Constants:

$e = 1.6 \times 10^{-19} C$; $\epsilon_0 = 8.85 \times 10^{-12}\, C^2/Nm^2$; $k = \frac{1}{4\pi\epsilon_0} = 9.0 \times 10^9\, N \cdot m^2/C^2$;
$\mu_0 = 4\pi \times 10^{-7}\, T \cdot m/A$

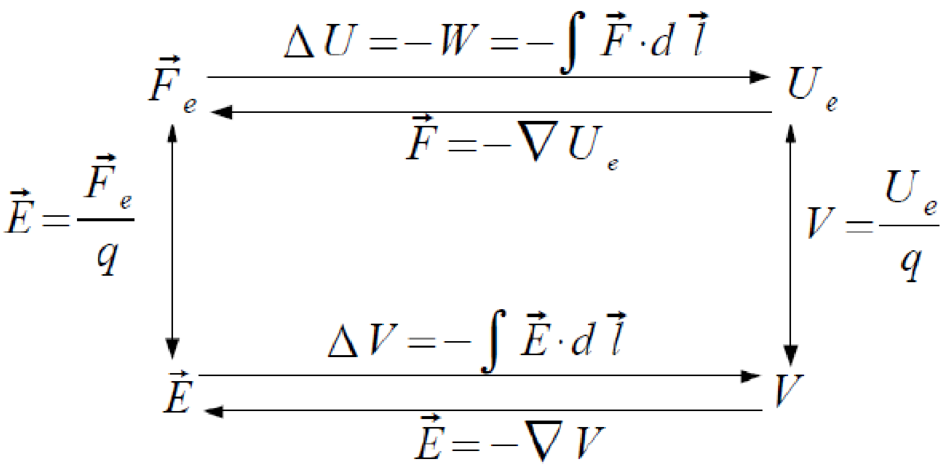
Unit conversion:

$eV = 1.6 \times 10^{-19} J$; Magnetic field is: tesla ($1T = 1\, N/A \cdot m$); Magnetic flux: weber ($1Wb = 1T \cdot m^2 = 1\, N \cdot m/A$)

Formulas

- $V = \frac{1}{4\pi\epsilon_0}\frac{q}{r}$ Electric potential due to a point charge
- $C = \frac{Q}{V}$ Capacitance
- $C_{eq} = C_1 + C_2$ Equivalent capacitance of two parallel connected capacitors
- $\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2}$ Equivalent capacitance of two series connected capacitors
- $U = \frac{1}{2} QV$ Energy stored in capacitor
- $K = \frac{\varepsilon}{\varepsilon_0}$ Dielectric constant of a material.
- $R = \rho \frac{L}{A}$ (resistivity); $R = \frac{V}{I}$ (Ohm's law); $R(T) = R_0[1 + \alpha(T - T_0)]$ (temperature dependent resistance)
- $\vec{F}_m = q\vec{v} \times \vec{B}$; $d\vec{F} = I\, d\vec{l} \times \vec{B}$
- $\vec{\tau} = I\vec{A} \times \vec{B}$ (magnetic torque for a current-carrying loop in magnetic field)
- $\vec{\mu} = I\vec{A}$ (magnetic dipole moment); $\vec{\tau} = \vec{\mu} \times \vec{B}$; $U_m = -\vec{\mu} \cdot \vec{B}$
- $d\vec{B} = \frac{\mu_0}{4\pi}\frac{I\, d\vec{l} \times \hat{r}}{r^2}$
- Magnetic field produced by a circular current loop: $\vec{B} = \frac{\mu_0 I a^2}{2(x^2 + a^2)^{3/2}}\hat{i}$ (on the axis of a circular loop who axis is aligned along $\hat{i}$)
- $\epsilon = \frac{-d\Phi_B}{dt}$

- Relationships among $\vec{F}$, $\vec{E}$, U, and V



Maxwell's equations

- $\oint \vec{E}\cdot d\vec{A} = \frac{Q_{encl}}{\epsilon_0}$ (Gauss's Law for $\vec{E}$)
- $\oint \vec{B}\cdot d\vec{A} = 0$ (Gauss's Law for $\vec{B}$)
- $\oint \vec{B}\cdot d\vec{l} = \mu_0 (I_{encl} + \epsilon_0 \frac{d\Phi_E}{dt})$ (Ampere's Law)
- $\oint \vec{E}\cdot d\vec{l} = -\frac{d\Phi_B}{dt}$ (Faraday's Law)