PH-214 Cheat Sheet

Jacob Sigman

Constants

$\mu_0 = 12.57{*}10^{7}$ H/m $\quad$ $\epsilon_0 = 8.85{*}10^{-12}$ C^2/Nm^2 $\quad$ $m_{\text{Proton}} = 1.67{*}10^{-27}$ kg $\quad$ $m_{\text{Electron}} = 9.11{*}10^{-}31$ kg

$$q = 1.60 * 10^{-19} \text{ C}$$

Maxwell's Equations

Integral Form	$\oint \overrightarrow{E} \cdot d\overrightarrow{A} = \frac{q_{\text{enc}}}{\epsilon_0}$	$\oint \overrightarrow{B} \cdot d\overrightarrow{A} = 0$	$\oint \overrightarrow{E} \cdot d\overrightarrow{s} = -\frac{d\phi_B}{dt}$	$\oint \overrightarrow{B} \cdot d\overrightarrow{s} = \mu_0\epsilon_0\frac{d\phi_B}{dt} + \mu_0 i_{\text{enc}}$
Differential Form	$\nabla \cdot \overrightarrow{E} = 0$	$\nabla \cdot \overrightarrow{B} = 0$	$\nabla \times \overrightarrow{E} = -\frac{\partial \overrightarrow{B}}{\partial t}$	$\nabla \times \overrightarrow{B} = \mu_0\epsilon_0\frac{\partial \overrightarrow{E}}{\partial t}$

$$\nabla^2\overrightarrow{B} = \mu_0\epsilon_0\frac{\partial^2\overrightarrow{B}}{\partial t^2} \qquad \nabla^2\overrightarrow{E} = \mu_0\epsilon_0\frac{\partial^2\overrightarrow{E}}{\partial t^2} \qquad \frac{1}{c_0}\frac{\partial^2\overrightarrow{E}}{\partial t^2} = \nabla^2\overrightarrow{E} \qquad \frac{1}{c_0}\frac{\partial^2\overrightarrow{B}}{\partial t^2} = \nabla^2\overrightarrow{B}$$

$$\overrightarrow{E} = \overrightarrow{E_0}e^{i(k\cdot r-\omega t)} \qquad \overrightarrow{B} = \overrightarrow{B_0}e^{i(k\cdot r-\omega t)} \qquad \mu_E = \frac{1}{2}\epsilon_0\left|\overrightarrow{E}\right|^2 \qquad \mu_B = \frac{1}{2\mu_0}\epsilon_0\left|\overrightarrow{B}\right|^2$$

Radiation

$$\overrightarrow{s} = \frac{1}{\mu_0}\overrightarrow{E} \times \overrightarrow{B} \qquad P = \frac{q^2a^2}{6\pi\epsilon_0 c^3} \qquad \sigma_{\text{Th}} = \frac{8\pi}{3}\left(\frac{q^2}{4\pi\epsilon_0 m_e c^2}\right)^2$$

$$E_\theta = \frac{a\sin\theta\, q}{4\pi\, c^2\epsilon_0 R} \qquad E_R = \frac{a\, T\sin\theta\, q}{4\pi c\,\epsilon_0 R^2}$$