Formula Exam 2 - PH106

Current:

$I = \frac{dQ}{dt}$ $I = nev_dA$ $n = N/V$ $J = \frac{I}{A} = \sigma A$
$I = \frac{\Delta V}{R}$ $J = \frac{E}{\rho}$
$R = \rho\frac{l}{A}$ $\rho(T) = \rho_0[1 + \alpha(T - T_0)]$ $R(T) = R_0[1 + \alpha(T - T_0)]$
$P = I\Delta V = I^2R = \frac{\Delta V^2}{R}$
$Q(t) = Q_0(1 - e^{-\frac{t}{RC}})$ $Q(t) = Q_0e^{-\frac{t}{RC}}$ $\tau = RC.$
$\Delta V = \mathcal{E} - Ir$
$R_{eq} = R_1 + R_2 + R_3 + ...$ $I = I_1 = I_2 = ...$ Series
$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + ...$ $I = I_1 + I_2 + ...$ Parallel

At a node $\sum_i I_i = 0$. Around loop $\sum_i \Delta V_i = 0$

Magnetism:

$\vec{F}_B = q\vec{v} \times \vec{B}$ $F_B = qvB\sin\theta$ $F_B = IlB\sin\theta$
$\vec{F} = q\vec{E} + q\vec{v} \times \vec{B}$
$\vec{\mu} = I\vec{A}$ $\vec{A} = A\vec{n}$ $\vec{\tau} = \vec{\mu} \times \vec{B}$ $\tau = IAB\sin\theta$
$\Phi(B) = \int \vec{B}d\vec{A}$
$\Phi(B) = 0$ for a closed surface
$d\vec{B} = \frac{\mu_0}{4\pi}\frac{Id\vec{l}\times\hat{r}}{r^2}$ $\oint \vec{B} \cdot d\vec{l} = \mu_0 I_{enclose}$
$B = \frac{\mu_0 I}{2\pi r}$ $B = N\frac{\mu_0 I}{2R}$ $B = \mu_0 nI$ $n = N/l$
$\frac{F_B}{l} = \frac{\mu_0 I_1 I_2}{2\pi d}$

Induction:

$I_D R = \mathcal{E} = -N\frac{d\Phi(B)}{d(t)}$ direction of I_D such that it's against $\frac{d\Phi(B)}{dt}$
$\mathcal{E} = \frac{dB}{dt}A$ $\mathcal{E} = Blv$ $\mathcal{E} = N\omega AB\sin\omega t$ $\omega = 2\pi f$ $f = \frac{1}{T}$
$\oint \vec{E} \cdot d\vec{l} = -\frac{d\Phi(B)}{dt}$
$L = \frac{N\Phi(B)}{I}$ $L = \frac{\mu_0 N^2 A}{l}$ $\mathcal{E} = -L\frac{dI(t)}{dt}$
$U = \frac{1}{2}LI^2$
$I(t) = I_{max}(1 - e^{-tR/L})$ $I(t) = I_{max}e^{-tR/L}$ $I = \frac{P}{A}$

$k_e = 8.99 \times 10^9$ $c = 3.00 \times 10^8$ $\epsilon_0 = 8.85 \times 10^{-12}$ $\mu_0 = 4\pi \times 10^{-7}$
$e = 1.6 \times 10^{-19}$ $m_e = 9.11 \times 10^{-31}$ $m_p = 1.67 \times 10^{-27}$ $m_n = 1.67 \times 10^{-27}$