1. (Ch03, Q02) **No, the ball is not accelerated.** During each time interval, the ball travels the same distance. Therefore its speed

\[ s = \frac{d}{t} \]

is the same for each time interval. Since there is no change in speed, the ball does not accelerate.

2. (Ch03, Q04) Both balls have the **same** acceleration due to gravity. **All** objects experience the same acceleration, independent of their mass. Therefore it does not matter that lead is more massive than aluminum.

3. (Ch03, Q12) The rock is **decelerating** as it rises up in the air, so it is traveling more slowly near the top of its flight than it is near the bottom. Since it covers less distance in the same amount of time, the time spent in the top 5 meters is **greater** than the time spent in the first 5 meters of flight.

4. (Ch03, Q16) Yes, the acceleration **is constant** during this process. The velocity **is not constant**. The acceleration is **never equal to zero**.

5. (Ch03, Q18) The **first** ball has the greatest total velocity. Both balls have the same **vertical** velocity component, the first ball has a **horizontal** component of velocity as well. The combined horizontal plus vertical velocity is greatest for the first ball.

6. (Ch03, E01)
   (a)
   \[ v = v_o + at = 0 + 9.8 \times 0.8 = 7.84 \text{ meters/sec} \]
   (b)
   \[ v = v_o + at = 0 + 9.8 \times 1.6 = 15.68 \text{ meters/sec} \]

7. (Ch03, E02)
   (a)
   \[ d = v_o t + \frac{1}{2} at^2 = 0 + \frac{1}{2} \times 9.8 \times 0.8^2 = 3.136 \text{ meters} \]
   (b)
   \[ d = v_o t + \frac{1}{2} at^2 = 0 + \frac{1}{2} \times 9.8 \times 1.6^2 = 12.544 \text{ meters} \]
8. (Ch03, E10)

(a) In the usual constant acceleration equations, we use $a = 3.0 \text{ m/s}^2$. The ball is initially travelling upward, we take this to be the positive direction. Acceleration is downward or negative.

$$v = v_o + at = 18 \text{ m/s} + (-3.0 \text{ m/s}^2)(4 \text{ s}) = 6.0 \text{ m/s}$$

(b) To solve this part of the problem, we need to realize that at the high point of its flight the ball’s velocity $v = 0$. Then we can use the usual relation:

$$v = v_o + at = 0$$

and solve for time (after some algebra):

$$t = \frac{v - v_0}{a} = \frac{0 - 18 \text{ m/s}}{-3.0 \text{ m/s}^2} = 6 \text{ s}$$

9. (Ch03, E14)

(a) Vertical and horizontal components of the motion are independent, therefore we compute the vertical velocity using the usual equation for motion under constant acceleration:

$$v = v_0 + at = 0 + 10 \times 0.6 = 6.0 \text{ m/s}$$

(the answer is 5.88 m/s using the usual $g = 9.8 \text{ m/s}^2$).

(b) The horizontal component of the ball’s velocity does not change (Law of Inertia). Therefore just before the ball hits the floor its horizontal velocity is 5 m/s.

10. (Ch03, SP02)

(a) Use the constant acceleration equation $v = v_0 + at$. Ball A has $v_0 = 0$, ball B has $v_o = 12 \text{ m/s}$. So,

$$v_A = v_{A0} + at = 0 + 9.8 \times 1.5 = 14.7 \text{ m/s}$$

$$v_B = v_{B0} + at = 12 + 9.8 \times 1.5 = 26.7 \text{ m/s}$$

(b) Now use the constant acceleration equation for the distance fallen, $d = v_0t + \frac{1}{2}at^2$:

$$d_A = v_{A0}t + (1/2)at^2 = 0 \times 1.5 + (1/2) \times 9.8 \times 1.5^2 = 11.025 \text{ meters}$$

$$d_B = v_{B0}t + (1/2)at^2 = 12 \times 1.5 + (1/2) \times 9.8 \times 1.5^2 = 29.025 \text{ meters}$$

(c) No, the difference between velocities will never change. Consider equations (1) and (2) above: The difference $v_B - v_A$ will always be just the difference between initial velocities $v_{B0} - v_{A0}$. 