Physics NYB Equation Sheet

$$\vec{F}_{12}(r) = k\frac{q_1 q_2}{{r_{12}}^2}\hat{r}_{12}$$

$$\vec{E}(P) \equiv k\sum_{i=1}^{N}\frac{q_i}{{r_i}^2}\hat{r}_i$$

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

$$\vec{p} = q\vec{d}$$

$$\vec{\tau} = \vec{p}\times\vec{E}$$

$$U(r) = k\frac{qQ}{r}$$

$$\Delta U = q\Delta V$$

$$V = \frac{U}{q} = -\int_R^P \vec{E}\cdot d\vec{l}$$

$$V = \frac{kq}{r}$$

$$V_{AB} = V_A - V_B$$

$$V_B - V_A = -\int_A^B \vec{E}\cdot d\vec{l}$$

$$I = \frac{dQ}{dt}$$

$$v_d = \frac{I}{nqA}$$

$$V = IR$$

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

$$\rho = \rho_0[1 + \alpha(T - T_0)]$$

$$R_{eq} = R_1 + R_2 + R_3 \ldots$$

$$R_{eq} = \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\ldots\right)^{-1}$$

$$P = IV$$

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

$$C = \varepsilon_0\frac{A}{d}$$

$$C = \kappa C_0$$

$$\frac{1}{C_S} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}\ldots$$

$$C_P = C_1 + C_2 + C_3 \ldots$$

$$U_C = \frac{1}{2}V^2 C = \frac{1}{2}\frac{Q^2}{C} = \frac{1}{2}QV$$

$$\tau = RC$$

$$q(t) = Q\left(1 - e^{\frac{-t}{\tau}}\right)$$

$$q(t) = Qe^{\frac{-t}{\tau}}$$

$$I(t) = I_0 e^{\frac{-t}{\tau}}$$

$$\vec{F} = q\vec{v}\times\vec{B}$$

$$\vec{F} = I\vec{l}\times\vec{B}$$

$$r = \frac{mv}{qB}$$

$$\vec{\mu} = NIA\hat{n}$$

$$\vec{\tau} = \vec{\mu}\times\vec{B}$$

$$\vec{B} = \frac{\mu_0}{4\pi}\int_{\text{wire}}\frac{Id\vec{l}\times\hat{r}}{r^2}$$

$$B_{\text{wire}} = \frac{\mu_0 I}{2\pi R}$$

$$B_{\text{loop}} = \frac{\mu_0 I}{2R}$$

$$B_{\text{solenoid}} = \frac{\mu_0 NI}{L} = \mu_0 nI$$

$$\Phi_{\text{m}} = \int_S \vec{B}\cdot\hat{n}\,dA$$

$$\mathcal{E} = -N\frac{d\Phi_{\text{m}}}{dt}$$

$$\mathcal{E} = Blv$$

Some useful constants

$$k = \frac{1}{4\pi\varepsilon_0} = 9.00\times10^9\frac{\text{N}\cdot\text{m}^2}{\text{C}^2}$$

$$e = 1.60\times10^{-19}\text{C}$$

$$m_e = 9.11\times10^{-31}\text{kg}$$

$$m_p = m_n = 1.67\times10^{-27}\text{kg}$$

$$\varepsilon_0 = 8.85\times10^{-12}\frac{C^2}{\text{N}\cdot\text{m}^2}$$

$$\mu_0 = 4\pi\cdot10^{-7}\frac{\text{N}}{\text{A}^2}\,or\,\frac{\text{Wb}}{\text{A}\cdot\text{m}}$$

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