$$\text{Cylindrical: } \nabla\psi = \frac{\partial\psi}{\partial\rho}\hat{\mathbf{e}}_1 + \frac{1}{\rho}\frac{\partial\psi}{\partial\phi}\hat{\mathbf{e}}_2 + \frac{\partial\psi}{\partial z}\hat{\mathbf{e}}_3, \quad \nabla\cdot\mathbf{A} = \frac{1}{\rho}\frac{\partial}{\partial\rho}(\rho A_1) + \frac{1}{\rho}\frac{\partial A_2}{\partial\phi} + \frac{\partial A_3}{\partial z}$$

$$\nabla\times\mathbf{A} = \left(\frac{1}{\rho}\frac{\partial A_3}{\partial\phi} - \frac{\partial A_2}{\partial z}\right)\hat{\mathbf{e}}_1 + \left(\frac{\partial A_1}{\partial z} - \frac{\partial A_3}{\partial\rho}\right)\hat{\mathbf{e}}_2 + \frac{1}{\rho}\left(\frac{\partial}{\partial\rho}(\rho A_2) - \frac{\partial A_1}{\partial\phi}\right)\hat{\mathbf{e}}_3$$

$$\nabla^2\psi = \frac{1}{\rho}\frac{\partial}{\partial\rho}\left(\rho\frac{\partial\psi}{\partial\rho}\right) + \frac{1}{\rho^2}\frac{\partial^2\psi}{\partial\phi^2} + \frac{\partial^2\psi}{\partial z^2}$$

$$\text{Spherical: } \frac{\partial\psi}{\partial r}\hat{\mathbf{e}}_1 + \frac{1}{r}\frac{\partial\psi}{\partial\theta}\hat{\mathbf{e}}_2 + \frac{1}{r\sin\theta}\frac{\partial\psi}{\partial\phi}\hat{\mathbf{e}}_3, \quad \nabla\cdot\mathbf{A} = \frac{1}{r^2}\frac{\partial}{\partial r}(r^2A_1) + \frac{1}{r\sin\theta}\frac{\partial}{\partial\theta}(\sin\theta A_2) + \frac{1}{r\sin\theta}\frac{\partial A_3}{\partial\phi}$$

$$\nabla\times\mathbf{A} = \frac{1}{r\sin\theta}\left[\frac{\partial}{\partial\theta}(\sin\theta A_3) - \frac{\partial A_2}{\partial\phi}\right]\hat{\mathbf{e}}_1 + \left[\frac{1}{r\sin\theta}\frac{\partial A_1}{\partial\phi} - \frac{1}{r}\frac{\partial}{\partial r}(rA_3)\right]\hat{\mathbf{e}}_2 + \frac{1}{r}\left[\frac{\partial}{\partial r}(rA_2) - \frac{\partial A_1}{\partial\theta}\right]\hat{\mathbf{e}}_3$$

$$\nabla^2\psi = \frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial\psi}{\partial r}\right) + \frac{1}{r^2\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial\psi}{\partial\theta}\right) + \frac{1}{r^2\sin^2\theta}\frac{\partial^2\psi}{\partial\phi^2}$$

$$\mathbf{P}\cdot\hat{\mathbf{n}} = \sigma_b, \quad -\nabla\cdot\mathbf{P} = \rho_b, \quad \epsilon_0\nabla\cdot\mathbf{E} = \rho_b + \rho_f = -\nabla\cdot\mathbf{P} + \rho_f, \quad \nabla\cdot(\epsilon_0\mathbf{E} + \mathbf{P}) = \rho_f$$

$$\nabla\cdot\mathbf{D} = \rho_f, \quad \oint\mathbf{D}\cdot d\mathbf{S} = q_{free}, \quad \mathbf{P} = \epsilon_0(\epsilon_r - 1)\mathbf{E}, \quad \epsilon = \epsilon_0\epsilon_r, \quad \mathbf{D} = \epsilon\mathbf{E}$$

$$(\mathbf{D}_2 - \mathbf{D}_1)\cdot\hat{\mathbf{n}}_{21} = \sigma_f, \quad (\mathbf{D}_2 - \mathbf{D}_1)\times\hat{\mathbf{n}}_{21} = (\mathbf{P}_2 - \mathbf{P}_1)\times\hat{\mathbf{n}}_{21},$$

$$(\mathbf{E}_2 - \mathbf{E}_1)\cdot\hat{\mathbf{n}}_{21} = \frac{\sigma}{\epsilon_0}, \quad (\mathbf{E}_2 - \mathbf{E}_1)\times\hat{\mathbf{n}}_{21} = 0, \quad \epsilon_1\mathbf{E}_{1n} = \epsilon_2\mathbf{E}_{2n}$$

$$W_{int} = k\sum_{i=1}^{n}\sum_{j<i}\frac{q_iq_j}{|\mathbf{x}_i - \mathbf{x}_j|} = \frac{k}{2}\sum_{i}^{n}\sum_{\substack{j\\ j\neq i}}\frac{q_iq_j}{|\mathbf{x}_i - \mathbf{x}_j|} = \frac{1}{2}\sum_{i=1}^{n}q_i\sum_{\substack{j\\ j\neq i}}k\frac{q_j}{|\mathbf{x}_i - \mathbf{x}_j|}$$

$$= \frac{1}{2}\sum_{i=1}^{n}q_i\Phi(\mathbf{x}_i) = \frac{1}{2}\int_\rho\rho(\mathbf{x})\Phi(\mathbf{x})\,d^3x = \frac{\epsilon_0}{2}\int_{all}|\mathbf{E}|^2\,d^3x = -\int_\infty^r\mathbf{F}\cdot d\mathbf{l} = \frac{1}{2}q\Phi_*(\mathbf{x})$$

$$W_{int} = \frac{1}{2}\int\mathbf{B}^2\ d^3r, \quad = \frac{1}{2}\int\mathbf{D}\cdot\mathbf{E}\ d^3r \quad W_{int\text{-}dip} = \mathbf{p}\cdot\mathbf{E}; \quad W_{12} = \frac{\mathbf{p}_1\cdot\mathbf{p}_2 - 3(\mathbf{n}\cdot\mathbf{p}_1)(\mathbf{n}\cdot\mathbf{p}_2)}{4\pi\epsilon_0|\mathbf{x}_1 - \mathbf{x}_2|^3}$$

$$\mathbf{B} = \frac{\mu_0}{4\pi}\int\frac{Id\mathbf{l}\times(\mathbf{r} - \mathbf{r}')}{|\mathbf{r} - \mathbf{r}'|^3}, \quad \nabla\times\mathbf{B} = \mu_0\mathbf{J}, \quad \nabla\cdot\mathbf{B} = 0, \quad d\mathbf{F} = Id\mathbf{l}\times\mathbf{B}, \quad w_B = \frac{B^2}{2\mu_0}$$

$$\mathbf{B} = \nabla\times\mathbf{A}, \quad \nabla^2\mathbf{A} = -\mu_0\mathbf{J}, \quad \mathbf{A}(\mathbf{x}) = \frac{\mu_0}{4\pi}\int\frac{\mathbf{J}(\mathbf{x}')}{|\mathbf{x} - \mathbf{x}'|}d^3x' + C$$

$$B = \frac{\mu_0 I}{4\pi r}(\sin\theta_2 - \sin\theta_1)$$

$$q' = -\left(\frac{\epsilon_2 - \epsilon_1}{\epsilon_2 + \epsilon_1}\right)q, \quad q'' = \left(\frac{2\epsilon_2}{\epsilon_2 + \epsilon_1}\right)q$$