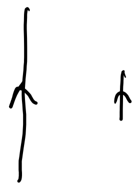
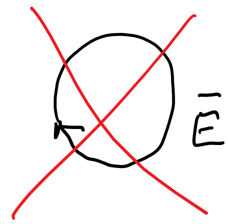
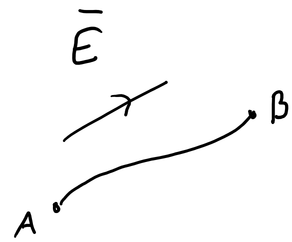






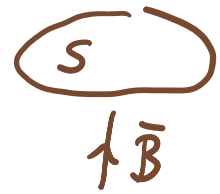
$$\int \bar{E} \cdot d\bar{l} = V_A - V_B$$

STATICS $\nabla \times \bar{E} = 0$

FARADAY

$$\nabla \times \bar{E} = -\frac{\partial \bar{B}}{\partial t}$$

$$V = -\frac{d\Phi}{dt}$$



$$\frac{d}{dt} B_0 \sin(\omega t) = B_0 \omega \cos(\omega t)$$

<u>LENZ</u>

EDDY CURRENTS !

$$\nabla \times \bar{E} = -\frac{\partial \bar{B}}{\partial t} \qquad \nabla \times \bar{H} = \bar{J} + \underbrace{\frac{\partial \bar{D}}{\partial t}}_{\text{DISPLACEMENT CURRENT}}$$

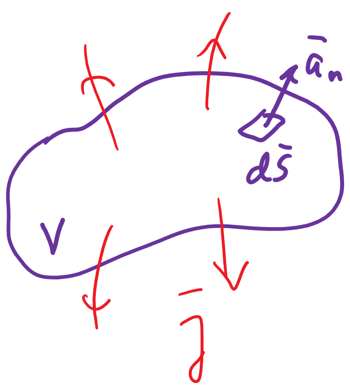
$$\nabla \cdot \bar{D} = \rho_v \qquad \nabla \cdot \bar{B} = 0$$

$$\frac{As}{m^2} \cdot \frac{1}{s} = \frac{A}{m^2}$$

$$\underbrace{\nabla \cdot \nabla \times \bar{H}}_{0} = \nabla \cdot \left(\bar{J} + \frac{\partial \bar{D}}{\partial t} \right)$$

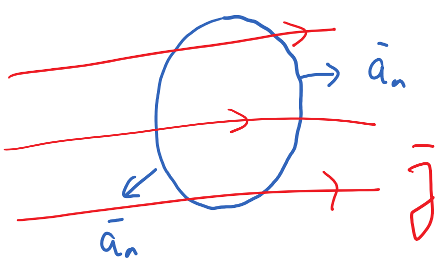
$$\Rightarrow \quad \nabla \cdot \bar{J} = -\frac{\partial \overbrace{\nabla \cdot \bar{D}}^{\rho_v}}{\partial t}$$

↓ ?



$$\int \nabla \cdot \bar{J} \, dV = \oint_S \bar{J} \cdot d\bar{s} = I$$

$$= -\frac{\partial}{\partial t} \int \rho_v \, dV = -\frac{\partial Q}{\partial t}$$



$$\nabla \times \bar{E} = -\frac{\partial \bar{B}}{\partial t}$$

$$\nabla \times \bar{H} = \cancel{\bar{J}} + \frac{\partial \bar{D}}{\partial t}$$

$$\nabla \cdot \bar{D} = \cancel{\rho_v}$$

$$0 \;//\; \nabla \cdot \bar{B} = 0$$

$\epsilon_0 \bar{E}$ $\quad$ $\mu_0 \bar{H}$ $\quad$ $\epsilon_0 \frac{\partial \bar{E}}{\partial t}$

$$\boxed{\begin{array}{ll} \bar{E} = ? & \epsilon_0 \\ \bar{H} = ? & \mu_0 \\ \bar{J} = 0 & \rho_v = 0 \end{array}}$$

$$-\mu_0 \frac{\partial \bar{H}}{\partial t}$$

$$\underbrace{\nabla \times (\nabla \times \bar{E})}_{\nabla(\underbrace{\nabla \cdot \bar{E}}_{\frac{1}{\epsilon_0}\nabla \cdot \bar{D} = 0}) - \nabla^2 \bar{E}} = -\mu_0 \frac{\partial}{\partial t} \nabla \times \bar{H} = -\mu_0 \epsilon_0 \underbrace{\frac{\partial}{\partial t} \frac{\partial}{\partial t}}_{\frac{\partial^2}{\partial t^2}} \bar{E}$$

WAVE EQUATION

$$\nabla^2 \bar{E}(\bar{R},t) - \mu_0 \epsilon_0 \frac{\partial^2}{\partial t^2} \bar{E}(\bar{R},t) = 0$$

$$\bar{E}(\bar{R},t) = \bar{a}\, E(z,t) \qquad \nabla^2 = \frac{\partial^2}{\partial z^2}$$

$$\bar{a}\left[\frac{\partial^2}{\partial z^2} E(z,t) - \underbrace{\mu_0 \epsilon_0}\frac{\partial^2}{\partial t^2} E(z,t)\right] = 0$$

$$g(w) \qquad g(z \mp vt)$$

$$\frac{\partial}{\partial z} g(z \mp vt) = g'(z \mp vt)$$

$$\frac{\partial}{\partial z} g(z \mp vt) = g'(z \mp vt)$$

$$\frac{\partial^2}{\partial z^2} g(z \mp vt) = g''(z \mp vt)$$

$$\frac{\partial}{\partial t} g(z \mp vt) = \mp v\, g'(z \mp vt)$$

$$\frac{\partial^2}{\partial t^2} g(z \mp vt) = (\mp v)^2 g''(z \mp vt)$$

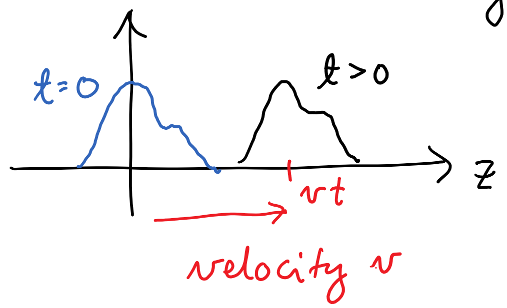
$$\frac{\partial^2}{\partial z^2} g(z - vt) - \underbrace{\frac{1}{v^2}}_{\mu_0 \varepsilon_0} \frac{\partial^2}{\partial t^2} g(z - vt) = 0$$

$g(w)$ $\qquad$ $g(z-vt)$

$t=0 \quad g(z)$

$t>0 \quad g(\underbrace{z-vt}_{=0})$

$z = vt$



$\xleftarrow{v}$

$g(z+vt)$

velocity $v = \dfrac{1}{\sqrt{\mu_0 \varepsilon_0}} = 299792458 \, \frac{m}{s}$

ε_0: $8{,}854 \cdot 10^{-12} \, \frac{As}{Vm}$

μ_0: $4\pi \cdot 10^{-7} \, \frac{Vs}{Am}$

$$\frac{1}{\sqrt{\frac{Vs}{Am} \frac{As}{Vm}}} = \frac{m}{s}$$

C = SPEED OF LIGHT!