

Physics 10154 - Exam #1D

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 person takes a trip, driving with a constant speed of 55 miles/hour the whole time except for a 15 minute rest stop. The overall average speed for the trip works out to 47 miles/hour. How far does the person travel during the entire trip?

<u>Part 1</u>	<u>Part 2</u>	<u>Tot</u>
$v_1 = 55 \text{ mi/hr}$	$v_2 = 0$	$v_{TOT} = 47 \text{ mi/hr}$
$\Delta x_1 =$	$\Delta x_2 = 0$	$\Delta x_{TOT} =$
$t_1 =$	$t_2 = 0.25 \text{ hr}$	$t_{tot} =$

$$v_{TOT} = \frac{v_1 t_1 + v_2 t_2}{t_1 + t_2} = \frac{55 t_1 + 0}{t_1 + .25}$$

$$47(t_1 + .25) = 55 t_1$$

$$11.75 = 8 t_1$$

$$t_1 = 1.47 \text{ hr}$$

$$\text{So } \Delta x_1 = v_1 t_1 = 81 \text{ miles}$$

$$\Delta x_{tot} = 81 \text{ miles}$$

2. A model rocket is launched with an initial speed of zero and an upward acceleration of 14 m/s^2 . It rises to a height of 1200 feet before the engines cut out, and then it continues upward in free-fall motion before reaching a maximum height and then falling to the ground.

To what maximum height does the rocket ascend (in meters) in how long (in seconds) does it take to reach that height?

<u>Part 1</u>	<u>Part 2</u>
$\Delta y_1 = 365.7 \text{ m}$	$\Delta y_2 =$
$v_{01} = 0$	$v_{02} = \underline{101.2}$
$v_1 =$	$v_2 = 0$
$a_1 = 14 \text{ m/s}^2$	$a_2 = -9.8 \text{ m/s}^2$
$t_1 =$	$t_2 =$

Find v_1

$$v_1^2 = v_{01}^2 + 2a_1 \Delta x_1 \Rightarrow v_1 = 101.2 \text{ m/s}$$

Use v_1 as v_{02}

$$v_2^2 = v_{02}^2 + 2a_2 \Delta y_2$$

$$0^2 = (101.2)^2 - 19.6 \Delta y_2 \quad \Delta y_2 = 522.5 \text{ m}$$

$$\Delta y_{\text{tot}} = 365.7 + 522.5 = \boxed{890 \text{ m}}$$

$$\Delta y_1 = v_{01} t_1 + \frac{1}{2} a_1 t_1^2 \Rightarrow 365.7 = 0 + 7 t_1^2 \quad t_1 = \underline{7.23 \text{ s}}$$

$$v_2 = v_{02} + a_2 t_2 \Rightarrow t_2 = \frac{0 - 101.2}{-9.8} = \underline{10.3} \quad \boxed{t_{\text{tot}} = 18 \text{ s}}$$