Formulas:

$F = k\frac{q_1 q_2}{r^2}$ Coulomb's law ; $k = \frac{1}{4\pi\varepsilon_0} = 8.99\times 10^9 \mathrm{N\cdot m^2/C^2}$; $\varepsilon_0 = 8.85\times 10^{-12} C^2/Nm^2$

Electric field: $\vec{E} = \frac{q}{4\pi\varepsilon_0 r^2}\hat{r} = \frac{kq}{r^2}\hat{r}$; $\vec{E}(\vec{r}) = k\int \rho(\vec{r}\,')\frac{\vec{r}-\vec{r}\,'}{|\vec{r}-\vec{r}\,'|^3}d^3r'$; $\vec{F} = q_0\vec{E}$

Linear, surface, volume charge density: $dq = \lambda\, d\ell$, $dq = \sigma\, da$, $dq = \rho\, dv$

Electric field of infinite: line of charge: $E = \frac{\lambda}{2\pi\varepsilon_0 r}$; sheet of charge: $E = \frac{\sigma}{2\varepsilon_0}$

$\vec{\nabla}\times\vec{E} = 0$ (electrostatics)

Gauss law: $\Phi = \oint \vec{E}\cdot d\vec{a} = \frac{q_{enc}}{\varepsilon_0} = \frac{1}{\varepsilon_0}\int d^3r\, \rho(\mathrm{r})$; Φ=electric flux

Energy: $U = k\frac{q_1 q_2}{r_{12}}$ $U = \frac{\varepsilon_0}{2}\int E(\vec{r})^2 d^3r$ Work: $W = \int \vec{F}\cdot d\vec{s}$

Electric potential: $\phi(P_2) - \phi(P_1) = -\int_{P_1}^{P_2}\vec{E}\cdot d\vec{s}$ $\phi(\vec{r}) = \frac{1}{4\pi\varepsilon_0}\int d^3r'\frac{\rho(\vec{r}\,')}{|\vec{r}-\vec{r}\,'|}$

Point charge: $\phi(\vec{r}) = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$ Dipole: $\phi(r,\theta) = \frac{p\cos\theta}{4\pi\varepsilon_0 r^2}$

$U = \frac{1}{2}\int \rho\,\phi\, d^3r$ $\vec{E} = -\vec{\nabla}\phi$; $\vec{\nabla}\cdot\vec{E} = \frac{\rho}{\varepsilon_0}$; $\vec{\nabla}\times\vec{E} = 0$

Capacitors: $Q = C\phi$, $U = \frac{Q^2}{2C}$; Planar: $C = \frac{\varepsilon_0 A}{s}$ electric field: $E = \sigma/\varepsilon_0$

$I = \int \vec{J}\cdot d\vec{a}$, $I = \frac{dQ}{dt}$, $\vec{J} = nq\vec{u}$; $div\vec{J} = -\frac{\partial\rho}{\partial t}$; Power: $P = I^2R$; $P = \varepsilon I$

V=IR; $\vec{J} = \sigma\vec{E}$; $\vec{E} = \rho\vec{J}$; $R = \rho\frac{L}{A}$; $\sigma = \frac{ne^2\tau}{m_e}$; $Q(t) = C\varepsilon(1-e^{-t/RC})$; $Q(t) = Q_0 e^{-t/RC}$

Lorentz force: $\vec{F} = q(\vec{E}+\vec{v}\times\vec{B})$; force on wire: $d\vec{F} = Id\vec{\ell}\times\vec{B}$; solenoid: $B = \mu_0 nI$

Stokes' theorem: $\oint_C \vec{F}\cdot d\vec{s} = \int_S (\vec{\nabla}\times\vec{F})\cdot d\vec{a}$; vector potential: $\vec{\nabla}\times\vec{A} = \vec{B}$

Ampere's law: $\oint_C \vec{B}\cdot d\vec{s} = \mu_0 I_{enc} = \mu_0\int_S \vec{J}\cdot d\vec{a}$; $\vec{\nabla}\times\vec{B} = \mu_0\vec{J}$; $\vec{\nabla}\cdot\vec{B} = 0$

Field of a wire: $B = \frac{\mu_0 I}{2\pi r}\hat{\theta}$; Force between wires: $F = \frac{\mu_0 I_1 I_2 \ell}{2\pi r}$; cyclotron: $\omega = \frac{qB}{m}$

loop (axis): $B = \frac{\mu_0 I b^2}{2(b^2+z^2)^{3/2}}$; Biot-Savart: $d\vec{B} = \frac{\mu_0}{4\pi}\frac{Id\vec{\ell}\times\hat{r}}{r^2}$ $\vec{B} = \vec{\nabla}\times\vec{A}$

Faraday's law $\varepsilon = \frac{1}{q}\int \vec{f}\cdot d\vec{s} = -\frac{d\Phi}{dt} = \oint \vec{E}\cdot d\vec{l}$; $\Phi = \int \vec{B}\cdot d\vec{a}$; $\vec{\nabla}\times\vec{E} = -\frac{\partial \vec{B}}{\partial t}$

Mutual inductance: $M_{21} = \frac{N_2\Phi_{21}}{I_1}$; $\varepsilon_2 = -M_{21}\frac{dI_1}{dt}$; $M_{21} = M_{12} = M$

Self - inductance: $L = \frac{N\Phi_B}{I}$; $\varepsilon_L = -L\frac{dI}{dt}$; $\frac{L}{l} = \mu_0 n^2 A$ for solenoid ; energy $U = \frac{1}{2}LI^2$

energy density: magnetic $u=\frac{1}{2}\frac{B^2}{\mu_0}$; electric $u=\frac{1}{2}\varepsilon_0 E^2$, $\mu_0 = 4\pi\times 10^{-7} kg\ m/C^2$

LR circuit: $I = \frac{V_0}{R}(1-e^{-t/\tau_L})$ (rise) ; $I = I_0 e^{-t/\tau_L}$ (decay) ; $\tau_L = L/R$

LRC circuit: $Q(t) = Q_0 e^{-\frac{R}{2L}t}\cos(\omega t+\phi)$; $\omega = \sqrt{\omega_0^2 - \frac{R^2}{4L^2}}$; $\omega_0 = 1/\sqrt{LC}$

AC circuit, LRC: $\varepsilon = \varepsilon_0 e^{i\omega t}$; $I = I_0 e^{i(\omega t+\phi)}$; $I=\varepsilon/Z$; $\tan\phi = -\frac{Z_L+Z_C}{R}$

$Z_L = i\omega L$; $Z_C = 1/i\omega C$; $Z = R + Z_L + Z_C$; $I_0 = \varepsilon_0/|Z|$; $\bar{P} = I_{rms}V_{rms}\cos\phi$

Ampere- Maxwell law: $\vec{\nabla}\times\vec{B} = \mu_0\vec{J} + \mu_0\varepsilon_0\frac{\partial\vec{E}}{\partial t} = \mu_0\vec{J} + \mu_0\vec{J}_d$

Electromagnetic wave in vacuum: $c = 1/\sqrt{\mu_0\varepsilon_0} = \omega/k$

$\vec{E} = \hat{z}E_0\sin(ky-\omega t)$; $\vec{B} = \hat{x}B_0\sin(ky-\omega t)$; propagates in direction $\vec{E}\times\vec{B}$

Poynting vector: $\vec{S} = \frac{\vec{E}\times\vec{B}}{\mu_0}$; $\frac{\partial u}{\partial t} = -\vec{\nabla}\cdot\vec{S}$; $u = \frac{1}{2}\varepsilon_0 E^2 + \frac{1}{2\mu_0}B^2$