Problem 5.7

a.) To determine the force using Newton's Second Law (F = ma), we need the acceleration. As the acceleration is constant, we can use kinematics and write:

$$\left(v_{x,2}\right)^2 = \left(v_{x,1}\right)^2 + 2a\left(x_2 - x_1\right)$$

$$\left(7.00\text{x}10^5\ \text{m/s}\right)^2 = \left(3.00\text{x}10^5\ \text{m/s}\right)^2 + 2a\left[\left(.0500\ \text{m}\right) - 0\right]$$

$$\Rightarrow \quad a = \frac{\left(7.00\text{x}10^5\ \text{m/s}\right)^2 - \left(3.00\text{x}10^5\ \text{m/s}\right)^2}{2\left(.0500\ \text{m}\right)}$$

$$= 4.00\text{x}10^{12}\ \text{m/s}^2$$

so that:

$$F = ma$$

$$= \left(9.10\text{x}10^{-31}\ \text{m/s}^2\right)\left(4.00\text{x}10^{12}\ \text{m/s}^2\right)$$

$$= 3.64\text{x}10^{-18}\ \text{N}$$

b.) The weight of the electron is:

$$F_g = mg$$

$$= \left(9.10\text{x}10^{-31}\ \text{m/s}^2\right)\left(9.8\ \text{m/s}^2\right)$$

$$= 8.92\text{x}10^{-30}\ \text{N}$$

Comparing the two forces, we get:

$$\frac{F_{acc}}{F_g} = \frac{\left(3.64\text{x}10^{-18}\ \text{N}\right)}{\left(8.92\text{x}10^{-30}\ \text{N}\right)}$$

$$= \frac{4.08\text{x}10^{11}}{1}$$