Chapter 32: The Magentic Field	
Electric Force:	$\overrightarrow{F_E} = q\overrightarrow{E}$
Magnetic Force:	$\overrightarrow{F_B} = q\vec{v} \times \overrightarrow{B}$
Biot-Savart Law:	$d\overrightarrow{B} = \frac{\mu_0}{4\pi}\frac{q\vec{v} \times \hat{r}}{r^2}$
Current Segment:	$d\overrightarrow{B} = \frac{\mu_0}{4\pi}\frac{i\Delta\vec{s} \times \hat{r}}{r^2}$
Superposition:	$\overrightarrow{B}_{Total} = \overrightarrow{B}_1 + \overrightarrow{B}_2 + ...$
B-Field, long straight wire:	$B = \frac{\mu_0 i}{2\pi d}$
B-Field, coil center (N loops):	$B = \frac{\mu_0 N i \phi}{2R}$
B-Field, Center of circular arc:	$B = \frac{\mu_0 i \phi}{4\pi R}$
B-Field, dipole, on-axis:	$B_{loop} = \frac{\mu_0 2\vec{\mu}}{4\pi z^3}$
Magnetic Dipole Moment (Coil)	$\vec{\mu} = Ni\overrightarrow{A}$
Ampere's Law:	$\oint \overrightarrow{B} \cdot d\vec{s} = \mu_0 i_{enc}$
B-Field, inside a long straight wire:	$B = \frac{\mu_0 i}{2\pi R^2} r$
B-Field, inside an ideal solenoid:	$B = \frac{\mu_0 N I}{l} = \mu_0 i n$
Circulating Charged Particle:	$r = \frac{mv}{\|q\|B}$
	$T = \frac{2\pi m}{\|q\|B}$
	$f = \frac{\|q\|B}{2\pi m}$
	$\|q\|vB = \frac{mv^2}{r}$
Force on a wire:	$\overrightarrow{F_B} = i\overrightarrow{L} \times \overrightarrow{B}$
Force between long parallel wires:	$\|F_{ba}\| = \frac{\mu_0 L i_a i_b}{2\pi d}$
Torque on a Mag. Dipole:	$\vec{\tau} = \vec{\mu} \times \overrightarrow{B}$
Potential Energy for a Mag. Dipole:	$U(\theta) = -\vec{\mu} \cdot \overrightarrow{B}$

Chapter 33: Electromagnetic Induction	
Wire moving at speed v on a U-shaped conductor	
Induced Current:	$I = \frac{vlB}{R}$
Force:	$F_{pull} = \frac{vl^2B^2}{R}$
Power:	$P_{dissipated} = \frac{v^2l^2B^2}{R}$
Magnetic Flux:	$\Phi_B = \oint \overrightarrow{B} \cdot d\overrightarrow{A}$
Magnetic Flux: ($\overrightarrow{B} \perp$ A, $\overrightarrow{B}$ uniform)	$\Phi_B = BA$
Faraday's Law:	$\mathscr{E} = -\frac{d\Phi_B}{dt}$
(for a coil with N turns):	$\mathscr{E} = -N\frac{d\Phi_B}{dt}$
Faraday's Law, reformulated:	$\oint \overrightarrow{E} \cdot d\vec{s} = -N\frac{d\Phi_B}{dt}$
Inductance (definition):	$L = \frac{\Phi_B}{I}$
Inductance of a solenoid:	$L = \frac{\mu_0 N^2 A}{l}$
Potential diff, Inductor:	$\mathscr{E}_L = \|L\frac{di}{dt}\|$
RL Circuit: rising current	$i(t) = \frac{\mathscr{E}}{R}(1 - e^{-t/\tau_L})$
RL Circuit: decay of current	$i(t) = i_0(e^{-t/\tau_L})$
RL Circuit: time constant	$\tau_L = \frac{L}{R}$
Energy in a Magnetic Field:	$U_B = \frac{1}{2}Li^2$

