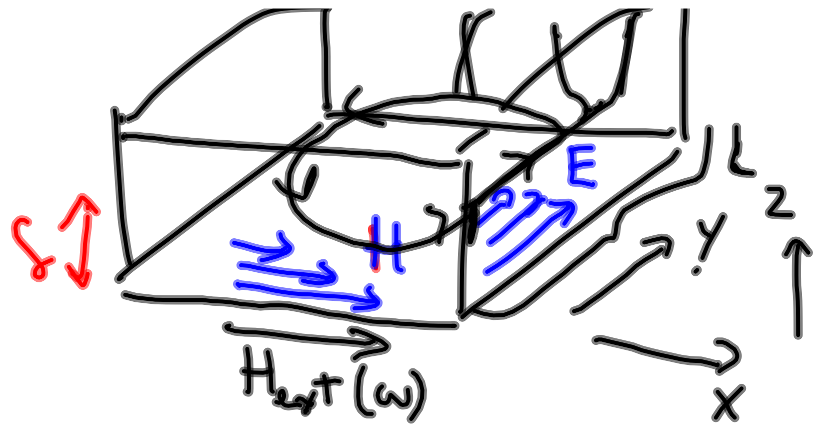


$$\nabla \times \vec{H} = \vec{J} = \sigma \vec{E}$$

$$\underbrace{\hat{e}_x}\,\underbrace{H(z,t)}_{H_x}$$

$$\begin{vmatrix} \hat{e}_x & \hat{e}_y & \hat{e}_z \\ \nabla_x & \nabla_y & \nabla_z \\ H_x & 0 & 0 \end{vmatrix} = \hat{e}_y \underbrace{\nabla_z H_x}_{\neq 0} - \hat{e}_z \underbrace{\nabla_y H_x}_{=0}$$

$$\mathrm{Re}\, e^{i\left(\frac{z}{\delta} - \omega t\right)}$$

$$E_y = \frac{\nabla_z H_x}{\sigma} \qquad H_x \rightarrow H_0 e^{-z/\delta} \cos\left(\frac{z}{\delta} - \omega t\right)$$

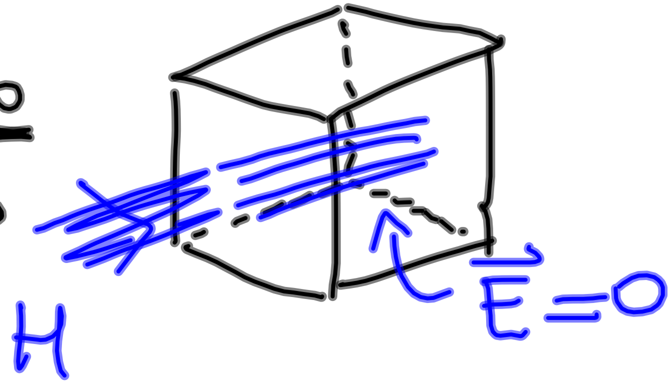
$$= \frac{\mu \delta \omega}{\sqrt{2}} H_0 e^{-z/\delta} \cos\left(\frac{z}{\delta} - \omega t + 3\pi/4\right)$$

