Appendix H: Common Units and Conversions

Temperature

Fahrenheit to Celsius: °C = (°F-32)/1.8
Celsius to Fahrenheit: °F = (1.8 × °C) + 32
Fahrenheit to Kelvin: convert °F to °C, then add 273.15
Celsius to Kelvin: add 273.15

Volume

1 liter (l) = 1.000×10^{-3} cubic meters (m^3) = 61.02 cubic inches (in^3)

Mass

1 kilogram (kg) = 1000 grams (g) = 2.205 pounds (lb)

Force

1 newton (N) = 0.2248 pounds (lb)

Electric resistivity

1 micro-ohm-centimeter (μΩ·cm)

= 1.000×10^{-6} ohm-centimeter (Ω·cm)
= 1.000×10^{-8} ohm-meter (Ω·m)
= 6.015 ohm-circular mil per foot (Ω·circ mil/ft)

Heat flow rate

1 watt (W) = 3.413 Btu/h
1 British thermal unit per hour (Btu/h) = 0.2930 W

A Note on SI

The values in this catalog are expressed in International System of Units, or SI (from the French Le Système International d'Unités). When possible, the common CGS or British equivalent has been parenthetically included as well.

These common conversions and constants have been included as a reference.

Please refer to NIST Special Publication 811 for further standards and conversions.

References:

Ambler Thompson and Barry N. Taylor (2008), Guide for the Use of the International System of Units (SI) NIST Special Publication 811, 2008 Edition (version 3.2). [Online] Available: http://physics.nist.gov/SP811 [2023, Aug 3]. National Institute of Standards and Technology, Gaithersburg, MD.

The NIST Physical Constants webpage (https://www.nist.gov/pml/fundamental-physical-constants)

Length

	centimeter (cm)	meter (m)	inch (in)
centimeter (cm)	1	1.000×10^{-2}	0.3937
meter (m)	100	1	39.37
inch (in)	2.540	2.540×10^{-2}	1

1 micrometer (sometimes referred to as micron) = 10^{-6} m

1 mil = 10^{-3} in

Area

	cm^2	m^2	in^2	circ mil
cm^2	1	10^{-4}	0.1550	1.974×10^{5}
m^2	10^{4}	1	1550	1.974×10^{9}
in^2	6.452	6.452×10^{-4}	1	1.273×10^{6}
circ mil	5.067×10^{-6}	5.067×10^{-10}	7.854×10^{-7}	1

Pressure

	pascal (Pa)	millibar (mbar)	torr (Torr)	atmosphere (atm)	psi (lbf/in^2)
pascal (Pa)	1	1.000×10^{-2}	7.501×10^{-3}	9.868×10^{-6}	1.450×10^{-4}
millibar (mbar)	1.000×10^{2}	1	7.502×10^{-1}	9.868×10^{-4}	1.450×10^{-2}
torr (Torr)	1.333×10^{2}	1.333×10^{0}	1	1.316×10^{-3}	1.934×10^{-2}
atmosphere (atm)	1.013×10^{5}	1.013×10^{3}	7.600×10^{2}	1	1.470×10^{1}
psi (lbf/in^2)	6.897×10^{3}	6.895×10^{1}	5.172×10^{1}	6.850×10^{-2}	1

1 torr (Torr) =	133.332	pascal (Pa)	1 pascal (Pa) =	0.01	millibar (mbar)
	1.33	millibar (mbar)		0.007501	torr (Torr)
	0.001316	atmosphere (atm)		9.87×10^{-6}	atmosphere (atm)
	0.01934	psi (lbf/in^2)		1.45×10^{-4}	psi (lbf/in^2)

Magnetic induction B

	gauss (G)	kiloline/in^2	Wb/m^2	milligauss (mG)	gamma (γ)
gauss (G)	1	6.452×10^{-3}	10^{-4}	1000	10^{5}
kiloline/in^2	155.0	1	1.550×10^{-2}	1.550×10^{5}	1.550×10^{7}
Wb/m^2	10^{4}	64.52	1	10^{7}	10^{9}
milligauss (mG)	0.001	6.452×10^{-6}	10^{-7}	1	100
gamma (γ)	10^{-5}	6.452×10^{-8}	10^{-9}	0.01	1

1 ESU = 2.998×10^{6} Wb/m^2

Magnetomotive force

	abampere·turn	ampere·turn	Gilbert (Gi)
abampere·turn	1	10	12.57
ampere·turn	0.1	1	1.257
Gilbert (Gi)	7.958×10^{-2}	0.7958	1

