

Physics 10154 - Exam #1C

Answer the following two questions. Be sure to clearly indicate your answer with a circle or box. Show all work. If I cannot see how you arrived at an answer, I will deduct points!

1. A driver is attempting to qualify for a 200-mile race, and he needs an overall average velocity of 180 miles/hour to do so. During the first 150 miles of the race, he drives at a constant speed of 195 miles/hour. How fast does he have to drive during the last 50 miles in order to have the target average velocity of 180 miles/hour? Answer with 3 SF.

<u>Part 1</u>	<u>Part 2</u>	<u>Total</u>
$\Delta x_1 = 150$	$\Delta x_2 = 50$	$\Delta x_{tot} = 200$
$v_1 = 195 \text{ mi/hr}$	$v_2 = ?$	$v_{tot} = 180 \text{ mi/hr}$
$t_1 = ?$	$t_2 = ?$	$t_{tot} = ?$

$$t_1 = \frac{\Delta x_1}{v_1} = .769 \text{ hr}$$

$$t_{tot} = \frac{\Delta x_{tot}}{v_{tot}} = 1.11 \text{ hr}$$

$$\text{so } t_2 = 0.342 \text{ hr}$$

$$v_2 = \frac{\Delta x_2}{t_2} = \frac{50}{.342} = \boxed{146 \text{ mi/hr}}$$

$$7.5 \text{ mi/hr} \cdot \frac{1609 \text{ m}}{\text{mi}} \cdot \frac{1 \text{ hr}}{3600 \text{ s}} = 3.35$$

2. A package is dropped from a descending balloon. It's initial speed is 7.5 miles/hour downward. It requires only 1.45 seconds to fall the last 25 meters. What was the initial height of the balloon (in meters) from which the package was dropped?

<u>Part 1</u>	<u>Part 2</u>
$\Delta y_1 =$	$\Delta y_2 = -25 \text{ m}$
$v_{01} = -3.35 \text{ m/s}$	v_{02}
$v_1 = ? \quad -10.1$	v_2
$a_1 = -9.8 \text{ m/s}^2$	$a_2 = -9.8 \text{ m/s}^2$
t_1	$t_2 = 1.45 \text{ s}$

Find v_{02}

$$\Delta y_2 = v_{02} t_2 + \frac{1}{2} a_2 t_2^2$$

$$-25 = v_{02} (1.45) - 4.9 (1.45)^2$$

$$-14.7 = v_{02} (1.45) \Rightarrow v_{02} = -10.1 \text{ m/s}$$

Use v_{02} as v_1 :

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

$$(-10.1)^2 = (-3.35)^2 + 2(-9.8)\Delta y_1$$

$$90.79 = -19.6 y_1, \quad y_1 = -4.63$$

$$\boxed{y_{\text{tot}} = 30 \text{ m}}$$