Equation Sheet PHYS 221

Elementary charge: $1.602x10^{-19}C$

Mass of an electron: $9.11x10^{-31}kg$

Mass of a proton: $1.673x10^{-27}kg$

$$\varepsilon_o = 8.85x10^{-12}\frac{C^2}{N\cdot m^2}$$

$$k = 8.99x10^9\frac{N\cdot m^2}{C^2}$$

$$g = 9.81\frac{m}{s^2}$$

$$\mu_o = 4\pi x10^{-7}\frac{T\cdot m}{A}$$

$$c = 3x10^8\, m/s$$

$$\mathrm{PE}_{\mathrm{cap}} = \frac{1}{2}Q\Delta V = \frac{1}{2}C(\Delta V)^2 = \frac{1}{2}\frac{Q^2}{C}$$

Capacitors in Series: $\frac{1}{C_{equiv}} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots$

Capacitors in Parallel: $C_{equiv} = C_1 + C_2 + \ldots$

Resistors in Parallel: $\frac{1}{R_{equiv}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$

Resistors in Series: $R_{equiv} = R_1 + R_2 + \ldots$

$$F = \frac{q_1 q_2}{4\pi\varepsilon_o r^2}$$

$$\vec{F} = q\vec{E}$$

$$E = \frac{q}{4\pi\varepsilon_o r^2}$$

$$\Phi_E = EA\cos\theta$$

$$\Phi_E = \frac{q_{enc}}{\varepsilon_o}$$

$$\Delta V = \frac{Q}{C}$$

$$C = \frac{\varepsilon_o A}{d}$$

$$V = \frac{PE_{elec}}{q}$$

$$E = -\frac{\Delta V}{\Delta x}$$

Discharging a Capacitor

$$q = C\varepsilon e^{-t/\tau}$$

$$I = \frac{-\varepsilon}{R}e^{-t/\tau}$$

$$V_{cap} = \frac{Q}{C} = \varepsilon e^{-t/\tau}$$

Charging a Capacitor

$$q = CV_{cap} = C\varepsilon(1 - e^{-t/\tau})$$

$$I = \frac{\varepsilon}{R}e^{-t/\tau}$$

$$V_{cap} = \varepsilon(1 - e^{-t/\tau})$$

$$\sum_{\substack{closed\\path}} B_{\parallel}\Delta L = \mu_o I_{enc}$$

$$F_B = qvB\sin\theta$$

$$F_{\text{on wire}} = ILB\sin\theta$$

Magnetic Field Near a Long Wire

$$B = \frac{\mu_o I}{2\pi r}$$

Magnetic Field of a Current Loop

$$B = \frac{\mu_o I}{2R}$$

Magnetic Field inside a Solenoid

$$B = \frac{\mu_o NI}{L}$$

$$I = \frac{\Delta q}{\Delta t}$$

$$V = IR$$

$$R = \rho\frac{L}{A}$$

$$P = IV$$

$$c = \frac{1}{\sqrt{\varepsilon_o\mu_o}} = 3.00x10^8\ m/s$$

$$E_o = cB_o$$

Equation Sheet PHYS 221 for Final Exam on December 11, 2012

Elementary charge: $1.6x10^{-19} C$

Mass of an electron: $9.11x10^{-31} kg$

Mass of a proton: $1.673x10^{-27} kg$

$$\varepsilon_o = 8.85x10^{-12} \frac{C^2}{N \cdot m^2}$$

$$k = 8.99x10^9 \frac{N \cdot m^2}{C^2}$$

$$g = 9.81 \frac{m}{s^2}$$

$$\mu_o = 4\pi x10^{-7} \frac{T \cdot m}{A}$$

$$c = 3x10^8 m/s$$

$$c = \frac{1}{\sqrt{\varepsilon_o \mu_o}} = 3.00x10^8 \ m/s$$

$$E_o = cB_o$$

$$I = \frac{1}{2}\varepsilon_0 c E^2$$

$$I_{out} = I_{in}\cos^2\theta$$

$$Intensity = \frac{Power}{Area}$$

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

$$\frac{1}{s_o} + \frac{1}{s_i} = \frac{1}{f} \qquad m = -\frac{s_i}{s_o}$$

$$d\sin\theta = m\lambda$$

$$\sin\theta_R = 1.22\frac{\lambda}{D}$$

$$F = \frac{q_1 q_2}{4\pi\varepsilon_o r^2}$$

$$\vec{F} = q\vec{E}$$

$$E = \frac{q}{4\pi\varepsilon_o r^2}$$

$$\Phi_E = EA\cos\theta$$

$$\Phi_E = \frac{q_{enc}}{\varepsilon_o}$$

$$\Delta V = \frac{Q}{C}$$

$$C = \frac{\varepsilon_o A}{d}$$

$$V = \frac{PE_{elec}}{q}$$

$$E = -\frac{\Delta V}{\Delta x}$$

$$\varepsilon = -\frac{\Delta\Phi_B}{\Delta t}$$

$$\Phi_B = BA\cos\theta$$

$$\varepsilon = NBA\omega\sin(\omega t)$$

$$PE_{mag} = \frac{1}{2\mu_o}B^2$$

$$V_L = L\frac{\Delta I}{\Delta t}$$

$$PE_{ind} = \frac{1}{2}LI^2$$

Charging an RL circuit

$$I = \frac{V}{R}(1 - e^{-t/\tau})$$

$$V = V_{max}\sin(2\pi ft)$$

$$V_{rms} = \frac{V_{max}}{\sqrt{2}}$$

$$P_{ave} = V_{rms} I_{rms}$$

$$I_{max} = \frac{V_{max}}{X_C} \qquad X_C = \frac{1}{2\pi fC}$$

$$I_{max} = \frac{V_{max}}{X_L} \qquad X_L = 2\pi fL$$

$$q = q_{max}\cos(2\pi ft) \qquad I = I_{max}\sin(2\pi ft)$$

$$f_{res} = \frac{1}{2\pi\sqrt{LC}}$$

$$V = IZ$$

$$I = \frac{\Delta q}{\Delta t}$$

$$V = IR$$

$$R = \rho\frac{L}{A}$$

$$P = IV$$