Constants: $e = 1.6 \times 10^{-19}$ C $\quad m_p = 1.67 \times 10^{-27}$ kg $\quad m_e = 9.1 \times 10^{-31}$ kg

$\epsilon_o = 8.85 \times 10^{-12} C^2/N \cdot m^2 \quad k = 1/(4\pi\epsilon_o) = 9 \times 10^9 \, N \cdot m^2/C^2 \quad \text{nano} = 10^{-9} \quad \text{micro} = 10^{-6}$

Coulomb's Law: $|\vec{F}| = \frac{|q_1||q_2|}{4\pi\epsilon_o r^2}$ (point charge)

Electric field: $\vec{E} = \frac{\vec{F}}{q} \quad \vec{E} = \frac{q}{4\pi\epsilon_o r^2}\hat{r}$ (point charge) $\quad \vec{E} = \int \frac{dq}{4\pi\epsilon_o r^2}\hat{r}$ (general) $\quad E = \frac{\sigma}{2\epsilon_o}$ (plane)

Gauss' law: $\Phi = \hat{n} \cdot \vec{E}\, A = \oint \hat{n} \cdot \vec{E}\, dA = \frac{q_{enc}}{\epsilon_o}$

Energy: $W = \int \vec{F} \cdot d\vec{s} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 = K_f - K_i$

For conservative forces $U_f - U_i = -\int \vec{F} \cdot d\vec{s} \rightarrow K_i + U_i = K_f + U_f$

Electric potential: $V = \frac{U}{q} \quad V = \frac{q}{4\pi\epsilon_o r}$ (point charge) $\quad V = \int \frac{dq}{4\pi\epsilon_o r}$ (general)

$V_b - V_a = -\int_a^b E_x dx = -\int_a^b \vec{E} \cdot d\vec{s} \quad E_x = -\frac{\partial V}{\partial x}, \quad E_y = -\frac{\partial V}{\partial y}, \quad E_z = -\frac{\partial V}{\partial z}$