Honors Physics Test - Ch. 2a - horizontal kinematics - 9-25-02 - Mr. Ward

Name WARD ____ °

1. (10 pts) How many seconds does it take a radio message to reach Mars if the velocity of the signal is a constant 2.99×10^8 m/s and the distance to Mars that day is 2.28×10^{11} m?

Kinematics Equations
(for constant "a")

missing	
Δx	$v_f = v_i + at$
v_f	$\Delta x = v_i t + \frac{1}{2} at^2$
t	$v_f^2 = v_i^2 + 2a\Delta x$
a	$\Delta x = \frac{1}{2}(v_f + v_i)\, t$
v_i	$\Delta x = v_f t - \frac{1}{2} at^2$

$t =$ ____ s

$V_{av} = 2.99 \times 10^8 \frac{m}{s}$

$\Delta X = 2.28 \times 10^{11} m$

$\Delta X = V_{av}\, t$

$t = \frac{\Delta X}{V_{av}}$

$= \frac{2.28 \times 10^{11} m}{2.99 \times 10^8 \frac{m}{s}}$

$\boxed{t = 763 s}$

$t =$ ____ s

$V_i = 2.99 \times 10^8 \frac{m}{s}$

$V_f = 2.99 \times 10^8 \frac{m}{s}$

$\Delta X = 2.28 \times 10^{11} m$

OR $\Delta X = \left(\frac{V_f + V_i}{2}\right) t$

$t = \frac{2\Delta X}{V_f + V_i}$

$= \frac{2(2.28 \times 10^{11} m)}{2.99 \times 10^8 \frac{m}{s} + 2.99 \times 10^8 \frac{m}{s}}$

$\boxed{t = 763 s}$

2. (10 pts) A rapid transit car accelerates at 2.05 m/s^2 and covers 200 m in 10.3 s. What is its initial velocity?

$V_i =$ ____ $\frac{m}{s}$

$a = 2.05 \frac{m}{s^2}$

$\Delta X = 200 m$

$t = 10.3 s$

$\Delta X = V_i t + \frac{1}{2} a t^2$

$V_i = \frac{\Delta X - \frac{1}{2} a t^2}{t}$

$= \frac{200 m - 0.5(2.05 \frac{m}{s^2})(10.3 s)^2}{10.3 s}$

$\boxed{V_i = 8.86 \frac{m}{s}}$

SLOWS DOWN

3. (10 pts) A ball hit the wall at 34.7 m/s and bounced back. If the collision lasted 4.85×10^{-3} seconds, and the ball's acceleration is 1.34×10^{4} m/s^2, at what velocity did it bounce back?

$V_f = \_\_\_ \frac{m}{s}$

$V_i = 34.7 \frac{m}{s}$

$t = 4.85 \times 10^{-3} s$

$a = -1.34 \times 10^{4} \frac{m}{s^2}$

$V_f = V_i + at$

$= 34.7 \frac{m}{s} - 1.34 \times 10^{4} \frac{m}{s^2} (4.85 \times 10^{-3} s)$

$\boxed{V_f = -30.3 \frac{m}{s}}$

4. (10 pts) A truck runs into a wall. If the truck is 95 cm shorter when it finally stops and if the crash takes 0.12 s, what speed was the truck going just before it hit?

$V_i = \_\_\_ \frac{m}{s}$

$\Delta X = 0.95 m$

$t = 0.012 s$

$V_f = 0 \frac{m}{s}$

$\Delta X = \frac{1}{2}(V_f + V_i)t$

$\frac{2\Delta X}{t} = V_f + V_i$

$V_i = \frac{2\Delta X}{t} - V_f$

$= \frac{2(0.95 m)}{0.12 s} - 0 \frac{m}{s}$

$\boxed{V_i = 15.8 \frac{m}{s}}$

5. (10 pts) A car going a constant 20 m/s in a school zone drives past a parked motorcycle policeman. At that instant he takes off after the car at a constant acceleration of 5.5 m/s^2. Draw a diagram! (a) How long will it take to catch the car? (b) What will the motorcycle's velocity be when it catches the car?

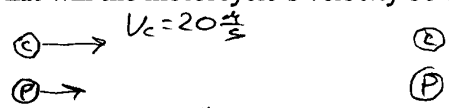
$t = \_\_\_\_ s$

$a_p = 5.5 \frac{m}{s^2}$

$V_{ip} = 0 \frac{m}{s}$

$V_{fp} = \_\_\_\_ \frac{m}{s}$

$V_{av_c} = 20 \frac{m}{s}$



$V_{ip} = 0 \frac{m}{s}$

$a = 5.5 \frac{m}{s^2}$

$\Delta X_c = \Delta X_p$

$V_c t = \cancel{V_{ip}}^{0} t + \frac{1}{2} a t^2$

$V_c = \frac{1}{2} a t$

$t = \frac{2 V_c}{a}$

$= \frac{2(20 \frac{m}{s})}{5.5 \frac{m}{s^2}}$

a) $\boxed{t = 7.27 s}$

$V_f = \cancel{V_i}^{0} + at$

$= 5.5 \frac{m}{s^2} (7.27 s)$

b) $\boxed{V_f = 40 \frac{m}{s}}$

OR $V_{av_M} = 20 \frac{m}{s}$ since he goes same ΔX as car.

$\therefore V_{av} = \frac{V_f + \cancel{V_i}^{0}}{2}$

$V_f = 2 V_{av}$

$= 2(20 \frac{m}{s})$ ← Use this to find "t".

$\boxed{V_f = 40 \frac{m}{s}}$

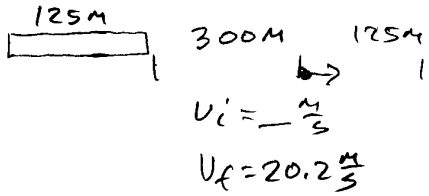
6. (EC 2.5 pts) A 125-m long train begins accelerating uniformly from rest. The front of the train then passes a railway worker, who is standing 300 m from where the front of the train started. Later, the velocity of the rear end of the train as it passes the worker is 20.2 m/s. Draw a diagram! What was the train's velocity when the front passed the worker?

$V_i = 0 \frac{m}{s}$

$V_f = 20.2 \frac{m}{s}$

$\Delta X_1 = 125 m$

$\Delta X_2 = 300 m$



Train goes from $0 \frac{m}{s}$ to $20.2 \frac{m}{s}$ over a distance of 425m.

$V_f^2 = V_i^2 + 2a\Delta X$

$a = \frac{V_f^2 - V_i^2}{2\Delta X}$

$= \frac{(20.2 \frac{m}{s})^2 - (0 \frac{m}{s})^2}{2(425 m)}$

$a = 0.480 \frac{m}{s^2}$

$V_f^2 = V_i^2 + 2a\Delta X$

$V_i^2 = V_f^2 - 2a\Delta X$

$V_i^2 = (20.2 \frac{m}{s})^2 - 2(0.48 \frac{m}{s^2})(125 m)$

$\boxed{V_i = 17.0 \frac{m}{s}}$