# Level 2: 1-D Motion Problems

1. You throw a tennis ball vertically upward and it returns to your hand at the same height 6.0 seconds later.
    a. For how many seconds did the ball fall after reaching its high point? _____
        (*Think* about it. Your guess is probably right!)

    b. How high did the ball go? **Solve this on the way down INSTEAD of on the way up…easier and same distance!** *(44 m or -44 m depending on direction)*
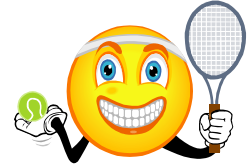
2. You are driving at 55.1 **miles per hour**, and suddenly you see a deer in front of you. You apply the brakes at a constant rate and bring your car to rest in 21.4 seconds.
    a. What is the acceleration? (A negative acceleration is the same as a deceleration.)*(-1.15 m/s²)*

    b. How far (Δx) did you travel while you decelerated? *(ans. 263 m)*

3. A bullet is shot from rest and leaves the muzzle of the gun at a speed of 410 m/s. The length of the gun barrel is 0.50 m. *(that's Δx)* How long (Δt) was the bullet in the gun's barrel after it was fired? *(ans. 0.0024 sec. Hint: This is a **2-step problem** because it is not moving at constant speed. You need to solve for the acceleration first and then use that to get the time.)*

4. During a 30-second interval, the speed of a rocket traveling horizontally in outer space rose steadily from 100 m/s to 500 m/s.   How far did the rocket travel during this time? *(≈9,000 m)* **HINT: a is NOT -9.8m/s², you need to solve it first*!***

5. An electron was uniformly accelerated from rest to a speed of 2.0 x 10⁷ m/s in a horizontal particle accelerator.
    a. If the electron traveled 0.10 m while being accelerated, what was its acceleration? *(2.0 x 10¹⁵ m/s²)*

    b. How long did it take to attain its final speed? Solve this part using <u>two different</u> equations. Make sure you get the same answer for each. *(1.0 x 10⁻⁸ sec.)*
Equation 1:   **Equation 2**:

6.
    a. A bullet is shot vertically upwards at an initial velocity of 908 **miles per hour**. Neglecting air resistance, how long does it take before the bullet stops rising? *(41.4 sec)*

    b. How high does the bullet go during this time? (ans. approximately 8,410m or -8,410 m depending on how you look at the problem, It is either going up through that distance or falling down that distance-either answer is correct.)