Phys 2120
Equations for Exam #2

$$k = \frac{1}{4\pi\epsilon_0} = 8.99 \times 10^9 \, \tfrac{\mathrm{N \cdot m^2}}{\mathrm{C^2}} \qquad \epsilon_0 = 8.85 \times 10^{-12} \, \tfrac{\mathrm{C^2}}{\mathrm{N \cdot m^2}} \qquad e = 1.602 \times 10^{-19} \text{ C}$$

$$m_{\text{elec}} = 9.1094 \times 10^{-31} \text{ kg} \qquad m_{\text{prot}} = 1.673 \times 10^{-27} \text{ kg} \qquad 1 \text{ eV} = 1.609 \times 10^{-19} \text{ J}$$

$$\mathbf{F} = m\mathbf{a} \qquad g = 9.80 \, \tfrac{\mathrm{m}}{\mathrm{s^2}} \qquad F = k\frac{|q_1 q_2|}{r^2} = \frac{1}{4\pi\epsilon_0}\frac{|q_1 q_2|}{r^2}$$

$$\mathbf{F} = q\mathbf{E} \qquad E_{\text{pt ch}} = k\frac{|q|}{r^2} \qquad dq = \lambda dx \qquad dq = \sigma dA \qquad dq = \rho dV$$

$$E_{\text{plane}} = \frac{\sigma}{2\epsilon_0} \qquad E_{\text{cond surf}} = \frac{\sigma}{\epsilon_0} \qquad p = qd \qquad E_{\text{dipole}} = \frac{1}{2\pi\epsilon_0}\frac{p}{z^3}$$

$$E_{\text{ring}} = \frac{qz}{4\pi\epsilon_0(z^2 + R^2)^{3/2}} \qquad \vec{\tau} = \mathbf{p} \times \mathbf{E} \qquad U = -\mathbf{p} \cdot \mathbf{E}$$

$$\Phi = \oint \mathbf{E} \cdot d\mathbf{A} = \frac{q_{\text{encl}}}{\epsilon_0} \qquad \Delta U + \Delta K = 0 \qquad \Delta U = q\Delta V \qquad \Delta V = -\int_i^f \mathbf{E} \cdot d\mathbf{s}$$

$$V_{\text{pt-ch}} = \frac{1}{4\pi\epsilon_0}\frac{q}{r} \qquad V = \frac{1}{4\pi\epsilon_0}\int \frac{dq}{r} \qquad E_x = -\frac{\partial V}{\partial x} \qquad E_{x,\text{uniform}} = -\frac{\Delta V}{\Delta x}$$

$$q = CV \qquad C_{\text{p.-pl.}} = \epsilon_0 \frac{A}{d} \qquad C_{\text{cyl}} = 2\pi\epsilon_0 \frac{L}{\ln(b/a)} \qquad C_{\text{sph}} = 4\pi\epsilon_0 \frac{ab}{b-a}$$

$$C = \kappa C_{\text{air}} \qquad C_{\text{par}} = C_1 + C_2 + \dots \qquad \frac{1}{C_{\text{series}}} = \frac{1}{C_1} + \frac{1}{C_2} + \dots \qquad U = \frac{q^2}{2C} = \tfrac{1}{2}CV^2$$

$$u = \tfrac{1}{2}\epsilon_0 E^2 \qquad i = \frac{dq}{dt} \qquad J = i/A \qquad J = (ne)v_d \qquad V = iR \qquad P = iV = i^2 R$$

$$R = \rho\frac{L}{A} \qquad R_{\text{series}} = R_1 + R_2 + \dots \qquad \frac{1}{R_{\text{par}}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$$

$$\tau = RC \qquad q(t) = C\mathcal{E}(1 - e^{-t/\tau}) \qquad i(t) = \frac{\mathcal{E}}{R}e^{-t/\tau} \qquad q(t) = q_0 e^{-t/\tau} \qquad i(t) = \left(\frac{q_0}{RC}\right)e^{-t/\tau}$$

$$\mathbf{F} = q\mathbf{v} \times \mathbf{B} \qquad \mathbf{F} = I\mathbf{L} \times \mathbf{B} \qquad \frac{mv}{r} = qB \qquad \mu = NiA \qquad \tau = \mu B \sin\phi \qquad \vec{\tau} = \vec{\mu} \times \vec{B}$$

$$\mu_0 = 4\pi \times 10^{-7} \tfrac{\mathrm{T \cdot m}}{\mathrm{A}} \qquad d\mathbf{B} = \frac{\mu_0}{4\pi}\frac{i\, d\mathbf{s} \times \mathbf{r}}{r^3} \qquad B_{\text{wire}} = \frac{\mu_0 i}{2\pi R} \qquad B_{\text{arc}} = \frac{\mu_0 i \phi}{4\pi R} \qquad B_{\text{loop}} = \frac{\mu_0 i}{2R}$$