

Physics 10154 - Exam #1A

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 travels for 2 hours and 35 minutes along a straight road at 55 miles/hour. He then stops for a 25 minute rest break. How fast must he go during the final 90 minutes of his drive in order to average 58 miles/hour for the trip? Answer with 2 SF.

<u>Part 1</u>	<u>Part 2</u>	<u>Part 3</u>
$\Delta x_1 =$	$\Delta x_2 = 0$	$\Delta x_3 = ?$
$v_1 = 55 \text{ mi/hr}$	$v_2 = 0$	$v_3 = ?$
$t_1 = 2.583 \text{ hr}$	$t_2 = .417 \text{ hr}$	$t_3 = 1.5 \text{ hr}$

$$v_{\text{tot}} = 58 \frac{\text{miles}}{\text{hr}}$$

$$t_{\text{tot}} = 2.583 + .417 + 1.5 = 4.5 \text{ hr}$$

$$\text{so } \Delta x_{\text{tot}} = 261 \text{ miles}$$

$$v_1 t_1 + \Delta x_2 + \Delta x_3 = 261$$

$$142 + 0 + \Delta x_3 = 261 \quad \Delta x_3 = 119$$

$$v_3 = \frac{119 \text{ miles}}{1.5 \text{ hr}} = \boxed{79 \text{ mi/hr}}$$

2. A cross country runner is trying to complete a 3-mile course in 18 minutes. After 15 minutes at a constant speed, he realizes that there are still 1000 meters to go, but luckily it is slightly downhill, and so the runner will be able to uniformly accelerate at a rate of 0.018 m/s^2 for the remainder of the race.

Will the runner finish in a time less than 18 minutes total? Justify your yes/no answer numerically. Maintain at least 3 SF while doing calculations here.

3 miles
= 4827 m

Part 1

Part 2

$$\Delta x_1 = 3827 \text{ m}$$

$$\Delta x_2 = 1000 \text{ m}$$

$$v_{01} = 4.25$$

$$v_{02} = 4.25 \text{ m/s}$$

$$v_1 = 4.25$$

$$v_2 =$$

$$a_1 = 0$$

$$a_2 = 0.018 \text{ m/s}^2$$

$$t_1 = 900 \text{ s}$$

$$t_2 = 180 \text{ s}$$

$$v_{01} = v_1 = \frac{\Delta x_1}{t_1} = 4.25 \text{ m/s}$$

Assume $t = 180 \text{ s}$
+ find Δx

If $\Delta x_2 > 1000$, then runner finishes in time.

$$\Delta x_2 = v_{02} t_2 + \frac{1}{2} a_2 t_2^2$$

$$= (4.25)(180) + \frac{1}{2}(0.018)(180)^2$$

$$= 765.4 + 291.6 = \underline{1060}$$

So $\Delta x_2 > 1000$

yes