

Engineering B47 Unit Conversion Tables

Conversion values are given to four significant digits. Pounds, ounces, and tons are given in avoirdupois units unless otherwise noted. T = temperature in kelvin. T_R = degrees Rankine. t_C = degrees Celsius. t_F = degrees Fahrenheit.

Multiply	By	To Obtain
abamperes	10	amperes
abacoulombs	10	coulombs
abfarads	10^9	farads
abhenries	10^{-9}	henries
abohms	10^{-9}	ohms
abvolts	10^{-8}	volts
acres	43 560	square feet
"	4047	square meters
"	4840	square yards
acre-feet	43 560	cubic feet
"	3.259×10^5	gallons (U.S. liquid)
amperes	1	coulombs per second
angstroms	10^{-10}	meters
ares	0.024 71	acres
"	100	square meters
astronomical units	1.496×10^{11}	meters
atmospheres	76	centimeters of mercury
"	29.92	inches of mercury
"	33.90	feet of water
"	14.70	pounds per square inch (force)
"	1.013×10^5	pascals

Sources: *Standard Practice Manual for Use of the International System of Units (E380-89a)* (Philadelphia, Pa.: American Society for Testing and Materials, 1989); R. G. Hudson, *The Engineers' Manual*, 2nd ed. (New York: Wiley, 1947); *Metric Guide for Educational Materials* (Washington: American National Metric Council, 1977); E. A. Mechtly, *The International System of Units, Fundamental Constants and Conversion Factors* (Champaign, Ill: Stipes Publishing Co., 1977); *Reference Manual for SI (Metric)* (Inland Steel Company, 1976).

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Multiply	By	To Obtain
bars	0.9872	atmospheres
"	10^6	dynes per square centimeter
"	14.51	pounds per square inch (force)
"	10^5	pascals
barrels (petroleum)	42	gallons (U.S. liquid)
becquerels (radioactivity)	1	disintegrations per second
British thermal units	778.2	foot-pounds-force
"	1055	joules
"	2.931×10^{-4}	kilowatt-hours
Btu per minute	17.58	watts
Btu per pound	2326	joules per kilogram
bushels	1.244	cubic feet
"	0.035 24	cubic meters
"	4	pecks
calories	4.187	joules
"	10^{-3}	kilocalories
calories per gram	4187	joules per kilogram
Calories (kilocalorie)	4187	joules
candelas per square meter	3.141×10^{-4}	lamberts
carats (metric)	2×10^{-4}	kilograms (mass)
centimeters	0.3937	inches
centimeters of mercury	0.013 16	atmospheres
"	0.4461	feet of water
"	0.1935	pounds per square inch (force)
"	1333	pascals
circular mils	5.067×10^{-6}	square centimeters
"	7.854×10^{-7}	square inches
cords	8 ft. \times 4 ft. \times 4 ft.	cubic feet
coulombs (quantity of electricity)	1	ampere-seconds
cubic centimeters	3.531×10^{-5}	cubic feet
"	6.102×10^{-2}	cubic inches
"	10^{-6}	cubic meters
"	10^{-3}	liters
"	2.642×10^{-4}	gallons (U.S. liquid)
cubic feet	2.832×10^4	cubic centimeters
"	1728	cubic inches
"	0.028 32	cubic meters
"	0.037 04	cubic yards
"	7.481	gallons (U.S. liquid)
"	28.32	liters
cubic inches	16.39	cubic centimeters
"	5.787×10^{-4}	cubic feet
"	1.639×10^{-5}	cubic meters
"	2.143×10^{-5}	cubic yards
"	4.329×10^{-3}	gallons (U.S. liquid)
cubic meters	35.31	cubic feet
"	61 024	cubic inches
"	1.308	cubic yards
"	264.2	gallons (U.S. liquid)

(Continued)

