SI / mks		**Gaussian / cgs**

Basic rule of thumb: $\mu_0 \varepsilon_0 = 1 / c^2$ and

$\mathbf{B}$	$\rightarrow$	$\mathbf{B} / c$
ε_0	$\rightarrow$	$1 / 4\pi$

Therefore

$\mathbf{A}$	$\rightarrow$	$\mathbf{A} / c$
μ_0	$\rightarrow$	$4\pi / c^2$

$\mathbf{E}$, current I, current density $\mathbf{J}$, charge e,
charge density ρ_c, and potential Φ all stay the same

Maxwell's Equations:

$$\nabla \cdot \mathbf{E} = \rho_c / \varepsilon_0 \qquad \nabla \cdot \mathbf{E} = 4\pi \rho_c$$

$$\nabla \cdot \mathbf{B} = 0 \qquad \nabla \cdot \mathbf{B} = 0$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t} \qquad \nabla \times \mathbf{E} = -\frac{1}{c}\frac{\partial \mathbf{B}}{\partial t}$$

$$\nabla \times \mathbf{B} = \mu_0 \mathbf{J} + \frac{1}{c^2}\frac{\partial \mathbf{E}}{\partial t} \qquad \nabla \times \mathbf{B} = \frac{4\pi}{c}\mathbf{J} + \frac{1}{c}\frac{\partial \mathbf{E}}{\partial t}$$

Forces:

$$\mathbf{F}_{\text{Coulomb}} = \frac{1}{4\pi\varepsilon_0}\frac{e_1 e_2}{r^2} \qquad \mathbf{F}_{\text{Coulomb}} = \frac{e_1 e_2}{r^2}$$

$$\mathbf{F}_{\text{Lorentz}} = e\left[\mathbf{E} + \mathbf{v} \times \mathbf{B}\right] \qquad \mathbf{F}_{\text{Lorentz}} = e\left[\mathbf{E} + \frac{1}{c}\mathbf{v} \times \mathbf{B}\right]$$

Etc:

$$\mathbf{E} = -\nabla\Phi - \frac{\partial \mathbf{A}}{\partial t} \qquad \mathbf{E} = -\nabla\Phi - \frac{1}{c}\frac{\partial \mathbf{A}}{\partial t}$$

$$\mathbf{B} = \nabla \times \mathbf{A} \qquad \mathbf{B} = \nabla \times \mathbf{A}$$

$$\mathbf{B} = \frac{\mu_0 I}{4\pi}\int \frac{d\mathbf{l} \times \mathbf{r}}{r^3} \qquad \mathbf{B} = \frac{I}{c}\int \frac{d\mathbf{l} \times \mathbf{r}}{r^3}$$

$$U = \frac{1}{2}\int d^3v\left[\varepsilon_0 E^2 + \frac{1}{\mu_0}B^2\right] \qquad U = \frac{1}{8\pi}\int d^3v\left[E^2 + B^2\right]$$

Plasma parameters:

SI / mks	Gaussian / cgs	
$\Omega_c = \frac{eB}{m}$	$\Omega_c = \frac{eB}{mc}$	Gyro-frequency, a.k.a. Larmor frequency, a.k.a. cyclotron frequency
$\rho_L = \frac{v_{thermal}}{\Omega_c} = \frac{\sqrt{Tm}}{eB}$	$\rho_L = \frac{v_{thermal}}{\Omega_c} = \frac{c\sqrt{Tm}}{eB}$	Gyro-radius, a.k.a Larmor radius
$\omega_p = \sqrt{ne^2 / \left(\varepsilon_0 m\right)}$	$\omega_p = \sqrt{4\pi n e^2 / m}$	Plasma frequency
$\lambda_D = \sqrt{\frac{\varepsilon_0 T}{ne^2}}$	$\lambda_D = \sqrt{\frac{T}{4\pi n e^2}}$	Debye length
$v_A = B / \sqrt{\mu_0 n_i m_i}$	$v_A = B / \sqrt{4\pi n_i m_i}$	Alfven speed
$\beta = 2\mu_0 p / B^2$	$\beta = 8\pi p / B^2$	Beta
$v_* = \frac{v_{thermal}^2}{\Omega R} = \frac{T}{eBR}$	$v_* = \frac{v_{thermal}^2}{\Omega R} = \frac{cT}{eBR}$	Drift speed

The relations $\omega_p \lambda_D = v_{thermal}$, $v_* = \dfrac{v_{thermal}^2}{\Omega R} = \dfrac{\rho_L v_{thermal}}{R}$, and $\dfrac{v_{thermal,i}^2}{v_A^2} = \dfrac{\beta}{2}$ all hold in both systems of units.

A reverse transformation from Gaussian to SI exists as well, but it is much more cumbersome:

SI / mks		**Gaussian / cgs**
$\dfrac{e}{\sqrt{4\pi\varepsilon_0}}$	$\leftarrow$	e
$\sqrt{4\pi\varepsilon_0}\mathbf{E}$	$\leftarrow$	$\mathbf{E}$
$c\sqrt{4\pi\varepsilon_0}\mathbf{B} = \sqrt{\dfrac{4\pi}{\mu_0}}\mathbf{B}$	$\leftarrow$	$\mathbf{B}$
$\dfrac{\rho_c}{\sqrt{4\pi\varepsilon_0}}$	$\leftarrow$	ρ_c
$\dfrac{1}{\sqrt{4\pi\varepsilon_0}}\mathbf{J}$	$\leftarrow$	$\mathbf{J}$
$\sqrt{4\pi\varepsilon_0}\Phi$	$\leftarrow$	Φ
$c\sqrt{4\pi\varepsilon_0}\mathbf{A}$	$\leftarrow$	$\mathbf{A}$

All non-electromagnetic quantities (length, frequency, speed, force, density, temperature, pressure, etc.) stay the same.

Warning!: these substitutions do not necessarily work for dielectrics (permittivity, susceptibility, etc.) and magnetic moment.

<u>For more info on E&M in various systems of units:</u>

D. J. Griffiths, *Introduction to Electrodynamics*, appendix C

NRL Plasma Formulary, p.19 in 2009 edition

J. D. Jackson, *Classical Electrodynamics*, appendix