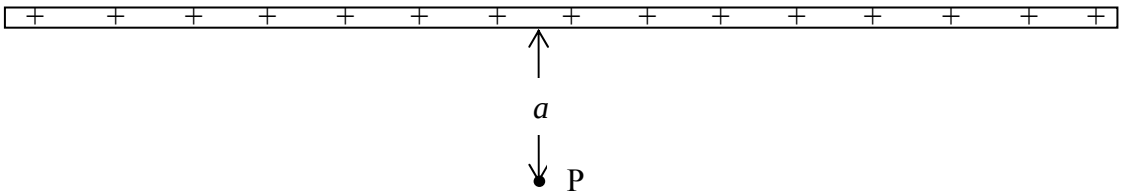
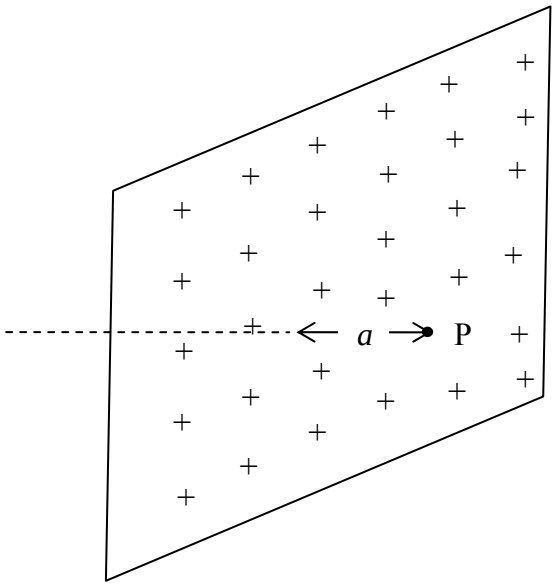
Tutorial 6

1. Use Gauss' law of electrostatics to find the electric field intensity vector $\vec{E}$ at a point P located at a distance a from an infinite linear charge distribution described by a constant linear charge density $\lambda = \frac{\mathrm{d}q}{\mathrm{d}x}$.



2. Use Gauss' law of electrostatics to find the electric field intensity vector $\vec{E}$ at a point P located at a distance a from an infinite plane charge distribution described by a constant surface charge density $\sigma = \frac{\mathrm{d}q}{\mathrm{dS}}$.



3. What is the relation between the amplitudes of the electric and magnetic fields in an electromagnetic wave propagating in a medium whose relative dielectric constant is 2? Assume the magnetic permeability of the medium is that of the vacuum.
4. A light wave has 670 nm wavelength in air. Its wavelength in a transparent solid is 420 nm. Determine the speed of light in this solid. What is the frequency of light in the solid?
5. Find the relative change in wavelength and frequency (if any) of an electromagnetic wave whose frequency in vacuum is $f = 3.0\text{MHz}$ when it passes from vacuum into a nonmagnetic medium ($\mu_\mathrm{r} = 1$) whose relative permittivity is $\varepsilon_\mathrm{r} = 4$.
6. The phase of a plane electromagnetic wave is of the form $\frac{1}{3}\left(\sqrt{5}x + 2y\right)\pi \cdot 10^7 - 9.42 \cdot 10^{15} t$ (SI units). Find a) the direction of propagation of the wave; b) the phase speed of the wave; c) the refractive index of the medium in which this wave propagates.