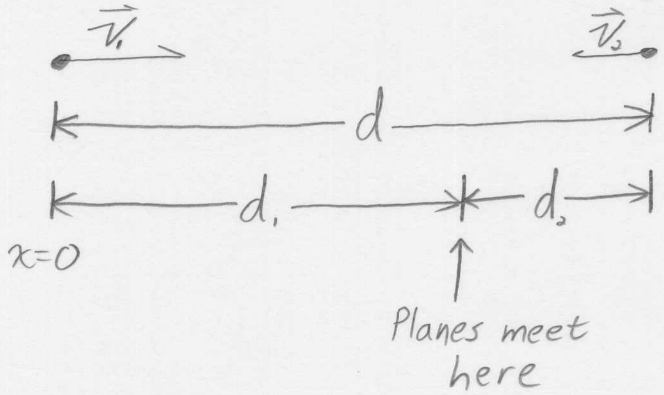
Homework 2
Physics 111, Fall 09
Problems: 2-49, 50, 60, 77

2-49



Given

$d = 4600\ km$

$v_1 = 1100\ km/hr$

$v_2 = 700\ km/hr$

$d_1 = ?$

Plane 1

$$x_f = x_0 + v_0 t + \tfrac{1}{2}at^2$$

$$d_1 = 0 + v_1 t + 0$$

$$t = \frac{d_1}{v_1}$$

Plane 2

$$x_f = x_0 + v_0 t + \tfrac{1}{2}at^2$$

$$d_1 = d - v_2 t + 0$$

$$d_1 = d - \frac{v_2}{v_1} d_1$$

$$d_1 + \frac{v_2}{v_1} d_1 = d$$

$$d_1\left(1 + \frac{v_2}{v_1}\right) = d$$

$$d_1\left(\frac{v_1 + v_2}{v_1}\right) = d$$

$$\boxed{d_1 = \frac{v_1}{v_1 + v_2} d}$$

$$d_1 = \frac{1100\ km/hr}{1100\ km/hr + 700\ km/hr} \cdot 4600\ km = \boxed{2811\ km}$$

2-50

$x(t) = bt + ct^3$ $\quad b = 1.5\ m/s$

$c = 0.64\ m/s^3$

$x(0) = 0, \quad \bar{v} = \frac{x(t_2) - x(t_1)}{t_2 - t_1}$

↑ average velocity

a) $t_1 = 1_s,\ t_2 = 3.0_s,\ \bar{v} = \frac{21.78 - 2.14}{2} = \underline{9.82}$

b) $t_1 = 1.5_s,\ t_2 = 2.5_s,\ \bar{v} = \frac{13.75 - 4.41}{1} = \underline{9.34}$

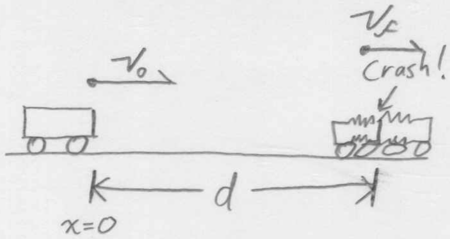
c) $t_1 = 1.95,\ t_2 = 2.05,\ \bar{v} = \frac{8.59 - 7.67}{0.1} = \underline{9.18}$

d) $\frac{dx}{dt} = b + 3ct^2$

at $t = 2.0$,

$\frac{dx}{dt} = 1.5 + (3)(0.64)(2)^2 = \underline{7.42}$

2-60



GIVEN — note sign!

$a = -6.3\ m/s^2$

$v_f = 18\ km/hr$

$d = 34\,m = 34 \cdot \frac{1}{1\times10^3}\frac{km}{m} = 3.4\times10^{-2}\,km$

$a = -6.3\ m/s^2 \cdot \frac{1}{1\times10^3}\frac{km}{m} \cdot \left(3600\frac{s}{hr}\right)^2 = 8.16\times10^{4}\ km/hr^2$

WANT

$v_o = ?$

$t = ?$

a) $x_f = x_o + v_o t + \frac{1}{2}at^2$ $\qquad$ $v_f = v_o + at$

$d = 0 + v_o t + \frac{1}{2}at^2$ $\qquad$ $v_f = v_o + at$

Solve for t

$t = \frac{v_f - v_o}{a}$

$$d = \frac{v_o(v_f - v_o)}{a} + \frac{1}{2}a\frac{(v_f - v_o)^2}{a^2}$$

$$= \frac{1}{a}\left[-v_o^2 + v_o v_f + \frac{1}{2}\left(v_o^2 - 2v_o v_f + v_f^2\right)\right]$$

$$= \frac{1}{a}\left[-v_o^2 + v_o v_f + \frac{1}{2}v_o^2 - v_o v_f + \frac{1}{2}v_f^2\right]$$

$$d = \frac{1}{a}\left[-\frac{1}{2}v_o^2 + \frac{1}{2}v_f^2\right]$$

$$d = \frac{v_f^2 - v_o^2}{2a} \Rightarrow \boxed{v_o = \left(v_f^2 - 2ad\right)^{1/2}}$$

From neg acceleration

$$v_o = \left[\left(18\ km/hr\right)^2 + (2)\left(8.16\times10^4\ km/hr^2\right)\left(3.4\times10^{-2}\right)\right]^{1/2}$$

$$\boxed{v_o = 76.6\ km/hr}$$

2-60 continued

b) From part a:

$$t = \frac{v_f - v_o}{a} = \frac{18\,\text{km/hr} - 76.6\,\text{km/hr}}{-8.16\times10^{4}\,\text{km/hr}^2} = 7.18\times10^{-4}\,\text{hr}\cdot 3600\,\text{s/hr}$$

$$= 2.59\,\text{s}$$