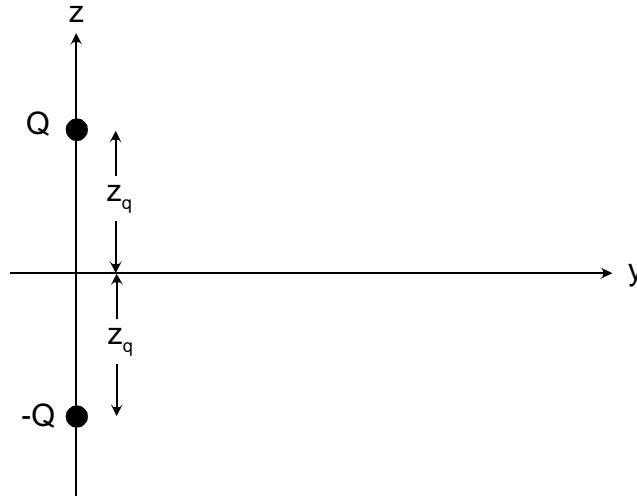


ELEG240- Spring, 2006
Homework 2, due 3/1 at noon

1. Two point charges exist on the z-axis, a positive charge at $z=z_q$ and negative charge of equal magnitude at $z=-z_q$:



On the y-axis, what direction does the electric field point in? If the charges are oscillating, that is, $z_q = |z_q| \cos(\omega t)$, what direction does the magnetic field point in?

2. Show that the units of $\epsilon \frac{\partial \mathbf{E}}{\partial t}$ are current/area.
3. A conducting material, such as a metal, can be represented as having a conductivity σ and permittivity ϵ_0 . Assuming that the solution for the electric field of a plane electromagnetic wave is still $Ae^{i(kz-\omega t)}$ (equation 3.15, forward going wave only), and the solution for the magnetic field of an electromagnetic wave is $\frac{k}{\omega} Ae^{i(kz-\omega t)}$ (equation 3.7, phasor notation), and letting k be complex, what is k ? Note: you will need to redo equation 3.2 with a term including conductivity. Also, you may assume that $\sigma \ll \omega \epsilon_0$. What does this imply about light propagation through a conductor?