$\mathbf{E}(\mathbf{x}) = \frac{1}{4\pi\epsilon_0}\int \rho(\mathbf{x}')\frac{\mathbf{x}-\mathbf{x}'}{|\mathbf{x}-\mathbf{x}'|^3}\,d^3x'$ Coulomb's Law (1.5)

$\delta(f(x)) = \sum_i \frac{1}{\left|\frac{\mathrm{d}f}{\mathrm{d}x}(x_i)\right|}\delta(x-x_i)$ Delta function Rule 5

$\oint_S \mathbf{E}\cdot\mathbf{n}\,da = \frac{1}{\epsilon_0}\int_V \rho(\mathbf{x})d^3x$ Gauss' Law (1.11)

$\nabla\times\mathbf{E} = 0$ Curl of electric field (1.14)

$\mathbf{E} = -\nabla\Phi$ Electric field in terms of scalar potential (1.16)

$\Phi(\mathbf{x}) = \frac{1}{4\pi\epsilon_0}\int\frac{\rho(\mathbf{x}')}{|\mathbf{x}-\mathbf{x}'|}d^3x'$ Scalar potential in terms of charge density (1.17)

$(\mathbf{E_2}-\mathbf{E_1})\cdot\mathbf{n} = \sigma/\epsilon_0$ Electric field of a surface distribution (1.22)

$\nabla^2\Phi = -\rho/\epsilon_0$ Poisson Equation (1.28)

$\nabla^2\Phi = 0$ Laplace Equation (1.29)

$G(\mathbf{x},\mathbf{x}') = \frac{1}{|\mathbf{x}-\mathbf{x}'|} + F(\mathbf{x},\mathbf{x}')$ Green's function for Poisson's equation (1.40)

$\Phi(\mathbf{x}) = \frac{1}{4\pi\epsilon_0}\int_V \rho(\mathbf{x}')G_D(\mathbf{x},\mathbf{x}')d^3x' = \frac{1}{4\pi}\oint_S(\mathbf{x}')\frac{\partial G_D}{\partial n'}da'$ DBCs (1.44)

$\Phi(\mathbf{x}) = \langle\Phi\rangle_S + \frac{1}{4\pi\epsilon_0}\int_V\rho(\mathbf{x}')G_N(\mathbf{x},\mathbf{x}')d^3x + \frac{1}{4\pi}\oint_S\frac{\partial\Phi}{\partial n'}G_N\,da'$ NBCs (1.46)

$W = \frac{\epsilon_0}{2}\int|\nabla\Phi|^2d^3x = \frac{\epsilon_0}{2}\int|\mathbf{E}|^2\,d^3x$ Energy stored in electric field (1.54)

$q' = -\frac{a}{y}q, \quad y' = \frac{a^2}{y}$ Magnitude and position of image charge on sphere (2.4)

$\Phi = -E_0\left(r - \frac{a^3}{r^2}\right)$ Electric potential of conducting sphere in $\mathbf{E} = E_0\hat{\mathbf{z}}$ (2.14)

$\frac{1}{|\mathbf{x}-\mathbf{x}'|} = 4\pi\sum_{\ell=0}^{\infty}\sum_{m=-\ell}^{\ell}\frac{1}{2\ell+1}\frac{r_<^{\ell}}{r_>^{\ell+1}}Y^*_{\ell m}(\theta',\phi')Y_{\ell m}(\theta,\phi)$ GFE (3.70)

Where $r_<(r_>)$ is the smaller (larger) of $|\mathbf{x}|$ and $|\mathbf{x}'|$

$q = \int\rho(\mathbf{x}')\,d^3x'$ Monopole (4.4)

$\mathbf{p} = \int\mathbf{x}'\rho(\mathbf{x}')\,d^3x'$ Dipole (4.8)

$Q_{ij} = \int(3x_i'x_j' - r'\delta_{ij})\rho(\mathbf{x}')d^3x'$ Quadrupole (4.9)

$\Phi(\mathbf{x}) = \frac{1}{4\pi\epsilon_0}\left[\frac{q}{r} + \frac{\mathbf{p}\cdot\mathbf{x}}{r^3} + \frac{1}{2}\sum_{i,j}Q_{ij}\frac{x_ix_j}{r^5} + \ldots\right]$ Multipole Expansion (4.10)

$E_r = \frac{2p\cos\theta}{4\pi\epsilon_0}, \quad E_\theta = \frac{2p\sin\theta}{4\pi\epsilon_0}$ Dipole in $\hat{\mathbf{z}}$ (4.12)

$\mathbf{E}(\mathbf{x}) = \frac{3\mathbf{n}(\mathbf{p}\cdot\mathbf{n})-\mathbf{p}}{4\pi\epsilon_0|\mathbf{x}-\mathbf{x}_0|^3}$ **E**-field due to dipole **p** (4.13)

