E & M Units

Symbol	Quantity	SI Unit	Gaussian cgs equivalent
Q, q	Charge	coulomb$\equiv$C=JV^{-1}[=s A]	$10\mathrm{c}=2.99792458\times10^{9}$esu =statcoulomb[=cm$^{3/2}g^{1/2}s^{-1}\epsilon^{1/2}$]
λ, μ	Linear Charge Density	Cm^{-1}[=m^{-1}s A]	$\frac{\mathrm{c}}{10}=2.99792458\times10^{7}$esu cm^{-1} [=cm$^{1/2}g^{1/2}s^{-1}\epsilon^{1/2}$]
σ	Surface Charge Density	Cm^{-2}[=m^{-2}s A]	$\frac{\mathrm{c}}{10^{3}}=2.99792458\times10^{5}$esu cm^{-2} [=cm$^{-1/2}g^{1/2}s^{-1}\epsilon^{1/2}$]
ρ	Volume Charge Density	Cm^{-3}[=m^{-3}s A]	$\frac{\mathrm{c}}{10^{5}}=2.99792458\times10^{3}$esu cm^{-3} [=cm$^{-3/2}g^{1/2}s^{-1}\epsilon^{1/2}$]
I, i	Current	ampere$\equiv$A	$10\mathrm{c}=2.99792458\times10^{9}$esu s^{-1} =statampere[=cm$^{3/2}$g$^{1/2}$s$^{-2}\epsilon^{1/2}$]
$\mathbf{K}, \mathcal{J}$	Surface Current Density	m^{-1}A	$\frac{\mathrm{c}}{10}=2.99792458\times10^{7}$esu cm^{-1}s^{-1} [=cm$^{1/2}g^{1/2}s^{-2}\epsilon^{1/2}$]
$\mathbf{J}$	Current Density	m^{-2}A	$\frac{\mathrm{c}}{10^{3}}=2.99792458\times10^{5}$esu cm^{-2}s^{-1} [=cm$^{-1/2}g^{1/2}s^{-2}\epsilon^{1/2}$]
$V, \mathcal{E}, \phi$	Voltage, EMF Potential	volt$\equiv$V=JC^{-1}[m^{2}kg s^{-3}A^{-1}]	$\frac{10^{6}}{\mathrm{c}}=3.335640952\times10^{-3}$statvolt =erg esu^{-1}[=cm$^{1/2}$g$^{1/2}$s$^{-1}\epsilon^{-1/2}$]
R	Resistance	ohm$\equiv$ Ω=VA^{-1}[=m^{2}kg s^{-3}A^{-2}]	$\frac{10^{5}}{\mathrm{c}^{2}}=1.112650056\times10^{-12}$cm^{-1}s$\epsilon^{-1}$
G	Conductance	siemens$\equiv$S=Ω^{-1}[=m^{-2}kg^{-1}s^{3}A^{2}]	$\frac{\mathrm{c}^{2}}{10^{5}}=8.987551787\times10^{11}$cm s$^{-1}\epsilon$
ρ	Resistivity	Ωm[=m^{3}kg s^{-3}A^{-2}]	$\frac{10^{7}}{\mathrm{c}^{2}}=1.112650056\times10^{-10}s\epsilon^{-1}$
σ	Conductivity	Sm^{-1}[=m^{-3}kg^{-1}s^{3}A^{2}]	$\frac{\mathrm{c}^{2}}{10^{7}}=8.987551787\times10^{9}s^{-1}\epsilon$
