Electricity & Magnetism

Coulomb's Law

$$F = k\frac{q_1 q_2}{r^2}$$

Electric Field, Def.

$$\mathbf{E} = \frac{\mathbf{F}_E}{q}$$

Electric Potential, Def.

$$\Delta V = \frac{\Delta U_E}{q}$$

Field & Potential

$$\bar{E} = -\frac{\Delta V}{d}$$

$$\mathbf{E} = -\nabla V$$

Electric Field

$$\mathbf{E} = k\sum\frac{q}{r^2}\hat{\mathbf{r}}$$

$$\mathbf{E} = k\int\frac{dq}{r^2}\hat{\mathbf{r}}$$

Electric Potential

$$V = k \sum \frac{q}{r}$$

$$V = k \int \frac{dq}{r}$$

Capacitance

$$C = \frac{Q}{V}$$

Plate Capacitor

$$C = \frac{\kappa \varepsilon_0 A}{d}$$

Cylindrical Capacitor

$$C = \frac{2\pi\kappa\varepsilon_0 \ell}{\ln(b/a)}$$

Spherical Cpacitor

$$C = \frac{4\pi\kappa\varepsilon_0}{(1/a) - (1/b)}$$

Capacitive Potential Energy.

$$U = \frac{1}{2} CV^2 = \frac{1}{2} \frac{Q^2}{C} = \frac{1}{2} QV$$

Electric Current

$$\bar{I} = \frac{\Delta q}{\Delta t}$$

$$I = \frac{dq}{dt}$$

Ohm's law

$$V = IR$$

$$\mathbf{E} = \rho\, \mathbf{J}$$

$$\mathbf{J} = \sigma \mathbf{E}$$

Resitivity-Conductivity

$$\rho = \frac{1}{\sigma}$$

Electric Resistance

$$R = \frac{\rho \ell}{A}$$

Electric Power

$$P = VI = I^2 R = \frac{V^2}{R}$$

Resistors In Series

$$R_s = \sum R_i$$

Resistors In Parallel

$$\frac{1}{R_p} = \sum \frac{1}{R_i}$$