1. You are throwing a ball straight up in the air. At the highest point, the ball's

   (a) velocity and acceleration are zero.

   (b) velocity is not zero but its acceleration is zero.

   (c) acceleration is not zero, but its velocity is zero.

   (d) velocity and acceleration are both not zero

   Answer (c): Acceleration due to gravity is constant and downward. Velocity changes uniformly form positive to negative and is zero at the highest point.

2. Which one of the following choices is correct in the case of uniformly accelerated motion?

   (a) Distance increases at the same rate as time.

   (b) Velocity increases at the same rate as time.

   (c) Acceleration increases at the same rate as time.

   (d) Force increases at the same rate as time.

   Answer (b): Acceleration is the change in velocity with respect to time. If acceleration is uniform (ie constant) then velocity must change at the same rate as time.

3. A sprinter in a 100 dash accelerates uniformly from rest reaching a top speed of 14.7 m/s after 6.00 seconds. He then runs at constant speed for the remainder of the race.

   (a) What is his rate of acceleration during the initial phase of the race?
   $a = \dfrac{\Delta v}{\Delta t} = (14.7 - 0)/6.0 = 2.45 \text{ m/s}^2$

   (b) How far did he travel in the first phase of the race?
   The distance covered is $\Delta x = \frac{1}{2}at^2 = \frac{1}{2}(2.45)(6)^2 = 44.1$ m

   (c) What was his time in the race?
   For the first part of the race $t_1 = 6.00$ s.
   For the second part $t_2 = \dfrac{\Delta x}{v} = \dfrac{100 - 44.1}{14.7} = 3.80$ s so total time is $t = 9.80$ s

   (d) What was his average acceleration over the entire race?
   $\bar{a} = \dfrac{\Delta v}{\Delta t} = \dfrac{14.7 - 0}{9.80} = 1.50 \text{ m/s}^2$

   (e) What was his average speed over the entire race?
   $\bar{v} = \dfrac{\Delta x}{\Delta t} = \dfrac{100}{9.8} = 10.2 \text{ m/s}$

4. You wake up and find yourself on a planet in a galaxy far far away. As you ponder your fate you gently toss a ball straight up. It it slowly rises and reaches a maximum height of 40 m after 10 seconds and then returns to your hand 20 seconds after you tossed it.

   (a) What was its average velocity on the way up? For the whole trip?

   Average velocity on the way up $\bar{v} = \dfrac{\Delta x}{\Delta t} = \dfrac{40}{10} = 4$ m/s. Similarly on the way down the displacement is zero so $\bar{v} = 0$ m/s.

   (b) From your answer to (a) deduce the initial velocity of the ball?

   For uniformly accelerated motion $\bar{v} = \dfrac{v_i + v_f}{2}$. But $v_f = 0$ since the velocity is zero at the highest point. Therefore $4 = \dfrac{v_i + 0}{2} \Rightarrow v_i = 8$ m/s.

   (c) Use this result to determine the acceleration due to gravity on this planet?

   $a = \dfrac{\Delta v}{t} = \dfrac{0 - 8}{10} = -0.8$ m/s