1 pragilbert = 4π ampere·turn
1 ESU = 2.655×10^{-11} ampere·turn

Magnetic field strength H

	abampere·turn/cm	ampere·turn/cm	ampere·turn/in	ampere·turn/m	oersted (Oe)
abampere·turn/cm	1	10	25.40	1000	12.57
ampere·turn/cm	0.1	1	2.540	100	1.257
ampere·turn/in	3.937×10^{-2}	0.3937	1	39.37	0.4947
ampere·turn/m	0.001	0.01	2.540×10^{-2}	1	1.257×10^{-2}
oersted (Oe)	7.958×10^{-2}	0.7958	2.021	79.58	1

1 Oe = 1 Gi
1 ESU = 2.655×10^{-9} ampere·turn/m
1 praoersted = 4π ampere·turn/m

Energy, work, heat

	Btu	erg	J	cal	kW·h
British thermal unit	1	1.055×10^{10}	1055	252.0	2.930×10^{-4}
erg	9.481×10^{-11}	1	10^{-7}	2.389×10^{-8}	2.778×10^{-14}
joule (J)	9.481×10^{-4}	10^{7}	1	0.2389	2.778×10^{-7}
calorie (cal)	3.968×10^{-3}	4.186×10^{7}	4.186	1	1.163×10^{-6}
kilowatt hour (kW·h)	3413	3.6×10^{13}	3.6×10^{6}	8.601×10^{5}	1

1 electronvolt (eV) = 1.602×10^{-19} joules (J)

Fundamental physical constants

Quantity	Symbol	Value*	Unit
speed of light in a vacuum	c, c_0	299 792 458	$m \cdot s^{-1}$
magnetic constant	μ_0	$4\pi \times 10^{-7} = 12.566\,370\,614... \times 10^{-7}$	$N \cdot A^{-2}$
electric constant $1/\mu_0 c^2$	ε_0	$8.854\,187\,817... \times 10^{-12}$	$F \cdot m^{-1}$
characteristic impedance of vacuum $\sqrt{\mu_0/\in_0} = \mu_0 c$	Z_0	376.730 313 461...	Ω
Planck constant	h	$6.626\,0693(11) \times 10^{-34}$	$J \cdot s$
in $eV \cdot s$		$4.135\,667\,43(35) \times 10^{-15}$	$eV \cdot s$
$h/2\pi$	h	$1.054\,571\,68(18) \times 10^{-34}$	$J \cdot s$
in $eV \cdot s$		$6.582\,119\,15(56) \times 10^{-16}$	$eV \cdot s$
elementary charge	e	$1.602\,176\,53(14) \times 10^{-19}$	C
magnetic flux quantum h/2e	Φ_0	$2.067\,833\,72(18) \times 10^{-15}$	Wb
Avogadro constant	N_A, L	$6.022\,1415(10) \times 10^{23}$	mol^{-1}
atomic mass constant $m_u = 1/12 m(^{12}C) = 1$ u	m_u	$1.660\,538\,86(28) \times 10^{-27}$	kg
Faraday constant $N_A e$	F	96 485.3383(83)	$C \cdot mol^{-1}$
molar gas constant	R	8.314 472(15)	$J \cdot mol^{-1} \cdot K^{-1}$
Boltzmann constant R/N_A	k	$1.380\,650\,5(24) \times 10^{-23}$	$J \cdot K^{-1}$
molar volume of ideal gas RT / p			
T = 273.15 K, p = 101.325 kPa	V_m	$22.413\,996(39) \times 10^{-3}$	$m^3 \cdot mol^{-1}$
T = 273.15 K, p = 100 kPa	V_m	$22.710\,981(40) \times 10^{-3}$	$m^3 \cdot mol^{-1}$
Stefan-Boltzmann constant $(\pi^2/60)k^4/h^3c^2$	σ	$5.670\,400(40) \times 10^{-8}$	$W \cdot m^{-2} \cdot K^{-4}$
electron volt: (e/C) J	eV	$1.602\,176\,53(14) \times 10^{-19}$	J
Bohr magneton $eh/2m_e$	μ_B	$927.400\,949(80) \times 10^{-26}$	$J \cdot T^{-1}$
in $eV \cdot T^{-1}$ $[\mu_B/(J \cdot T^{-1})](e/C)$		$5.788\,381\,804(39) \times 10^{-5}$	$eV \cdot T^{-1}$

** Values are shown in their concise form with uncertainty in parentheses. Numbers with uncertainty values are subject to revision. Refer to the NIST Reference on Constants, Units, and Uncertainty website for the latest values*