Multiply	By	To Obtain
cubic yards	27	cubic feet
"	46 656	cubic inches
"	0.7646	cubic meters
"	202.0	gallons (U.S. liquid)
curies	3.7×10^{10}	becquerels
days	24	hours
"	1440	minutes (time)
"	8.640×10^4	seconds (time)
degrees (angle)	60	minutes (angle)
"	0.017 45	radians
degrees Fahrenheit	—	degrees Celsius: $t_C = (t_F - 32)/1.8$
degrees Celsius	—	kelvin: $T = t_C + 273.15$ K
degrees Fahrenheit	—	kelvin: $T = (t_F + 459.67^\circ\text{R})/1.8$
degrees Rankine	—	kelvin: $T = T_R/1.8$
degrees per second (angle)	0.1667	revolutions per minute
degrees Kelvin (see kelvin)	—	—
density: pounds-mass/in. ³	27 680	kilograms per cubic meter (mass)
drams	1.772	grams-force
"	0.0625	ounces-force
dynes	1.020×10^{-3}	grams-force
"	7.233×10^{-5}	pounds
"	2.248×10^{-6}	pounds-force
"	1	gram-centimeters/s ² (mass)
"	10^{-5}	newtons
electron volts	1.602×10^{-19}	joules
ergs	9.479×10^{-11}	British thermal units
"	7.378×10^{-8}	foot-pounds-force
"	10^{-7}	joules
"	1	dyne-centimeters
ergs per second	1.341×10^{-10}	horsepower
"	10^{-7}	watts
farads (electric capacitance)	1	coulombs per volt
fathoms	6	feet
feet	0.3048	meters
feet per second	0.3048	meters per second
feet of water	0.029 50	atmospheres
"	0.8827	inches of mercury
"	0.4336	pounds per square inch (force)
feet of water (39.2°F)	2989	pascals
foot-candles	10.76	lumens per square meter (lux)
"	10.76	lux
"	1	lumens per square foot
foot-pounds-force	1.285×10^{-3}	British thermal units
"	1.356×10^7	ergs
"	1.356	joules

(Continued)

Multiply	By	To Obtain
force: lbf	4.448	newtons
force: kgf ("kilopond")	9.807	newtons
force (1 kg·m/s ²)	1	newtons
frequency (1/s)	1	hertz
furlongs	40	rods
gallons (U.S. liquid)	3.785 × 10 ⁻³	cubic meters
" " "	0.1337	cubic feet
" " "	231	cubic inches
" " "	4	quarts (U.S. liquid)
gallons (U.S. dry)	4.405 × 10 ⁻³	cubic meters
gallons (U.K. liquid)	4.546 × 10 ⁻³	cubic meters
gals (unit of acceleration)	10 ⁻²	meters per second per second
gammas (mass)	10 ⁻⁹	kilograms (mass)
gammas (magnetic flux density)	10 ⁻⁹	teslas
gausses	10 ⁻⁴	teslas
gills	0.25	pints (U.S. liquid)
grads	1.571 × 10 ⁻²	radians
grains	1.429 × 10 ⁻⁴	pounds
grams	10 ⁻³	kilograms
grams-force	0.035 27	ounces-force
" "	0.032 15	ounces-force (troy)
" "	2.205 × 10 ⁻³	pounds-force
hectares	2.471	acres
" "	10 ⁴	square meters
henries (inductance)	1	webers per ampere
horsepower	42.41	British thermal units per minute
" "	33 000	foot-pounds per minute (force)
" "	550	foot-pounds per second (force)
" "	745.7	watts
horsepower-hour	2.684 × 10 ⁶	joules
inches	2.540	centimeters
" "	2.540 × 10 ⁻²	meters
inches of mercury (32°F)	0.033 42	atmospheres
" " " "	0.4912	pounds per square inch (force)
" " " "	3.386 × 10 ³	pascals
inches of mercury (60°F)	3.377 × 10 ³	pascals
joules (energy, work, heat)	1	newton-meters
" "	9.478 × 10 ⁻⁴	British thermal units
" "	0.7376	foot-pounds-force
" "	2.778 × 10 ⁻⁴	watt-hours
" "	0.2388	calories
" "	2.388 × 10 ⁻⁴	kilocalories
joules per kilogram	4.300 × 10 ⁻⁴	Btu per pound
kelvin	—	degrees Celsius: $t_c = T - 273.15$ K
" "	—	degrees Fahrenheit: $t_F = 1.8T - 459.67$ °R
" "	—	degrees Rankine: $T_R = 1.8T$

