Name:

One Dimensional Motion Practice Problems

Please complete the following problems on lined paper. Restate each question before solving. Also be sure to include all units and work for credit!

Questions:

1. A car is traveling 10.0 m/s and accelerates for 3.00 seconds at a rate of 0.500 m/s^2. What is the final velocity?

2. A car initially traveling 20.0 m/s accelerates at a constant rate of 5.00 m/s2
   a. How much time will it take it to reach 33.0 m/s?
   b. How far does it travel to reach 33.0 m/s?
   c. What is its velocity 20.0 meters after starting to accelerate?
   d. How far does it travel to reach 40.0 m/s?

3. The car in #9 brakes with a constant acceleration of -4.00 m/s2
   a. How much time does it take to come to a complete stop from 40.0 m/s?
   b. How far does it travel from the time the brakes are applied until it comes to a complete stop?

4. Usain Bolt runs the 100 meter dash in 9.59 seconds. [The 100 meters is the defined length of the race so it is an exact number.]
   a. What is his average velocity over the entire race?
   b. Assume his acceleration is constant throughout the entire race (in reality this is not the case), what is his acceleration?
   c. What was his instantaneous velocity at 20.0 meters, 50.0 meters and 100.0 meters?

Formulas:

Constant velocity, no acceleration:

$$v_x = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{\Delta t} \quad or \quad x_f = x_i + v_x \Delta t$$

Displacement with unknown constant acceleration:

$$\Delta x = \tfrac{1}{2}(v_i + v_f)\Delta t$$

Final velocity with constant acceleration:

$$v_f = v_i + a \cdot \Delta t$$

Displacement with known constant acceleration:

$$\Delta x = v_i \cdot \Delta t + \tfrac{1}{2} a \cdot (\Delta t)^2$$

Final velocity after any displacement

$$v_f^2 = v_i^2 + 2a \cdot \Delta x$$