- intercept of your graph? What is its slope? What is its equation?

(b) What is the speed of the stone 1.2 s after it is thrown? In what direction is it moving?

(c) How far does the stone rise during the first 1.2 s after it is thrown?

(d) What is the speed of the stone 1.8 s after it is thrown? In what direction is it moving?

(e) What is the stone's displacement during the 1.8 s after it is thrown? 1.8 s after it is thrown, is it above or below the point from which it was thrown?

(f) What is the displacement of the stone during the first 3.0 s after it is thrown? 3.0 s after it is thrown, is it above or below the point from which it was thrown?

(g) What is the displacement of the stone during the first 5.0 s after it is thrown? 5.0 s after it is thrown, is it above or below the point from which it was thrown?

(h) How long after the stone is thrown is it travelling upward with a speed of 9.5 m/s?

(i) How long after the stone is thrown is it travelling downward with a speed of 9.5 m/s?

(j) How long after the stone is thrown does it reach its highest point? (Hint: What is the stone's velocity at this point?)

(k) How long after the stone is thrown does it come back again to the point from which it was thrown? (Hint: At this point, what is the stone's displacement from its original position?)

(l) What is the stone's speed when it comes back again to its original position? How does it compare with the speed with which it was thrown?

(m) Solve Problem 10 again, this time assuming that the stone is thrown upward with a speed of 12.74 m/s.