SI / Gaussian Formula Conversion Table

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This table may be used to convert any electromagnetic formula between SI units and Gaussian units; simply make the substitutions indicated. To simplify the results, you may use $\varepsilon_0\mu_0 = 1/c^2$.

Note that in SI units there are two conventions for magnetic pole strength and dipole moment: one based on the B field (pole strength in A m), and one based on the H field (pole strength in Wb). Both conventions are given here.

As an example, given Coulomb's law in Gaussian units ($F = q_1 q_2/r^2$), we use the table to create the corresponding equation in SI units: $F = (q_1/\sqrt{4\pi\varepsilon_0})(q_2/\sqrt{4\pi\varepsilon_0})/r^2 = (1/4\pi\varepsilon_0)\, q_1 q_2/r^2$.

SI / Gaussian Formula Conversion Table.

Quantity	Gaussian Units	SI Units
Electric field	$\mathbf{E}$	$\sqrt{4\pi\varepsilon_0}\,\mathbf{E}$
Electric potential	V	$\sqrt{4\pi\varepsilon_0}\,V$
Electric displacement	$\mathbf{D}$	$\sqrt{4\pi/\varepsilon_0}\,\mathbf{D}$
Electric charge	q	$q/\sqrt{4\pi\varepsilon_0}$
Electric charge density	ρ	$\rho/\sqrt{4\pi\varepsilon_0}$
Electric current	I	$I/\sqrt{4\pi\varepsilon_0}$
Electric current density	$\mathbf{J}$	$\mathbf{J}/\sqrt{4\pi\varepsilon_0}$
Electric polarization	$\mathbf{P}$	$\mathbf{P}/\sqrt{4\pi\varepsilon_0}$
Electric dipole moment	$\mathbf{p}$	$\mathbf{p}/\sqrt{4\pi\varepsilon_0}$
Magnetic induction	$\mathbf{B}$	$\sqrt{4\pi/\mu_0}\,\mathbf{B}$
Magnetic flux	Φ_B	$\sqrt{4\pi/\mu_0}\,\Phi_B$
Magnetic vector potential	$\mathbf{A}$	$\sqrt{4\pi/\mu_0}\,\mathbf{A}$
Magnetic scalar potential	φ^*	$\sqrt{4\pi\mu_0}\,\varphi^*$
Magnetic intensity	$\mathbf{H}$	$\sqrt{4\pi\mu_0}\,\mathbf{H}$
Magnetomotive force	mmf	$\sqrt{4\pi\mu_0}$ mmf

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Quantity	Gaussian Units	SI Units
Magnetic pole strength (B conv.)	q^*	$\sqrt{\mu_0/4\pi}\, q^*$
Magnetic moment (B conv.)	$\mathbf{m}$	$\sqrt{\mu_0/4\pi}\, \mathbf{m}$
Magnetization	$\mathbf{M}$	$\sqrt{\mu_0/4\pi}\, \mathbf{M}$
Magnetic pole strength (H conv.)	Q^*	$Q^*/\sqrt{4\pi\mu_0}$
Magnetic moment (H conv.)	$\mathbf{d}$	$\mathbf{d}/\sqrt{4\pi\mu_0}$
Electric permittivity	ε	$\varepsilon/\varepsilon_0$
Magnetic permeability	μ	μ/μ_0
Electric susceptibility	χ_e	$\chi_e/4\pi$
Magnetic susceptibility	χ_m	$\chi_m/4\pi$
Conductivity	σ	$\sigma/4\pi\varepsilon_0$
Conductance	S	$S/4\pi\varepsilon_0$
Capacitance	C	$C/4\pi\varepsilon_0$
Resistivity	ρ	$4\pi\varepsilon_0\,\rho$
Resistance	R	$4\pi\varepsilon_0\,R$
Inductance	L	$4\pi\varepsilon_0\,L$
Memristance	M	$4\pi\varepsilon_0\,M$
Magnetic reluctance	$\mathcal{R}$	$\mu_0\,\mathcal{R}$