Up and Down Motion in Free Fall

1. A ball is thrown upward from ground level with an initial speed of 49.0 m/s. Use the how far? and how fast? equations to determine the displacement and velocity of the ball each consecutive second.

   How Far? $d = v_i \bullet t + 0.5 \bullet a \bullet t^2$

   How Fast? $v_f = v_i + a \bullet t$

2. At what time is the ball …

   a. … at its highest point? _____ s

   b. … landing on the ground? _____ s

3. How does the time to rise compare to the time to fall?

4. How does the launch speed of the ball compare to the landing speed of the ball?

t Time in Air (s)	d Displacement (m)	v Velocity (m/s)
0.0	0.0	49.0
1.0		
2.0		
3.0		
4.0		
5.0		
6.0		
7.0		
8.0		
9.0		
10.0		

5. Write an equation that relates the time to rise to the highest point (t_{up}) to the initial vertical velocity.

   $$t_{up} =$$

6. Use the equation in #5 and other concepts from #1-#4 to complete the following statements:

   a. A ball thrown upward at 19.6 m/s will reach its peak at t = _____ s and land on the ground at t = _____ s. It will be moving with a speed of _____ m/s when it lands.

   b. A ball thrown upward at 39.2 m/s will reach its peak at t = _____ s and land on the ground at t = _____ s. It will be moving with a speed of _____ m/s when it lands.

   c. A ball thrown upward at 26.2 m/s will reach its peak at t = _____ s and land on the ground at t = _____ s. It will be moving with a speed of _____ m/s when it lands.

   d. A ball thrown upward at _____ m/s will reach its peak at t = _____ s and land on the ground at t = 6.4 s. It will be moving with a speed of _____ m/s when it lands.

   e. A ball thrown upward at _____ m/s will reach its peak at t = _____ s and land on the ground at t = _____ s. It will be moving with a speed of _____ m/s when it lands. *(Free Choice)*

   f. A ball thrown upward at _____ m/s will reach its peak at t = _____ s and land on the ground at t = _____ s. It will be moving with a speed of _____ m/s when it lands. Insert expressions, using symbols v_i and a.