$$\delta = \sqrt{\frac{2}{\mu\sigma\omega}}$$

$\sigma = \text{finite}$

If $\underline{\omega = 0}$

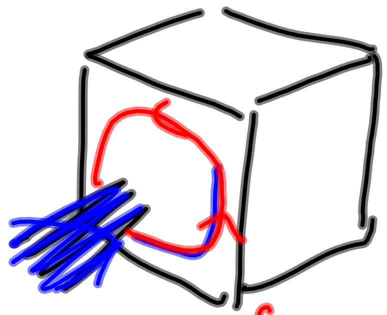
$\delta \to \infty$



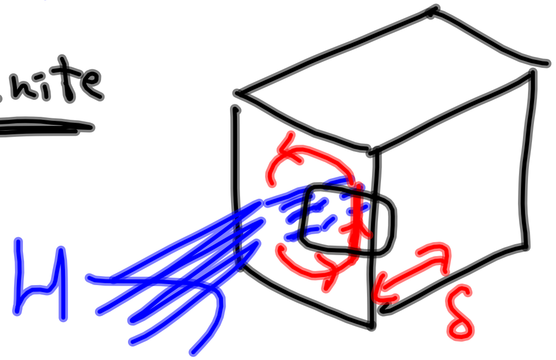
If $\underline{\omega \to \infty}$

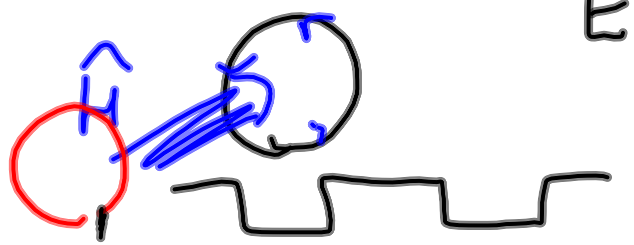
$\sigma = \sigma(\omega)$

$\delta \to 0$



If $\underline{\omega = \text{finite}}$





$$E_y \propto \delta\omega = \sqrt{\frac{2\omega}{\mu\sigma}}\, e^{-z/\delta}$$

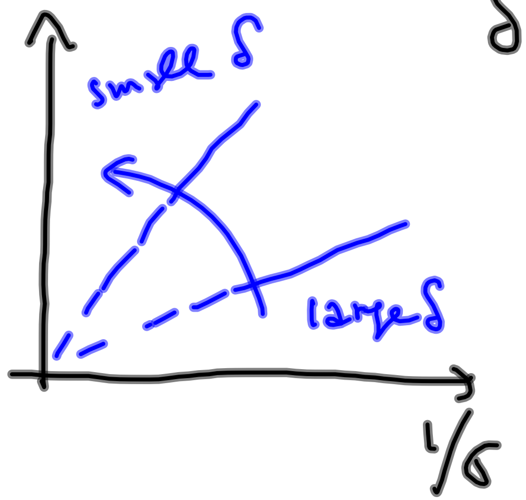
$\to 1$

$z \to 0$

$\sigma = \infty$, perfect metal

$\omega =$ finite

$\delta = 0$



$$\delta \sim \frac{1}{\sqrt{\omega \sigma}}$$

$$\omega \sim \frac{1}{\delta^2 \sigma}$$

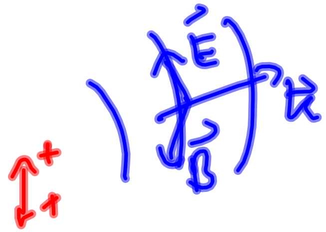
6.1 Maxwell Equations

$\nabla\cdot\vec{D} = \rho$ Coulomb

$\nabla\times\vec{H} = \vec{J} + \frac{\partial\vec{D}}{\partial t}$ Ampere

$\nabla\times\vec{E} + \frac{\partial\vec{B}}{\partial t} = 0$ Faraday

$\nabla\cdot\vec{B} = 0$ no monopoles



$$\nabla\cdot\vec{J} = 0$$

$$\rho = \nabla\cdot\vec{D}$$

$$\frac{\partial\rho}{\partial t} = \nabla\cdot\left(\frac{\partial\vec{D}}{\partial t}\right) = -\nabla\cdot\vec{J}$$

$$\nabla\cdot\underbrace{\left(\vec{J} + \frac{\partial\vec{D}}{\partial t}\right)} = 0$$

$$\nabla\cdot\vec{J} + \frac{\partial\rho}{\partial t} = 0$$

second order diff. eq.

$\Phi, \vec{A}$

$$\frac{p^2}{2m} \rightarrow \frac{(-i\hbar\nabla)^2}{2m} \qquad \left(\vec{p} - \frac{e}{c}\vec{A}\right) \qquad \hat{H}\psi = E\psi$$