C	Capacitance	farad$\equiv$F=CV^{-1}[=m^{-2}kg^{-1}s^{4}A^{2}]	$\frac{\mathrm{c}^{2}}{10^{5}}=8.987551787\times10^{11}cm\epsilon$
L	Inductance	henry$\equiv$H=VsA^{-1}[=m^{2}kg s^{-2}A^{-2}]	$\frac{10^{5}}{\mathrm{c}^{2}}=1.112650056\times10^{-12}$cm^{-1}s$^{2}\epsilon^{-1}$
$\mathbf{E}$	Electric Field Strength	Vm^{-1}=NC^{-1}[=m kg s^{-3}A^{-1}]	$\frac{10^{4}}{\mathrm{c}}=3.335640952\times10^{-5}$dyn esu^{-1} =statvolt cm^{-1}[=cm$^{-1/2}$g$^{1/2}$s$^{-1}\epsilon^{-1/2}$]
$\mathbf{D}$	Electric Displacement Field	Cm^{-2}[=m^{-2}s A]	$\frac{4\pi\mathrm{c}}{10^{3}}=3.76730313\times10^{6}$ [cm$^{-1/2}$g$^{1/2}$s$^{-1}\epsilon^{1/2}$]
$\mathbf{P}$	Dipole Moment per unit volume (Polarization)	Cm^{-2}=Cm$\cdot$m^{-3}[=m^{-2}s A]	$\frac{\mathrm{c}}{10^{3}}=2.99792458\times10^{5}$esu cm^{-2} =esu cm$\cdot$cm^{-3}[=cm$^{-1/2}g^{1/2}s^{-1}\epsilon^{1/2}$]
$\mathbf{p}$	Electric Dipole Moment	Cm=J(Vm^{-1})$^{-1}$[=m s A]	$10^{3}\mathrm{c}=2.99792458\times10^{11}$esu cm [=cm$^{5/2}g^{1/2}s^{-1}\epsilon^{1/2}$]
$\Psi_{\mathbf{E}}$	Electric Flux ($\mathbf{E}$ Field)	Vm=Vm$^{-1}\cdot$m^{2}[=m^{3}kg s^{-3}A^{-1}]	$\frac{10^{8}}{\mathrm{c}}=3.335640952\times10^{-1}$statvolt cm [=cm$^{3/2}g^{1/2}s^{-1}\epsilon^{-1/2}$]
$\Psi_{\mathbf{D}}$	Electric Flux ($\mathbf{D}$ Field)	C=Cm$^{-2}\cdot$m^{2}[=s A]	$40\pi\mathrm{c}=3.76730313\times10^{10}$ [cm$^{3/2}$g$^{1/2}$s$^{-1}\epsilon^{1/2}$]
ϵ	Permittivity	Fm^{-1}[=m^{-3}kg^{-1}s^{4}A^{2}] ($\epsilon_{\mathrm{o}}=\frac{10^{7}}{4\pi\mathrm{c}^{2}}$)	$\frac{4\pi\mathrm{c}^{2}}{10^{7}}=1.129409067\times10^{11}$ [dimensionless$\equiv$ ϵ]
χ	Electric Susceptibility	[dimensionless]	$\frac{1}{4\pi}=0.07957747154$ [dimensionless=ϵ]
α, γ	Atomic Polarizability	m^{3} † ($\mathbf{p}=\epsilon_{\mathrm{o}}\alpha\mathbf{E}$)	$\frac{10^{6}}{4\pi}=7.957747154\times10^{4}cm^{3}\epsilon$

