Formulae and Constants

Electrostatics		
$\vec{F}_e = k\frac{q_1 q_2}{r^2}\hat{r} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}\hat{r}$	$\vec{E} = k\frac{q}{r^2}\hat{r} = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}\hat{r}$	$\vec{F}_e = q\vec{E}$
$U = k\frac{q_1 q_2}{r} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r}$	$V = k\frac{q}{r} = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$	$U = qV$
$\Phi_E = \oiint \vec{E}\cdot d\vec{A} = \oiint EdA\cos\theta = \frac{Q_{enc}}{\varepsilon_0}$		$\vec{E} = -\frac{\partial V}{\partial x}\hat{\imath} - \frac{\partial V}{\partial y}\hat{\jmath} - \frac{\partial V}{\partial z}\hat{k}$
$\Delta V = -\int_a^b \vec{E}\cdot\vec{dl}$	$W = -q\Delta V$	$C = \frac{\varepsilon_0 A}{d}$
$C = \kappa C_0 = \kappa\varepsilon_0\frac{A}{d} = \varepsilon\frac{A}{d}$	$U = \frac{1}{2}\frac{Q^2}{C} = \frac{1}{2}QV = \frac{1}{2}CV^2$	$u = \frac{1}{2}\varepsilon_0 E^2$
Electrodynamics		
$\Delta V_R = IR$	$P = IV = I^2R = \frac{V^2}{R}$	$\vec{J} = \sum_i n_i q_i \vec{v}_i$
$R = R_1 + R_2 + R_3 + \cdots$	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots$	$R = \frac{\rho L}{A}$
$\Delta V_C = \frac{Q}{C}$	$C = C_1 + C_2 + C_3 + \cdots$	$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \cdots$
$\sum_{\text{junction}} i = 0$	$\sum_{\text{loop}} (\mathcal{E} + \Delta V_R + \Delta V_C) = 0$	$\tau = RC$
Magnetostatics		
$\vec{F}_m = q\vec{v}\times\vec{B}$	$\Phi_B = \int \vec{B}\cdot d\vec{A}$	$\vec{F} = I\vec{l}\times\vec{B}$
$\vec{\mu} = I\vec{A}$	$\vec{B} = \frac{\mu_0}{4\pi}\frac{q\vec{v}\times\hat{r}}{r^2}$	$d\vec{B} = \frac{\mu_0}{4\pi}\frac{Id\vec{l}\times\hat{r}}{r^2}$
$\oint \vec{B}\cdot d\vec{l} = \mu_0 I_{enc}$	$\vec{\tau} = \vec{\mu}\times\vec{B}$	$U = -\vec{\mu}\cdot\vec{B}$
$nq = -\frac{J_x B_y}{E_z}$	$r = \frac{mv}{qB}$	
Magnetodynamics		
$\mathcal{E} = -\frac{d\Phi_B}{dt}$	$\mathcal{E} = \int_a^b (\vec{v}\times\vec{B})\cdot d\vec{l}$	$\mathcal{E}_2 = -N_2\frac{d\Phi_{B2}}{dt}$
$\mathcal{E}_2 = -M\frac{di_1}{dt}$	$M = \frac{N_2\Phi_2}{i_1} = \frac{N_1\Phi_1}{i_2}$	$\mathcal{E} = -L\frac{dI}{dt}$
$L = \frac{N\Phi}{i}$	$U = \frac{1}{2}LI^2$	$u = \frac{1}{2\mu_0}B^2$
$\tau = \frac{L}{R}$	$x = x_0 e^{-t/\tau}$	$x = x_0\left(1 - e^{-t/\tau}\right)$

Formulae and Constants (continued)

Fundamental Constants		
$k = 8.99 \cdot 10^9 \frac{\mathrm{Nm}^2}{\mathrm{C}^2}$	$\varepsilon_0 = 8.85 \cdot 10^{-12} \frac{\mathrm{C}^2}{\mathrm{Nm}^2}$	$\mu_0 = 4\pi \cdot 10^{-7} \frac{\mathrm{Tm}}{\mathrm{A}}$
$q_e = -1.602 \cdot 10^{-19}\mathrm{C}$	$m_e = 9.11 \cdot 10^{-31}\mathrm{kg}$	$m_p = 1.67 \cdot 10^{-27}\mathrm{kg}$

Kinematics and Dynamics			
$\sum \vec{F} = m\vec{a}$	$x = x_0 + v_{x0}t + \frac{1}{2}a_x t^2$	$v_x = v_{x0} + a_x t$	$v_{xf}^2 = v_{xi}^2 + 2a_x \Delta x$

Mathematical Formulae & Prefixes			
milli $(m) = 10^{-3}$	micro $(\mu) = 10^{-6}$	nano $(n) = 10^{-9}$	pico $(p) = 10^{-12}$
$C = 2\pi r$	$A_{CIRCLE} = \pi r^2$	$A_{SPHERE} = 4\pi r^2$	
$V_{SPHERE} = \frac{4}{3}\pi r^3$	$A_{CYL} = 2\pi r L$	$V_{CYL} = \pi r^2 L$	
$ax^2 + bx + c = 0 \rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	$\int \frac{dx}{\sqrt{x^2 + a^2}} = \ln\left(x + \sqrt{x^2 + a^2}\right)$		
$\int \frac{dx}{\sqrt{a^2 - x^2}} = \arcsin\frac{x}{a}$	$\int \frac{dx}{x^2 + a^2} = \frac{1}{a}\arctan\frac{x}{a}$		
$\int \frac{dx}{(x^2 + a^2)^{3/2}} = \frac{1}{a^2}\frac{x}{\sqrt{x^2 + a^2}}$	$\int \frac{xdx}{(x^2 + a^2)^{3/2}} = -\frac{1}{\sqrt{x^2 + a^2}}$		
$(1 + x)^n = 1 + nx + \frac{n(n-1)}{2}x^2 + \cdots \ \ if\ x \ll 1, then\ (1 + x)^n \cong 1 + nx$			