(Continued)

Multiply	By	To Obtain
miles per hour	88	feet per minute
" " "	0.8688	knots (international)
milliamperes	10 ⁻³	amperes
millibars	10 ²	pascals
millimeters	0.039 37	inches
" "	10 ⁻³	meters
millimeters of mercury (0°C)	133.3	pascals
millivolts	10 ⁻³	volts
mils	10 ⁻³	inches
miner's inches	1.5	cubic feet per minute
minutes (angle)	2.909 × 10 ⁻⁴	radians
newtons	1	kilograms-meters per second
" "	—	per second (kg·m/s ²)
" "	0.2248	pounds-force
" "	10 ⁵	dynes
" "	0.1020	kilograms-force
" "	7.233	pounds
newton-meters	0.7376	pound-feet (force)
oersteds	79.58	amperes per meter
ohms (electric resistance)	1	volts per ampere
ounces (troy)	0.083 33	pounds (troy)
" "	1.097	ounces (avoirdupois)
ounces-force	0.2780	newtons
" "	28.35	grams-force
" "	0.0625	pounds-force
ounces-force (troy)	31.10	grams-force
parsecs	3.086 × 10 ¹⁶	meters
pascals (pressure, stress)	1	newtons per square meter
" "	0.9872 × 10 ⁻⁵	atmospheres
" "	2.953 × 10 ⁻⁴	inches of mercury (32°F)
" "	7.501 × 10 ⁻³	millimeters of mercury (0°C) (torr)
" "	1.450 × 10 ⁻⁴	pounds per square inch (force)
pecks (U.S.)	8.810 × 10 ⁻³	cubic meters
pennyweights	1.555 × 10 ⁻³	kilograms (mass)
picas (printer's)	4.218 × 10 ⁻³	meters
pints (U.S. liquid)	4.732 × 10 ⁻⁴	cubic meters
" (U.S. dry)	5.506 × 10 ⁻⁴	cubic meters
points (printer's)	3.515 × 10 ⁻⁴	meters
poises (absolute viscosity)	10 ⁻¹	pascal-seconds
poundals	0.1383	newtons
" "	1.383 × 10 ⁴	dynes
" "	0.031 08	pounds-force
pounds (avoirdupois)	7000	grains
pounds (troy)	0.8229	pounds (avoirdupois)
" "	5760	grains
pound-feet (force)	1.356	newton-meters

(Continued)

Multiply	By	To Obtain
kilocalories	4.187 × 10 ³	joules
" "	10 ³	calories
kilograms-force (kgf)	70.93	poundals
" " "	2.205	pounds-force
" " "	9.807	newtons
kilograms-mass (kg)	1	kilograms
" " "	0.068 54	slugs (mass)
" " "	2.205	pounds-mass
kilograms per cubic meter	0.062 43	pounds per cubic foot
kilograms per square meter (force)	1.422 × 10 ⁻³	pounds per square inch (force)
kilometers	3281	feet
" "	0.6214	miles
" "	10 ³	meters
kiloponds (kgf)	9.807	newtons
kilowatts	10 ³	watts
kilowatt-hours	3.600 × 10 ⁶	joules
kips (1000 lbf)	4.448 × 10 ³	newtons
kips per square inch	6.895 × 10 ⁶	pascals
knots (international)	1.151	miles per hour
" "	0.5144	meters per second
lamberts	3183	candelas per square meter
leagues (nautical)	5556	meters
leagues (U.S. survey)	4828	meters
light years	9.461 × 10 ¹⁵	meters
liters	10 ⁻³	cubic meters
" "	0.035 31	cubic feet
" "	0.2642	gallons (U.S. liquid)
" "	10 ³	cubic centimeters
lumens (luminous flux)	1	candela-steradians
lumens per square foot	1	foot-candles
lumens per square meter	1	lux
lux (illumination)	1	lumens per square meter
lux (lm/m ²)	0.0929	foot-candles
mass: lb	0.4536	kilograms (mass)
maxwells	10 ⁻⁸	webers
meters	1.094	yards
" "	3.281	feet
" "	39.37	inches
" "	6.214 × 10 ⁻⁴	miles (U.S. survey)
meters per second	3.281	feet per second
metric carats	2 × 10 ⁻⁴	kilograms
metric tons (tonnes)	10 ³	kilograms
mhos	1	siemens
microns	10 ⁻⁶	meters
miles (nautical)	1852	meters
miles (U.S. survey)	1609	meters
" " "	5280	feet
" " "	1.609	kilometers
" " "	1760	yards

