

SI Units of Kinematic and Electromagnetic Quantities

Quantity	Symbol	Common Units	Units Symbol	SI Base Units
Length	ℓ	Meters, m	m	m
Mass	m	Kilograms, kg	kg	kg
Time	t	Seconds, sec or s	s	s
Velocity	$\mathbf{v}$	m/s	m/s	m/s
Acceleration	$\mathbf{a}$	m/s ²	m/s ²	m/s ²
Force	$\mathbf{F} = m\mathbf{a} = d\mathbf{p}/dt$	Newtons = kg-m/s ²	N	kg-m/s ²
Momentum	$\mathbf{p} = m\mathbf{v}$	kg-m/s	kg-m/s	kg-m/s
Angular Momentum	$\mathbf{L} = \mathbf{r} \times \mathbf{p}$	kg-m ² /s = Joule-sec = N-m-s	J-s = N-m-s	kg-m ² /s
Pressure	$P = F/A$	Pascals, Pa = N/m ²	Pa = N/m ²	kg/m-s ²
Energy, Work	E, W	Joules = N-m	J = N-m	kg-m ² /s ²
(Volume) Energy Density	$U = E/V$	Joules/m ³	J/m ³	kg/m-s ²
Power	$P = dW/dt$	Watts = Joules/sec	J/s	kg-m ² /s ³
Electric Charge	Q	Coulombs, C	C = A-s	Ampere-sec
Linear Elect. Charge Density	$\lambda = Q/L$	Coulombs/m	C/m	A-s/m
Surface Elect. Charge Density	$\sigma = Q/A$	Coulombs/m ²	C/m ²	A-s/m ²
Volume Elect. Charge Density	$\rho = Q/V$	Coulombs/m ³	C/m ³	A-s/m ³
Electric Potential	V	Volts = N-m/C	V = N-m/C	kg-m ² /A-s ³
Electric Field	$\mathbf{E} = \mathbf{F}/Q = -\nabla V$	Volts/m = N/C	V/m = N/C	kg-m/A-s ³
Electric Displacement	$\mathbf{D} = \epsilon \mathbf{E}$	Coulombs/m ²	C/m ²	A-s/m ²
Electric Polarization	$\mathbf{P} = \epsilon_0 \chi_e \mathbf{E}$	Coulombs/m ²	C/m ²	A-s/m ²
Electric Flux	$\Phi_E = \mathbf{E} \cdot \mathbf{A} = Q/\epsilon_0$	Volt-m = N-m ² /C	V-m = N-m ² /C	kg-m ³ /A-s ³
Electric Displacement Flux	$\Phi_D = \mathbf{D} \cdot \mathbf{A} = Q$	Coulombs	C = A-s	A-s
Capacitance	$C = Q/V$	Farad = Coulomb/Volt	F = C/V	A ² -s ⁴ /kg-m ²
Electric Permittivity	$\epsilon = \epsilon_0(1+\chi_e)$	Farads/m = C ² /N-m ²	F/m = C/V-m	A ² -s ⁴ /kg-m ³
Electric Susceptibility	$\chi_e = K_e - 1 = \epsilon/\epsilon_0 - 1$	Dimensionless	*	*
Electric Line Current	$I = \mathbf{J} \cdot \mathbf{A}_\perp = \mathbf{K} \cdot \ell_\perp$	Amperes, Amps	A = C/s	A
Elect. Surface Current Density	$\mathbf{K}$	Amps/m	A/m	A/m
Elect. Volume Current Density	$\mathbf{J} = nq\mathbf{v}$	Amps/m ²	A/m ²	A/m ²
Magnetic Charge	$g_m = "qv"$	Amp-m = C-m/s	A-m	A-m
Magnetic Vector Potential	$\mathbf{A} = "p/Q"$	Tesla-m = Wb/m = N/A	T-m = N/A	kg-m/A-s ²
Magnetic Field	$\mathbf{B} = \nabla \times \mathbf{A}$	Teslas = Wb/m ² = N/A-m	T = Wb/m ²	kg/A-s ²
Magnetic Displacement	$\mathbf{H} = 1/\mu_0 \mathbf{B}$	Amps/m	A/m	A/m
Magnetization	$\mathbf{M} = \chi_m \mathbf{H}$	Amps/m	A/m	A/m
Magnetic Flux	$\Phi_m = \mathbf{B} \cdot \mathbf{A} = h/e$	Webers = Tesla-m ² = N-m/A	Wb = T-m ²	kg-m ² /A-s ²
Inductance	$L = \Phi_m/I$	Henrys=Wb/A=T-m ² /A=N-m/A ²	H = N-m/A ²	kg-m ² /A ² -s ²
Magnetic Permeability	$\mu = \mu_0(1+\chi_m)$	Henrys/m = T-m/A = N/A ²	H/m = N/A ²	kg-m/A ² -s ²
Magnetic Susceptibility	$\chi_m = K_m - 1 = \mu/\mu_0 - 1$	Dimensionless	*	*
Resistance	$R = \rho_c \ell/A = V/I$	Ohms, Ω	$\Omega = V/A$	kg-m ² /A ² -s ³
Resistivity	$\rho_c = 1/\sigma_c$	Ohm-m, Ω -m	Ω -m = V-m/A	kg-m ³ /A ² -s ³
Conductance	$G = 1/R = \sigma_c A/\ell$	Siemens = Ω^{-1} = "Mhos"	S = A/V	A ² -s ³ /kg-m ²
Conductivity	$\sigma_c = 1/\rho_c$	Siemens/m = Ω^{-1} /m = "Mhos"/m	S/m = A/V-m	A ² -s ³ /kg-m ³
Electric Charge	e	1.602×10 ⁻¹⁹ Coulombs	C	C
Magnetic Charge	g	3.291×10 ⁻⁹ Ampere-meters	A-m = C-m/s	A-m
Speed of Light (in vacuum)	$c = 1/\text{sqrt}(\epsilon_0 \mu_0)$	2.998×10 ⁸ meters/sec	m/s	m/s
Elect. Permittivity Free Space	ϵ_0	8.85×10 ⁻¹² Farads/meter	F/m = C ² /N-m ²	A ² -s ⁴ /kg-m ³
Magn. Permeability Free Space	μ_0	4 π ×10 ⁻⁷ Henrys/meter	H/m = N/A ²	kg-m/A ² -s ²
Planck's Constant	h	6.626×10 ⁻³⁴ Joule-sec	J-s = N-m-s	kg-m ² /s
Boltzmann's Constant	k _B	1.381×10 ⁻²³ Joule/Kelvin	J/K = N-m/K	kg-m ² /s ² -K