Chapter 29: Potential and Field	
Potential and E-Field:	$\Delta V = V_f - V_i = -\int_{s_i}^{s_f} \vec{E} \cdot d\vec{s}$
E-Field from a potential:	$E_x = -\frac{\partial V}{\partial x}$
	$E_y = -\frac{\partial V}{\partial y}$
	$E_z = -\frac{\partial V}{\partial z}$
Kirchhoff's Loop Law:	$\Delta V_{loop} = \sum_i (\Delta V)_i = 0$
Capacitor:	$Q = C\Delta V_C$
Parallel Plate Capacitor:	$C = \frac{\epsilon_0 A}{d}$
Capacitors in series:	$\frac{1}{C_{eq}} = \sum_{i=1}^{n} (\frac{1}{C_i})$
Capacitors in parallel:	$C_{eq} = \sum_{i=1}^{n} (C_i)$
Energy Stored in Capacitor:	$U = \frac{Q^2}{2C}$ or $U = \frac{1}{2}CV^2$
Energy Stored in an Electric field:	$U = \frac{1}{2}\epsilon_0 E^2$

Chapter 30: Current and Resistance	
Current:	$i = \frac{dq}{dt}$
Junction Rule:	$\sum I_{in} = \sum I_{out}$
Resistance:	$R = \rho \frac{L}{A}$
Resistance:	$R = \frac{V}{I}$
Ohm's law:	$\Delta V = IR$
	$I = \frac{\Delta V}{R}$

Prefixes			Constants
10^{-6}	micro	μ	$\epsilon_0 = 8.854 \times 10^{-12}\ \frac{\mathrm{C}^2}{\mathrm{Nm}^2}$
10^{-9}	nano	n	$e = 1.6 \times 10^{-19}$ C
10^{-12}	pico	p	$m_e = 9.109 \times 10^{-31}$ kg
10^{-15}	femto	f	$k = \frac{1}{4\pi\epsilon_0} = 8.99 \times 10^9\ \frac{\mathrm{Nm}^2}{\mathrm{C}^2}$
			$m_p = 1.673 \times 10^{-27} kg$

Chapter 31: Fundamentals of Circuits	
Power:	$P = IV$
Power (Resistive dissipation):	$P = I^2R$ or $P = \frac{V^2}{R}$
Resistors in series:	$R_{eq} = \sum_{i=1}^{n} (R_i)$
Resistors in parallel:	$\frac{1}{R_{eq}} = \sum_{i=1}^{n} (\frac{1}{R_i})$
RC Circuit - Charging	$Q(t) = C\mathscr{E}(1 - e^{-t/RC})$
	$I(t) = \frac{\mathscr{E}}{R}(e^{-t/RC})$
	$V(t) = \mathscr{E}(1 - e^{-t/RC})$
Time Constant:	$\tau = RC$
RC Circuit - discharging	$Q(t) = Q_0(e^{-t/RC})$
	$I(t) = -(\frac{Q_0}{RC})e^{-t/RC}$
	$V(t) = \frac{Q_0}{C}(e^{-t/RC})$

Units	
Force:	$1\ N = 1\ kg\frac{m}{s^2}$
Energy (Joules):	$1\ J = 1\ Nm$
Energy (eV)	$1\ eV = 1.6 \times 10^{-19}\ J$
Electric Field:	$1\ \frac{N}{C} = 1\ \frac{V}{m}$
Electric Potential	$1\ V = 1\ \frac{J}{C}$
Charge:	$1\ C = (1\ A)(1\ s)$
Current:	$1\ A = 1\ \frac{C}{s}$
Capacitance:	$1F = \frac{1C}{1V}$
Resistance:	$1\Omega = 1\frac{V}{A}$
Resistivity:	$1\Omega \cdot m$
Power:	$1\ W = 1\frac{J}{s}$
Magnetic Field:	$1\ T = 1\frac{N}{A\ m}$
Magnetic Flux:	$1\ Wb = 1\ T \cdot m^2$
Inductance:	$1\ H = 1\frac{T \cdot m^2}{A}$

Chapter 25: Electric Charges and Forces

Coulomb's Law:	$\vec{F} = \frac{\lvert q_1 \rvert \lvert q_2 \rvert}{4\pi\epsilon_0 r^2}\hat{r}$
Superposition:	$\vec{F}_{Total} = \vec{F}_{12} + \vec{F}_{13} + ...$
Force on charge in an E-Field:	$\vec{F}_{\mathrm{onq}} = q\vec{E}$
E-Field at (x,y,z):	$\vec{E}(x,y,z) = \frac{\vec{F}_{onq}\mathrm{at(x, y, z)}}{q}$
E-Field - point charge:	$\vec{E} = \frac{q}{4\pi\epsilon_0 r^2}\hat{r}$

