Physics 10154 - Exam #2B

Each problem is worth 50 points. Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work (or if some parts are incorrect) even if you get the right answer. Clearly indicate your answer with a circle or box and remember to include correct units and significant figures.

1. A car on a straight road starts from rest at a stoplight, accelerating at 3.5 m/s² for 55 meters. At that point, the driver sees a light turn red 33 meters away and starts to hit the brakes, decelerating at a rate of -5.0 m/s². Can the driver stop the car before reaching the red light?

Part 1

$\Delta x_1 = 55$

$v_{01} = 0$

$v_1 = ?$

$a_1 = 3.5\ m/s^2$

$t_1 = ?$

$v_1^2 = v_{01}^2 + 2a_1\Delta x_1$

$v_1^2 = 0^2 + 2(3.5)(55)$

$v_1 = 19.6\ m/s$

Part 2

$\Delta x_2 = ?$ (not 33)

$v_{02} = 19.6$ (from part 1)

$v_2 = 0$

$a_2 = -5.0\ m/s^2$

$t_2 = ?$

* or $\Delta x_2 = 33$, find $v_2 = ?$

$v_2^2 = v_{02}^2 + 2a_2\Delta x_2$

$0 = 19.6^2 + 2(-5)\Delta x$

$\Delta x = \frac{-19.6^2}{-10} = 38.5$

No, the car won't stop

2. An Australian swimmer in an Olympic race has a 0.30 second lead and is swimming at a constant speed of 5.5 meters/sec. He is 35 meters from the end of the race. Michael Phelps is in 2nd place. What must Phelps' average velocity be if he is to catch up with the leader at the end of the race?

$0.30\text{-sec lead} = (5.5)(0.3) = 1.65\text{-m lead}$

$\text{Phelps is } 35 + 1.65 = 36.65 \text{ m from finish}$

$\text{Australian will finish in } \frac{35}{5.5} = 6.36 \text{ s}$

$\text{So Phelps must swim: } v = \frac{36.65}{6.36}$

$= 5.76 \text{ or } \boxed{5.8 \text{ m/s}}$