$W = \int\rho(\mathbf{x})\Phi(\mathbf{x})\,d^3x$ Charge in *external* field (4.21)

$W = q\Phi(0) - \mathbf{p}\cdot\mathbf{E}(0) - \frac{1}{6}\sum_i\sum_j Q_{ij}\frac{\partial E_j}{\partial x_i}(0) + \ldots$ Work multipole expsn. (4.24)

$\mathbf{P}(\mathbf{x}) = \sum_i N_i\langle\mathbf{p}_i\rangle$ Electric polarization (4.28)

$\mathbf{D} = \epsilon_0\mathbf{E} + \mathbf{P}$ Electric displacement(4.34)

$\mathbf{P} = \epsilon_0\chi_e\mathbf{E}$ Induced polarization (4.36)

$\mathbf{D} = \epsilon\mathbf{E}$ Electric displacement (4.37)

$\epsilon = \epsilon_0(1+\chi_e)$ Electric permittivity (4.38)

$\begin{cases}(\mathbf{D_2}-\mathbf{D}_1)\cdot\mathbf{n}_{21} = \sigma\\(\mathbf{E_2}-\mathbf{E}_1)\times\mathbf{n}_{21} = 0\end{cases}$ Boundary conditions (4.40)

$\Phi_{\text{in}} = -\left(\frac{3}{\epsilon/\epsilon_0+2}\right)E_0r\cos\theta$

Dielectric sphere in $\mathbf{E} = E_0\hat{\mathbf{z}}$ (4.54)

$\Phi_{\text{out}} = -E_0r\cos\theta + \left(\frac{\epsilon/\epsilon_0-1}{\epsilon/\epsilon_0+2}\right)E_0\frac{a^3}{r^2}\cos\theta$

$W = \frac{1}{2}\int\mathbf{E}\cdot\mathbf{D}\,d^3x$ Electrostatic Energy (4.89)

$\Delta W = -\frac{1}{2}\int_{V_1}\mathbf{P}\cdot\mathbf{E}_0\,d^3x$ Dielectric placed in $\mathbf{E}_0$ (4.93)

$\mathbf{N} = \boldsymbol{\mu}\times\mathbf{B}$ Torque on magnetic dipole moment (5.1)

$\nabla\cdot\mathbf{J} = 0$ Condition of magnetostatics (5.3)

$d\mathbf{B} = kI\frac{d\mathbf{l}\times\mathbf{x}}{|\mathbf{x}|^3}$ Biot-Savart Law (5.4)

$\mathbf{F} = \int\mathbf{J}(\mathbf{x})\times\mathbf{B}(\mathbf{x})\,d^3x$ Force on current dist. (5.12)

$\mathbf{N} = \int\mathbf{x}\times(\mathbf{J}\times\mathbf{B})\,d^3x$ Torque on current dist. (5.13)

$\oint_C\mathbf{B}\cdot d\mathbf{l} = \mu_0I$ Ampère's law (5.25)

$\mathbf{B}(\mathbf{x}) = \nabla\times\mathbf{A}(\mathbf{x})$ Magnetic vector potential (5.27)

$\mathbf{A}(\mathbf{x}) = \frac{\mu_0}{4\pi}\int\frac{\mathbf{J}(\mathbf{x}')}{|\mathbf{x}-\mathbf{x}'|}d^3x'$ MVP, current dist. (5.32)

$\mathbf{m} = \frac{1}{2}\int\mathbf{x}'\times\mathbf{J}(\mathbf{x}')\,d^3x$ Magnetic moment def. (5.54)

$\mathbf{A}(\mathbf{x}) = \frac{\mu_0}{4\pi}\frac{\mathbf{m}\times\mathbf{x}}{|\mathbf{x}|^3}$ Dipole vector potential (5.55)

$\mathbf{B}(\mathbf{x}) = \frac{\mu_0}{4\pi}\left[\frac{3\mathbf{n}(\mathbf{n}\cdot\mathbf{m})-\mathbf{m}}{|\mathbf{x}|^3}\right]$ Dipole induction (5.56)

$\mathbf{m} = \frac{I}{2}\oint\mathbf{x}\times d\mathbf{l}$ Mag. moment of closed circuit

$|\mathbf{m}| = I\times(\text{Area})$ Moment of plane loop (5.57)

$\mathbf{F} = \boldsymbol{\nabla}(\mathbf{m}\cdot\mathbf{B})$ Force on dipole (5.69)

$\mathbf{M}(\mathbf{x}) = \sum_i N_i\langle\mathbf{m}_i\rangle$ Magnetization (5.76)

$\mathbf{J}_M = \boldsymbol{\nabla}\times\mathbf{M}$ Bound current density (5.79)