Chapter 26: The Electric Field

Electric dipole moment:	$\vec{p} = q\vec{d}$
E-Field - dipole (on axis):	$\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{2\vec{p}}{r^3}$
E-Field - dipole (bisecting plane):	$\vec{E} = -\frac{1}{4\pi\epsilon_0}\frac{\vec{p}}{r^3}$
Linear charge density:	$\lambda = \frac{Q}{L}$
Surface charge density:	$\eta = \frac{Q}{A}$
E-Field - charged rod:	$\vec{E}_{rod} = \frac{1}{4\pi\epsilon_0}\frac{\lvert Q \rvert}{r\sqrt{r^2 + (L/2)^2}}$
E-Field - infinite line:	$\vec{E}_{line} = \frac{1}{4\pi\epsilon_0}\frac{2\lvert\lambda\rvert}{r}$
E-Field - charged ring (on axis):	$\vec{E}_{ring} = \frac{zQ}{4\pi\epsilon_0(z^2 + R^2)^{3/2}}$
E-Field - charged disk:	$\vec{E}_{disk} = \frac{\eta}{2\epsilon_0}\left(1 - \frac{z}{\sqrt{z^2 + R^2}}\right)$
E-Field - above a plane of charge:	$\vec{E} = \frac{\eta}{2\epsilon_0}$
E-Field - below a plane of charge:	$\vec{E} = \frac{-\eta}{2\epsilon_0}$
E-Field - Outside a Sphere of charge:	$\vec{E}_{sphere} = \frac{\lvert Q \rvert}{4\pi\epsilon_0 r^2}\hat{r}$
E-Field - Capacitor (+ to -):	$\vec{E}_{capacitor} = \frac{\eta}{\epsilon_0}$
Motion in a uniform field:	$\vec{a} = \frac{q\vec{E}}{m}$
Torque on a dipole:	$\vec{\tau} = \vec{p} \times \vec{E}$

Chapter 27: Gauss's Law

Electric Flux (constant E-field):	$\Phi_E = \vec{E} \cdot \vec{A}$
Electric Flux:	$\Phi_E = \int \vec{E} \cdot d\vec{A}$
Gauss's Law:	$\epsilon_0 \Phi_E = q_{enc}$
Gauss's Law:	$\epsilon_0 \oint \vec{E} \cdot d\vec{A} = q_{enc}$

Chapter 28: The Electric Potential

Work from a constant force:	$W = \vec{F} \cdot \Delta\vec{r}$
Potential Energy and work:	$\Delta U = -W$
Work (general) :	$W = \int_i^f \vec{F} \cdot d\vec{s}$
Pot. Energy - uniform E-field:	$U_{elec} = U_0 + qEs$
Pot. Energy - 2 point charges:	$U_{elec} = k\frac{q_1 q_2}{r}$
Pot. Energy - Multiple point charges:	$U_{elec} = \sum_{i<j} k\frac{q_i q_j}{r}$
Potential Energy - dipole:	$U = -\vec{p} \cdot \vec{E}$
Potential Difference:	$\Delta V = V_f - V_i$
	$\Delta V = \frac{\Delta U}{q}$
	$\Delta V = -\frac{W}{q}$
Potential - capacitor:	$V = Es$
Potential - point charge:	$V = \frac{q}{4\pi\epsilon_0 r}$
Potential - many point charges:	$V = \sum_i \frac{q_i}{4\pi\epsilon_0 r_i}$
Potential - dipole:	$V = \frac{p cos\theta}{4\pi\epsilon_0 r^2}$
Potential - charge distr:	$V = \frac{1}{4\pi\epsilon_0}\int\frac{dq}{r}$
Potential - ring of charge (on axis):	$V_{ring} = \frac{1}{4\pi\epsilon_0}\frac{Q}{\sqrt{R^2 + z^2}}$
Potential - charged disk (on axis):	$V_{disk} = \frac{Q}{2\pi\epsilon_0 R^2}(\sqrt{z^2 + R^2} - z)$

Kinematic Equations

Position vs time for a constant ($\vec{a}$):	$x(t) = x_0 + v_0 t + \frac{1}{2}at^2$
velocity vs time for a constant ($\vec{a}$):	$v(t) = v_0 + at$