(Continued)

Multiply	By	To Obtain
pounds-force (lbf)	453.7	grams-force
" " "	16	ounces-force
" " "	32.18	poundals
" " "	4.448	newtons
pounds-mass (lb)	0.4536	kilograms (mass)
pounds per cubic foot	16.02	kilograms per cubic meter
pounds per square inch (force): psi	0.068 03	atmospheres
" " " " " " " "	2.036	inches of mercury
" " " " " " " "	6895	pascals
" " " " " " " "	6.895 × 10 ⁻³	megapascals
pressure: psi	6895	pascals
pressure: atmospheres	1.013 × 10 ⁵	pascals
quarts (U.S. liquid)	9.464 × 10 ⁻⁴	cubic meters
" " "	0.2500	gallons (U.S. liquid)
radians	57.30	degrees (angle)
" "	63.65	grads
" "	0.1592	revolutions
rads (radiation dose absorbed)	10 ⁻²	joules per kilogram (grays)
rods (U.S. survey)	16.5	feet
roentgens	2.580 × 10 ⁻⁴	coulombs per kilogram
revolutions	2π	radians
sections (U.S. survey)	640	acres
" " "	2.590 × 10 ⁶	square meters
siemens (electric conductance)	1	amperes per volt
" "	1	mhos
slugs (mass)	14.59	kilograms (mass)
square centimeters	10 ⁻⁴	square meters
statamperes	3.336 × 10 ⁻¹⁰	amperes
statcoulombs	3.336 × 10 ⁻¹⁰	coulombs
statfarads	1.113 × 10 ⁻¹²	farads
stathenries	8.988 × 10 ¹¹	henries
statohms	8.988 × 10 ¹¹	ohms
statvolts	299.8	volts
steres	1	cubic meters
stokes (kinematic viscosity)	10 ⁻⁴	square meters per second
tablespoons	1.479 × 10 ⁻⁵	cubic meters
teaspoons	4.929 × 10 ⁻⁶	cubic meters
temp. (degrees Celsius) + 273.15	1	absolute temp. (kelvin)
" " " " + 17.78	1.8	temp. (degrees Fahr.)
temp. (degrees Fahr.) + 459.67	1	absolute temp. (deg. Rankine)
" " " " - 32	5/9	temp. (degrees Celsius)
teslas (magnetic flux density)	1	webers per square meter
teslas	10 ⁴	gausses
therms	10 ⁵	British thermal units (Btu)
tonnes (metric tons)	10 ³	kilograms

(Continued)

Multiply	By	To Obtain
tons (long)	1016	kilograms
"	2240	pounds
tons (metric)	10^3	kilograms
"	2205	pounds
tons (short)	907.2	kilograms
"	2000	pounds
tons (of refrigeration)	1.2×10^4	British thermal units per hour
tons (nuclear equivalent of TNT)	4.184×10^9	joules
torr (mm Hg, 0°C)	133.3	pascals
volts (electric potential)	1	watts per ampere
watts (power)	0.056 88	British thermal units per minute
"	10^7	ergs per second
"	1.341×10^{-3}	horsepower
"	1	joules per second
watt-hours	3600	joules
webers (magnetic flux)	1	volt-seconds
"	10^8	maxwells
yards	0.9144	meters
"	3	feet