Conversion table for given amounts of a physical quantity

The table is arranged so that a given amount of some physical quantity, expressed as so many mks or Gaussian units of that quantity, can be expressed as an equivalent number of units in the other system . Thus the entries in each row stand for the same amount, expressed in different units. All factors of 3 (apart from exponents) should, for accurate work, be replaced by (2.997930 ± 0.000003), arising from the numerical value of the velocity of light. For example, in the row for displacement (D), the entry ($12\pi \times 10^5$) is actually ($2.99793 \times 4\pi \times 10^5$). Where a name for a unit has been agreed on or is in common usage, that name is given. Otherwise, one merely reads so many Gaussian units, or mks units.

Physical Quantity	Symbol	Rationalized mks	Gaussian	
Length	l	1 meter (m)	10^2	centimeters (cm)
Mass	m	1 kilogram (kg)	10^3	grams (gm)
Time	t	1 second (sec)	1	second (sec)
Force	F	1 newton	10^5	dynes
Work Energy	W U	1 joule	10^7	ergs
Power	P	1 watt	10^7	ergs sec^{-1}
Charge	q	1 coulomb (coul)	3×10^9	statcoulombs
Charge density	ρ	1 coul m^{-3}	3×10^3	statcoul cm^{-3}
Current	I	1 ampere (coul sec^{-1})	3×10^9	statamperes
Current density	J	1 amp m^{-2}	3×10^5	statamp cm^{-2}
Electric field	E	1 volt m^{-1}	$\frac{1}{3} \times 10^{-4}$	statvolt cm^{-1}
Potential	Φ, V	1 volt	$\frac{1}{300}$	statvolt
Polarization	P	1 coul m^{-2}	3×10^5	dipole moment cm^{-3}
Displacement	D	1 coul m^{-2}	$12\pi \times 10^5$	statvolt cm^{-1} (statcoul cm^{-2})
Conductivity	σ	1 mho m^{-1}	9×10^9	sec^{-1}
Resistance	R	1 ohm	$\frac{1}{9} \times 10^{-11}$	sec cm^{-1}
Capacitance	C	1 farad	9×10^{11}	cm
Magnetic flux	ϕ, F	1 weber	10^8	gauss cm^2 or maxwells
Magnetic induction	B	1 weber m^{-2}	10^4	gauss
Magnetic field	H	1 ampere-turn m^{-1}	$4\pi \times 10^{-3}$	oersted
Magnetization	M	1 ampere m^{-1}	10^{-3}	magnetic moment cm^{-3}
*Inductance	L	1 henry	$\frac{1}{9} \times 10^{-11}$	

Conversion table for symbols and formulas

The symbols for mass, length, time, force, and other not specifically electromagnetic quantities are unchanged. To convert any equation in Gaussian variables to the corresponding equation in mks quantities, on both sides of the equation replace the relevant symbols listed below under "Gaussian" by the corresponding "mks" symbols listed on the right. The reverse transformation is also allowed. Since the length and time symbols are unchanged, quantities which differ dimensionally from one another only by powers of length and/or time are grouped together where possible.

Quantity	Gaussian	mks
Velocity of light	c	$(\mu_0\epsilon_0)^{-1/2}$
Electric field (potential, voltage)	$\mathbf{E}(\Phi, V)$	$\sqrt{4\pi\epsilon_0}\,\mathbf{E}(\Phi, V)$
Displacement	$\mathbf{D}$	$\sqrt{\frac{4\pi}{\epsilon_0}}\,\mathbf{D}$
Charge density (charge, current density, current, polarization)	$\rho(q, \mathbf{J}, I, \mathbf{P})$	$\frac{1}{\sqrt{4\pi\epsilon_0}}\rho(q, \mathbf{J}, I, \mathbf{P})$
Magnetic induction	$\mathbf{B}$	$\sqrt{\frac{4\pi}{\mu_0}}\,\mathbf{B}$
Magnetic field	$\mathbf{H}$	$\sqrt{4\pi\mu_0}\,\mathbf{H}$
Magnetization	$\mathbf{M}$	$\sqrt{\frac{\mu_0}{4\pi}}\,\mathbf{M}$
Conductivity	σ	$\frac{\sigma}{4\pi\epsilon_0}$
Dielectric constant	ϵ	$\frac{\epsilon}{\epsilon_0}$
Permeability	μ	$\frac{\mu}{\mu_0}$
Resistance (impedance)	$R(Z)$	$4\pi\epsilon_0 R(Z)$
Inductance	L	$4\pi\epsilon_0 L$
Capacitance	C	$\frac{1}{4\pi\epsilon_0} C$

Definitions of ϵ_0, μ_0, D, H, macroscopic Maxwell's equations, and Lorentz force equation in various systems of units

Where necessary the dimensions of quantities are given in parentheses. The symbol c stands for the velocity of light in vacuum with dimensions $(lt^{-1}$

