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MISCELLANEOUS  
PUBLICATIONS  
OF THE  
NATIONAL  
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OF  
STANDARDS

NOS. 265, 267 - 270







**ELECTRICAL ENGINEERING UNITS AND CONSTANTS**

As adopted by NBS<sup>1</sup>

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	$\Omega$
conductance	$G$	mho (siemens)	A/V, or mho (S)
reactance	$X$	ohm	$\Omega$
susceptance	$B$	mho	A/V, or mho
impedance	$Z$	ohm	$\Omega$
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	$\rho$	ohm-meter	$\Omega\text{m}$
conductivity	$\sigma$	mho per meter	mho/m
electric displacement	$D$	coulomb per sq. meter	C/m <sup>2</sup>
electric field strength	$E$	volt per meter	V/m
permittivity (absolute)	$\epsilon$	farad per meter	F/m
relative permittivity	$\epsilon_r$	(numeric)	
magnetic flux	$\Phi$	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

<sup>1</sup> 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)	$\mu$	henry per meter	H/m
relative permeability	$\mu_r$	(numeric)	
length	$l$	meter	m
mass	$m$	kilogram	kg
time	$t$	second	s
frequency	$f$	hertz	Hz
angular frequency	$\omega$	radian per second	rad/s
force	$F$	newton	N
pressure	$p$	newton per sq. meter	N/m <sup>2</sup>
temperature (absolute)	$T$	degree Kelvin	°K
temperature (International)	$t$	degree Celsius	°C

Physical Constants<sup>2</sup>

Constant	Symbol	Rounded Value
electronic charge	$e$	$1.602 \times 10^{-19}$ C
speed of light in vacuum	$c$	$2.9979 \times 10^8$ m/s
permittivity of vacuum, electric constant	$\epsilon_0, \Gamma_e$	$8.8542 \times 10^{-12}$ F/m
permeability of vacuum, magnetic constant	$\mu_0, \Gamma_m$	$4\pi \times 10^{-7}$ H/m <sup>2</sup>
Planck constant	$h$	$6.63 \times 10^{-34}$ J·s
Boltzmann constant	$k$	$1.38 \times 10^{-23}$ J/°K
Faraday constant	$F$	$9.649 \times 10^4$ C/mol
proton gyromagnetic ratio	$\gamma$	$2.6752 \times 10^8$ rad/sT
standard gravitational acceleration	$g_n$	$9.80665$ m/s <sup>2</sup>
normal atmospheric pressure	atm	$101.325$ N/m <sup>2</sup> † († defined value)

<sup>2</sup> 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 305  
(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	$\Omega$
conductance	<i>G</i>	siemens	S
resistivity	$\rho$	ohm-meter	$\Omega \cdot m$
conductivity	$\sigma$	siemens per meter	S/m
reactance	<i>X</i>	ohm	$\Omega$
susceptance	<i>B</i>	siemens	S
impedance	<i>Z</i>	ohm	$\Omega$
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 <sup>2</sup>
electric field strength	<i>E</i>	volt per meter	V/m
permittivity	$\epsilon$	farad per meter (pure number)	F/m
relative permittivity	$\epsilon_r$	(pure number)	
magnetic flux	$\Phi$	weber	Wb
magnetic flux density	<i>B</i>	tesla	T
magnetic field strength	<i>H</i>	ampere per meter	A/m
permeability	$\mu$	henry per meter (pure number)	H/m
relative permeability	$\mu_r$	(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	$\omega$	radian per second	rad/s
plane angle	$\theta$	radian	rad
solid angle	$\Omega$	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 Constants<sup>1</sup>**

Constant	Symbol	Rounded Value
elementary charge	<i>e</i>	1.6022 × 10 <sup>-19</sup> C
speed of light in vacuum	<i>c</i>	2.9979246 × 10 <sup>8</sup> m/s
electric constant	$\epsilon_0$	8.854188 × 10 <sup>-12</sup> F/m
magnetic constant	$\mu_0$	4 $\pi$ × 10 <sup>-7</sup> H/m†
Planck constant	<i>h</i>	6.626 × 10 <sup>-34</sup> J · s
Boltzmann constant	<i>k</i>	1.381 × 10 <sup>-23</sup> J/K
Faraday constant	<i>F</i>	9.648 × 10 <sup>4</sup> C/mol
proton gyromagnetic ratio	$\gamma_p$	2.6752 × 10 <sup>8</sup> rad/(s · T)
standard acceleration of free fall	<i>g<sub>n</sub></i>	9.80665 m/s <sup>2</sup>
standard atmosphere	atm	101325 Pa†

<sup>1</sup> 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 <sup>18</sup>	exa	E	10 <sup>-1</sup>	deci	d
10 <sup>15</sup>	peta	P	10 <sup>-2</sup>	centi	c
10 <sup>12</sup>	tera	T	10 <sup>-3</sup>	milli	m
10 <sup>9</sup>	giga	G	10 <sup>-6</sup>	micro	$\mu$
10 <sup>6</sup>	mega	M	10 <sup>-9</sup>	nano	n
10 <sup>3</sup>	kilo	k	10 <sup>-12</sup>	pico	p
10 <sup>2</sup>	hecto	h	10 <sup>-15</sup>	femto	f
10 <sup>1</sup>	deka	da	10 <sup>-18</sup>	atto	a

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