Symbol	Quantity	SI Unit	Gaussian cgs equivalent
l	length	meter≡m	10^2=100 centimeter≡cm
m	mass	kilogram≡kg	10^3=1000 gram≡g
t	time	second≡s	1=1 second≡s
F	force	newton≡N[=m kg s^{-2}]	$10^5=10^5$dyne[=cm g s^{-2}]
W, E	Work, Energy	joule≡J[=m^2kg s^{-2}]	$10^7=10^7$erg[=cm^2g s^{-2}]
P	Power	watt≡W=Js^{-1}[=m^2kg s^{-3}]	$10^7=10^7$erg s^{-1}[=cm^2g s^{-3}]
P	Pressure	pascal≡Pa=Nm^{-2}[=m^{-1}kg s^{-2}]	10=10dyn cm^{-2}[=cm^{-1}g s^{-2}]
f, ν	Frequency	hertz≡Hz[=s^{-1}]	1=1 Hz
q_m	Mag. Charge (pole strength)	$NT^{-1}=m^2A{\cdot}m^{-1}$[=m A] *	10=10 dyn Gs^{-1}=esu [=$cm^{3/2}g^{1/2}s^{-1}\mu^{-1/2}$]
$\mathbf{B}$	Magnetic Flux Density	tesla≡T=Vsm^{-2}[=kg $s^{-2}A^{-1}$]	$10^4=10^4$gauss≡Gs =dyn esu^{-1}[=$cm^{-1/2}g^{1/2}s^{-1}\mu^{1/2}$]
$\mathbf{H}$	Magnetic Field Strength	m $A{\cdot}m^{-2}$[=m^{-1}A] *	$\frac{4\pi}{10^3}=1.256637061\times10^{-2}$oersted ≡Oe[=$cm^{-1/2}g^{1/2}s^{-1}\mu^{-1/2}$]
$\mathbf{M}$	Mag. Moment per unit volume (Magnetization)	$m^2A{\cdot}m^{-3}$[=m^{-1}A] *	$10^{-3}=10^{-3}$erg $Gs^{-1}{\cdot}cm^{-3}$ =esu cm^{-2}[=$cm^{-1/2}g^{1/2}s^{-1}\mu^{-1/2}$]
$\mathbf{m}, \mu$	Magnetic Dipole Moment	JT^{-1}=m A·m[=m^2A] *	$10^3=10^3$esu cm=erg Gs^{-1} [=$cm^{5/2}g^{1/2}s^{-1}\mu^{-1/2}$]
$\Phi_\mathbf{B}$	Magnetic Flux ($\mathbf{B}$ Field)	weber≡Wb=Vs[=m^2kg $s^{-2}A^{-1}$]	$10^8=10^8$maxwell≡Mx =Gs cm^2[=$cm^{3/2}g^{1/2}s^{-1}\mu^{1/2}$]
$\Phi_\mathbf{H}$	Magnetic Flux ($\mathbf{H}$ Field)	$m^{-1}A{\cdot}m^2$[=m A] *	$40\pi=1.256637061\times10^2$Oe cm^2 [=$cm^{3/2}g^{1/2}s^{-1}\mu^{-1/2}$]
$\mathbf{A}$	Magnetic Vector Potential	Tm=AHm^{-1}[=m kg $s^{-2}A^{-1}$] *	$10^6=10^6$erg esu^{-1} =Gs cm[=$cm^{1/2}g^{1/2}s^{-1}\mu^{1/2}$]
μ	Permeability	Hm^{-1}[=m kg $s^{-2}A^{-2}$] ($\mu_o=\frac{4\pi}{10^7}$)	$\frac{10^7}{4\pi}=7.957747154\times10^5$ [dimensionless≡ μ]
χ_m	Vol. Magnetic Susceptibility	[dimensionless]	$\frac{1}{4\pi}$=0.07957747154 [dimensionless]
$\mathcal{F}$	Magneto-motive Force	A (ampere-turn)	$\frac{4\pi}{10}$=1.256637061 gilbert≡Gb =Oe cm[=$cm^{1/2}g^{1/2}s^{-1}\mu^{-1/2}$]
$\mathcal{R}$	Reluctance	$AWb^{-1}=H^{-1}$[=$m^{-2}kg^{-1}s^2A^2$]	$\frac{4\pi}{10^9}=1.256637061\times10^{-8}$Gb Mx^{-1} [=$cm^{-1}\mu^{-1}$]
$\mathcal{P}, \Lambda$	Permeance	$WbA^{-1}=Hm^{-1}{\cdot}m$[=m^2kg $s^{-2}A^{-2}$]	$\frac{10^9}{4\pi}=7.957747154\times10^7$Mx Gb^{-1} [=cmμ]
α_m	Magnetic Polarizability	$H^{-1}m^4$[=$m^2kg^{-1}s^2A^2$]*($\mathbf{m}=\alpha_m\mathbf{B}$)	$10^{-1}=0.1cm^3\mu^{-1}$

The SI system is the rationalized m·kg·s·A system also known as the Giorgi system.

The Gaussian cgs system is a nonrationalized hybrid of the esu system and the emu system; the esu system is used for electrical units, and the emu system is used for magnetic units.

† Some texts define this quantity such that the SI unit differs by ϵ_o. To convert to the alternate definition, multiply the SI unit dimensions by [$m^{-3}kg^{-1}s^4A^2$], and the Gaussian cgs conversion factor by $4\pi c^2/10^7=1.129409067\times10^{11}$.

* A few texts define some or all of these quantities such that the SI units differ by μ_o. To convert to the alternate definitions, multiply the SI unit dimensions by [m kg $s^{-2}A^{-2}$], and the Gaussian cgs conversion factor by $10^7/4\pi=7.957747154\times10^5$.

Note: c is the SI value of 2.99792458×10^8