System	ϵ_0	μ_0	D, H	Macroscopic Maxwell's Equations				Lorentz Force per Unit charge
Electrostatic (esu)	1	c^{-2} $(t^2 l^{-2})$	$\mathbf{D} = \mathbf{E} + 4\pi\mathbf{P}$ $\mathbf{H} = c^2\mathbf{B} - 4\pi\mathbf{M}$	$\nabla \cdot \mathbf{D} = 4\pi\rho$	$\nabla \times \mathbf{H} = 4\pi\mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}$	$\nabla \times \mathbf{E} + \frac{\partial \mathbf{B}}{\partial t} = 0$	$\nabla \cdot \mathbf{B} = 0$	$\mathbf{E} + \mathbf{v} \times \mathbf{B}$
Electro-magnetic (emu)	c^{-2} $(t^2 l^{-2})$	1	$\mathbf{D} = \frac{1}{c^2}\mathbf{E} + 4\pi\mathbf{P}$ $\mathbf{H} = \mathbf{B} - 4\pi\mathbf{M}$	$\nabla \cdot \mathbf{D} = 4\pi\rho$	$\nabla \times \mathbf{H} = 4\pi\mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}$	$\nabla \times \mathbf{E} + \frac{\partial \mathbf{B}}{\partial t} = 0$	$\nabla \cdot \mathbf{B} = 0$	$\mathbf{E} + \mathbf{v} \times \mathbf{B}$
Gaussian	1	1	$\mathbf{D} = \mathbf{E} + 4\pi\mathbf{P}$ $\mathbf{H} = \mathbf{B} - 4\pi\mathbf{M}$	$\nabla \cdot \mathbf{D} = 4\pi\rho$	$\nabla \times \mathbf{H} = \frac{4\pi}{c}\mathbf{J} + \frac{1}{c}\frac{\partial \mathbf{D}}{\partial t}$	$\nabla \times \mathbf{E} + \frac{1}{c}\frac{\partial \mathbf{B}}{\partial t} = 0$	$\nabla \cdot \mathbf{B} = 0$	$\mathbf{E} + \frac{\mathbf{v}}{c} \times \mathbf{B}$
Heaviside-Lorentz	1	1	$\mathbf{D} = \mathbf{E} + \mathbf{P}$ $\mathbf{H} = \mathbf{B} - \mathbf{M}$	$\nabla \cdot \mathbf{D} = \rho$	$\nabla \times \mathbf{H} = \frac{1}{c}\left(\mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}\right)$	$\nabla \times \mathbf{E} + \frac{1}{c}\frac{\partial \mathbf{B}}{\partial t} = 0$	$\nabla \cdot \mathbf{B} = 0$	$\mathbf{E} + \frac{\mathbf{v}}{c} \times \mathbf{B}$
Rationalized mks	$\frac{10^7}{4\pi c^2}$ $(q^2 t^2 m^{-1} l^{-3})$	$4\pi \times 10^{-7}$ (mlq^{-2})	$\mathbf{D} = \epsilon_0\mathbf{E} + \mathbf{P}$ $\mathbf{H} = \frac{1}{\mu_0}\mathbf{B} - \mathbf{M}$	$\nabla \cdot \mathbf{D} = \rho$	$\nabla \times \mathbf{H} = \mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}$	$\nabla \times \mathbf{E} + \frac{\partial \mathbf{B}}{\partial t} = 0$	$\nabla \cdot \mathbf{B} = 0$	$\mathbf{E} + \mathbf{v} \times \mathbf{B}$

CGS UNITS

Quantity	Symbol	Rationalized MKSA (SI)	CGS (Gaussian)
Mass	m	1 kg	10^3 gm
Length	l	1 m	10^2 cm
Time	t	1 sec	1 sec
Frequency	ν	1 Hz = 1 sec^{-1}	1 Hz
Force	F	1 newton	10^4 dynes
Energy	E	1 joule	10^7 ergs
Power	P	1 watt	10^7 ergs/s
Charge	q	1 coulomb	3×10^9 statcoulombs
Current	I	1 amp	3×10^9 statamperes
Potential	V	1 volt	1/300 statvolts
Electric Field	$\vec{E}$	1 volt/m	$1/3 \times 10^{-4}$ statvolts/cm
Magnetic Field	$\vec{B}$	1 tesla/m	10^4 gauss
Conductivity	σ	1 mho/m	9×10^9 Hz

CONVERSIONS

Quantity	Gaussian	SI
Speed of light	c	$(\mu_o \epsilon_o)^{1/2}$
Electric field	$\vec{E}$	$(4\pi\epsilon_o)^{1/2}\vec{E}$
Magnetic field	$\vec{B}$	$(4\pi/\mu_o)^{1/2}\vec{B}$
Charge density	ρ	$(4\pi\epsilon_o)^{-1/2}\rho$
Conductiviy	σ	$(4\pi\epsilon_o)^{-1}\sigma$

Maxwell's Equations

$$\nabla \cdot E = 4\pi\rho$$

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

$$\nabla \cdot B = 0$$

$$\nabla \times B = \frac{4\pi}{c}J + \frac{1}{c}\frac{\partial B}{\partial t}$$

$1\,\text{eV} = 1.6 \times 10^{-12}$ erg

$m_e c^2 = 0.511$ MeV

$m_p c^2 \approx 1$ GeV (0.938 GeV)