

DEPARTMENT
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COMMERCE

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STANDARDS

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ELECTRICAL ENGINEERING UNITS AND CONSTANTS

As adopted by NBS¹

Quantity	Symbols and Units		Symbol
	Symbol	Unit	
charge	Q	coulomb	C
current	I	ampere	A
voltage, potential difference	V	volt	V
electromotive force	\mathcal{E}	volt	V
resistance	R	ohm	Ω
conductance	G	mho (siemens)	A/V, or mho (S)
reactance	X	ohm	Ω
susceptance	B	mho	A/V, or mho
impedance	Z	ohm	Ω
admittance	Y	mho	A/V, or mho
capacitance	C	farad	F
inductance	L	henry	H
energy, work	W	joule	J
power	P	watt	W
resistivity	ρ	ohm-meter	Ωm
conductivity	σ	mho per meter	mho/m
electric displacement	D	coulomb per sq. meter	C/m ²
electric field strength	E	volt per meter	V/m
permittivity (absolute)	ϵ	farad per meter	F/m
relative permittivity	ϵ_r	(numeric)	
magnetic flux	Φ	weber	Wb
magnetomotive force	\mathcal{F}	ampere (ampere-turn)	A
reluctance	\mathcal{R}	ampere per weber	A/Wb
permeance	\mathcal{P}	weber per ampere	Wb/A

¹ Reprinted from NBS Technical News Bulletin, May 1965.

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ELECTRICAL ENGINEERING UNITS AND CONSTANTS

Symbols and Units - Continued

Quantity	Symbol	Unit	Symbol
magnetic flux density	B	tesla	T
magnetic field strength	H	ampere per meter	A/m
permeability (absolute)	μ	henry per meter	H/m
relative permeability	μ_r	(numeric)	
length	l	meter	m
mass	m	kilogram	kg
time	t	second	s
frequency	f	hertz	Hz
angular frequency	ω	radian per second	rad/s
force	F	newton	N
pressure	p	newton per sq. meter	N/m ²
temperature (absolute)	T	degree Kelvin	°K
temperature (International)	t	degree Celsius	°C

Physical Constants²

Constant	Symbol	Rounded Value
electronic charge	e	1.602×10^{-19} C
speed of light in vacuum	c	2.9979×10^8 m/s
permittivity of vacuum, electric constant	ϵ_0, Γ_e	8.8542×10^{-12} F/m
permeability of vacuum, magnetic constant	μ_0, Γ_m	$4\pi \times 10^{-7}$ H/m ²
Planck constant	h	6.63×10^{-34} J·s
Boltzmann constant	k	1.38×10^{-23} J/°K
Faraday constant	F	9.649×10^4 C/mol
proton gyromagnetic ratio	γ	2.6752×10^8 rad/sT
standard gravitational acceleration	g_n	9.80665 m/s ²
normal atmospheric pressure	atm	101 325 N/m ² † († defined value)

² A general list of physical constants giving more exact values is contained in NBS Misc. Publ. 253, for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402 (5¢ each; \$2.50 per 100).

superseded by SP 365 (1976)

ELECTRICAL ENGINEERING UNITS AND CONSTANTS

Quantity	Units and Symbols		Identical Unit
	Symbol	Unit	
current	<i>I</i>	ampere	A
charge	<i>Q</i>	coulomb	C
voltage, potential	<i>V</i>	volt	V
energy, work	<i>W</i>	joule	J
power	<i>P</i>	watt	W
resistance	<i>R</i>	ohm	Ω
conductance	<i>G</i>	siemens	S
resistivity	ρ	ohm-meter	$\Omega \cdot m$
conductivity	σ	siemens per meter	S/m
reactance	<i>X</i>	ohm	Ω
susceptance	<i>B</i>	siemens	S
impedance	<i>Z</i>	ohm	Ω
admittance	<i>Y</i>	siemens	S
capacitance	<i>C</i>	farad	F
inductance	<i>L</i>	henry	H
electric flux density	<i>D</i>	coulomb per square meter	C/m ²
electric field strength	<i>E</i>	volt per meter	V/m
permittivity	ϵ	farad per meter (pure number)	F/m
relative permittivity	ϵ_r	(pure number)	
magnetic flux	Φ	weber	Wb
magnetic flux density	<i>B</i>	tesla	T
magnetic field strength	<i>H</i>	ampere per meter	A/m
permeability	μ	henry per meter (pure number)	H/m
relative permeability	μ_r	(pure number)	
magnetomotive force	\mathcal{F}	ampere	A
reluctance	\mathcal{R}	ampere per weber	A/Wb
permeance	\mathcal{P}	weber per ampere	Wb/A
length	<i>l</i>	meter	m
mass	<i>m</i>	kilogram	kg
time	<i>t</i>	second	s
force	<i>F</i>	newton	N
pressure	<i>p</i>	pascal	Pa
frequency	<i>f</i>	hertz	Hz
angular frequency	ω	radian per second	rad/s
plane angle	θ	radian	rad
solid angle	Ω	steradian	sr

(over)

Units and Symbols - Continued

Quantity	Symbol	Unit	Symbol
thermodynamic temperature	<i>T</i>	kelvin	K
Celsius temperature	<i>t</i>	degree Celsius	°C
amount of substance	<i>n</i>	mole	mol
luminous intensity	<i>I</i>	candela	cd

Physical Constants¹

Constant	Symbol	Rounded Value
elementary charge	<i>e</i>	1.6022 × 10 ⁻¹⁹ C
speed of light in vacuum	<i>c</i>	2.9979246 × 10 ⁸ m/s
electric constant	ϵ_0	8.854188 × 10 ⁻¹² F/m
magnetic constant	μ_0	4 π × 10 ⁻⁷ H/m†
Planck constant	<i>h</i>	6.626 × 10 ⁻³⁴ J · s
Boltzmann constant	<i>k</i>	1.381 × 10 ⁻²³ J/K
Faraday constant	<i>F</i>	9.648 × 10 ⁴ C/mol
proton gyromagnetic ratio	γ_p	2.6752 × 10 ⁸ rad/(s · T)
standard acceleration of free fall	g_n	9.80665 m/s ²
standard atmosphere	atm	101325 Pa†

¹ See Fundamental Physical Constants, NBS Special Publication 398, August 1974 (Pocket Card), Price 25c; \$6.35 per 100.

Decimal Prefixes

Factor	Prefix	Symbol	Factor	Prefix	Symbol
10 ¹⁸	exa	E	10 ⁻¹	deci	d
10 ¹⁵	peta	P	10 ⁻²	centi	c
10 ¹²	tera	T	10 ⁻³	milli	m
10 ⁹	giga	G	10 ⁻⁶	micro	μ
10 ⁶	mega	M	10 ⁻⁹	nano	n
10 ³	kilo	k	10 ⁻¹²	pico	p
10 ²	hecto	h	10 ⁻¹⁵	femto	f
10 ¹	deka	da	10 ⁻¹⁸	atto	a

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