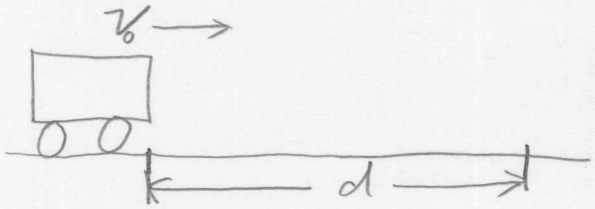
Phys 111
Problem 4-17

We want to compare two forces: $\frac{F_2}{F_1}$



F_1: Force required to stop in a distance d with $v_0 = v_1$

F_2: Force required to stop in a distance d with $v_0 = v_2$

Given that $v_2 = 2v_1$

In general, $F = ma$

So: $\frac{F_2}{F_1} = \frac{ma_2}{ma_1}$, and we need a_2 and a_1

Because a is constant:

$$v_f = v_0 + at \Rightarrow 0 = v_0 - at \Rightarrow t = \frac{v_0}{a}$$

$$x_f = x_0 + v_0 t + \frac{1}{2}at^2 \Rightarrow d = \frac{1}{2}at^2 \Rightarrow d = \frac{1}{2}\frac{v_0^2}{a}$$

$$\Rightarrow \boxed{a = \frac{1}{2}\frac{v_0^2}{d}}$$

continued ↓

4-17 continued

Then: $\frac{F_2}{F_1} = \frac{a_2}{a_1} = \frac{\frac{1}{2}\frac{v_2^2}{d}}{\frac{1}{2}\frac{v_1^2}{d}} = \frac{v_2^2}{v_1^2}$

But, $v_2 = 2v_1$ so

$$\frac{F_2}{F_1} = \frac{(2v_1)^2}{v_1^2} = 4\frac{v_1^2}{v_1^2}$$

$$\boxed{\frac{F_2}{F_1} = 4}$$