$\mathbf{H} = \frac{1}{\mu_0}\mathbf{B} - \mathbf{M}$ Magnetic field (5.81)

$\boldsymbol{\nabla}\times\mathbf{H} = \mathbf{J}$
$\boldsymbol{\nabla}\cdot\mathbf{B} = 0$ Macroscopic equations in matter (5.82)

$\mathbf{B} = \mu\mathbf{H}$ Linear condition (5.84)

$\begin{cases}(\mathbf{B}_2-\mathbf{B}_1)\cdot\mathbf{n} = 0\\\mathbf{n}\times(\mathbf{H}_2-\mathbf{H}_1) = \mathbf{K}\end{cases}$ Interface BC (5.86)

$\mathbf{H} = -\boldsymbol{\nabla}\Phi_M$ Magnetic scalar potential (5.93)

$\nabla^2\Phi_M = 0$ Magnetostatic Laplace Equation

$\nabla^2\Phi_M = -\rho_M$ Magnetostatic Poisson Equation (5.95)

$\rho_M = -\boldsymbol{\nabla}\cdot\mathbf{M}$ Effective magnetic charge density (5.96)

$\Phi_M(\mathbf{x}) = \frac{\mathbf{m}\cdot\mathbf{x}}{4\pi r^3}$ Mag. potential of dipole

$\sigma_M = \mathbf{n}\cdot\mathbf{M}$ Effective magnetic surface-charge density (5.99)

$\nabla^2\mathbf{A} = -\mu_0\mathbf{J}_M$ Poisson equation for **A** (5.101)

$\mathbf{A}(\mathbf{x}) = \frac{\mu_0}{4\pi}\int_V\frac{\boldsymbol{\nabla}'\times\mathbf{M}(\mathbf{x}')}{|\mathbf{x}-\mathbf{x}'|}\,d^3x + \frac{\mu_0}{4\pi}\oint_S\frac{\mathbf{M}(\mathbf{x}')\times\mathbf{n}'}{|\mathbf{x}-\mathbf{x}'|}\,da'$

$\mathbf{K}_M = \mathbf{M}\times\mathbf{n}$ Effective surface current

$\Phi_M(r,\theta) = \frac{1}{3}M_0a^2\frac{r_<}{r_>^2}\cos\theta$ Uniformly magnetized sphere (5.104)

$\mathbf{M} = \frac{3}{\mu_0}\left(\frac{\mu-\mu_0}{\mu+2\mu_0}\right)\mathbf{B}_0$ Sphere in uniform field (5.115)

$F = \int_S\mathbf{B}\cdot\mathbf{n}\,da$ Magnetic flux (5.133)

$\mathscr{E} = \oint_C\mathbf{E}'\cdot d\mathbf{l}$ Electromotive force (5.134)

$\mathscr{E} = -k\frac{\mathrm{d}F}{\mathrm{d}t}$ Faraday's Law (5.135)

$W = \frac{1}{2}\int\mathbf{H}\cdot\mathbf{B}\,d^3x$ Total magnetic energy (5.148)

$W = \frac{1}{2}\int\mathbf{J}\cdot\mathbf{A}\,d^3x$ Energy in terms of potential (5.149)

$\Delta W = \frac{1}{2}\int_{V_1}\mathbf{M}\cdot\mathbf{B}_0\,d^3x$ Change in energy for placing object (5.150)

$F_\xi = \left(\frac{\partial W}{\partial\xi}\right)_J$ Generalized force (5.151)

$W = \frac{1}{2}\sum_{i=1}^{N}L_iI_i^2 + \sum_{i=1}^{N}\sum_{j>i}^{N}M_{ij}I_iI_j$ Inductive energy (5.152)

$M_{ij} = \frac{1}{I_j}F_{ij}$ Mutual inductance (5.156)

$\tau = I\alpha = -\frac{\partial W}{\partial\theta}$ Mechanical torque

	Wiggly	Decaying
x, y, z	$e^{\pm ik_nx}$, $A\cos(k_nx) + B\sin(k_nx)$	$e^{\pm k_nx}$, $A\cosh(k_nx) + B\sinh(k_nx)$
ρ, ϕ, z	$e^{im\phi}$, $AJ_m(k_n\rho) + BY_m(k_n\rho)$	$AI_m(k_n\rho) + BK_m(k_n\rho)$
ρ, ϕ	$e^{im\phi}$	$A_0 + B_0\ln\rho + \sum A_m\rho^m + B_m\rho^{-m}$
r, θ	$P_\ell(\cos\theta)$	$A\left(\frac{r}{a}\right)^\ell + B(\frac{r}{a})^{-(\ell+1)}$
r, θ, ϕ	$Y_{\ell m}(\theta,\phi)$	$A\left(\frac{r}{a}\right)^\ell + B(\frac{r}{a})^{-(\ell+1)}$