3-1 The ratio of gravitational to Coulomb forces is

$$\frac{F_{grav}}{F_{elec.}} = \frac{G m_1 m_2 / r^2}{K q_1 q_2 / r^2} = \frac{G m_1 m_2}{K q_1 q_2} = 8.1 \times 10^{-37}$$

Using $m_1 = m_2 = 1.67 \times 10^{-27}$ Kg
$q_1 = q_2 = 1.602 \times 10^{-19}$ C
$G = 6.67 \times 10^{-11}$ N-m^2/Kg^2
$K = 8.99 \times 10^{9}$ N-m^2/C^2

3.3 $\vec{F} = q\vec{E} = eE_0 \hat{k} = m\vec{a}$

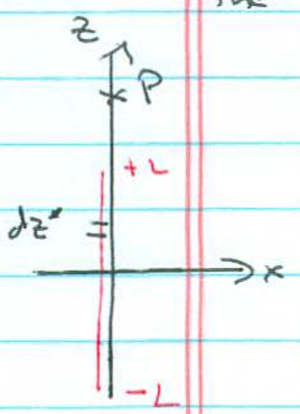
$\vec{a} = (eE_0/m)\hat{k}$

$x = v_0 t \; \hat{i}$

$y = 0$

$z = \frac{1}{2} a t^2 = \frac{1}{2}\left(\frac{eE_0}{m}\right) t^2$

3-5 A charged line goes from $-L$ to $+L$, on the z-axis. The point P is at $(0,0,z)$.



dz' is an arbitrary point source at z':

$$dE_z = \frac{\lambda\, dz'}{4\pi\varepsilon_0 (z-z')^2}$$

$$E_z(z) = \int_{-L}^{+L} \frac{\lambda}{4\pi\varepsilon_0} \frac{dz'}{(z-z')^2} = \frac{\lambda L}{2\pi\varepsilon_0 (z^2 - L^2)}$$

As $z \to L$, $E_z \to \infty$

as $z \to \infty$ $E_z \to \frac{Q}{4\pi\varepsilon_0 r^2}$, $Q = 2L\lambda$