

E Comprehensive Table of Conversion Factors¹

The following tables express the definitions of miscellaneous units of measure as exact numerical multiples of coherent SI units and provide multiplying factors for converting numbers and miscellaneous units to corresponding new numbers and SI units.

Conversion factors are expressed using computer exponential notation, and an asterisk follows each number which expresses an exact definition. For example, the entry “2.54 E – 2*” expresses the fact that 1 inch = 2.54 × 10^{–2} meter, exactly by definition. Numbers not followed by an asterisk are only approximate representations of definitions or are the results of physical measurements. In these tables pound-force is designated as lbf, whereas in the text pound-force is designated as lb.

■ **Table E.1**
Listing by Physical Quantity

To convert from	to	Multiply by
Acceleration		
foot/second ²	meter/second ²	3.048 E – 1*
free fall, standard	meter/second ²	9.806 65 E + 0*
gal (galileo)	meter/second ²	1.00 E – 2*
inch/second ²	meter/second ²	2.54 E – 2*
Area		
acre	meter ²	4.046 856 422 4 E + 3*
are	meter ²	1.00 E + 2*
barn	meter ²	1.00 E – 28*
foot ²	meter ²	9.290 304 E – 2*
hectare	meter ²	1.00 E + 4*
inch ²	meter ²	6.4516 E – 4*
mile ² (U.S. statute)	meter ²	2.589 988 110 336 E + 6*
section	meter ²	2.589 988 110 336 E + 6*
township	meter ²	9.323 957 2 E + 7
yard ²	meter ²	8.361 273 6 E – 1*
Density		
gram/centimeter ³	kilogram/meter ³	1.00 E + 3*
lbm/inch ³	kilogram/meter ³	2.767 990 5 E + 4
lbm/foot ³	kilogram/meter ³	1.601 846 3 E + 1
slug/foot ³	kilogram/meter ³	5.153 79 E + 2

¹This table is abridged from Mechtly, E. A., *The International System of Units, 2nd Revision*, NASA SP-7012, 1973.

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■ **Table E.1** (continued)

To convert from	to	Multiply by
Energy		
British thermal unit: (IST after 1956)	joule	1.055 056 E + 3
British thermal unit (thermochemical)	joule	1.054 350 E + 3
calorie (International Steam Table)	joule	4.1868 E + 0
calorie (thermochemical)	joule	4.184 E + 0*
calorie (kilogram, International Steam Table)	joule	4.1868 E + 3
calorie (kilogram, thermochemical)	joule	4.184 E + 3*
electron volt	joule	1.602 191 7 E − 19
erg	joule	1.00 E − 7*
foot lbf	joule	1.355 817 9 E + 0
foot poundal	joule	4.214 011 0 E − 2
joule (international of 1948)	joule	1.000 165 E + 0
kilocalorie (International Steam Table)	joule	4.1868 E + 3
kilocalorie (thermochemical)	joule	4.184 E + 3*
kilowatt hour	joule	3.60 E + 6*
watt hour	joule	3.60 E + 3*
Force		
dyne	newton	1.00 E − 5*
kilogram force (kgf)	newton	9.806 65 E + 0*
kilopound force	newton	9.806 65 E + 0*
kip	newton	4.448 221 615 260 5 E + 3*
lbf (pound force, avoirdupois)	newton	4.448 221 615 260 5 E + 0*
ounce force (avoirdupois)	newton	2.780 138 5 E − 1
pound force, lbf (avoirdupois)	newton	4.448 221 615 260 5 E + 0*
poundal	newton	1.382 549 543 76 E − 1*
Length		
angstrom	meter	1.00 E − 10*
astronomical unit (IAU)	meter	1.496 00 E + 11
cubit	meter	4.572 E − 1*
fathom	meter	1.8288 E + 0*
foot	meter	3.048 E − 1*
furlong	meter	2.011 68 E + 2*
hand	meter	1.016 E − 1*
inch	meter	2.54 E − 2*
league (international nautical)	meter	5.556 E + 3*
light year	meter	9.460 55 E + 15
meter	wavelengths Kr 86	1.650 763 73 E + 6*
micron	meter	1.00 E − 6*
mil	meter	2.54 E − 5*
mile (U.S. statute)	meter	1.609 344 E + 3*
nautical mile (U.S.)	meter	1.852 E + 3*
rod	meter	5.0292 E + 0*
yard	meter	9.144 E − 1*

■ **Table E.1** (continued)

To convert from	to	Multiply by
Mass		
carat (metric)	kilogram	2.00 E − 4*
grain	kilogram	6.479 891 E − 5*
gram	kilogram	1.00 E − 3*
ounce mass (avoirdupois)	kilogram	2.834 952 312 5 E − 2*
pound mass, lbm (avoirdupois)	kilogram	4.535 923 7 E − 1*
slug	kilogram	1.459 390 29 E + 1
ton (long)	kilogram	1.016 046 908 8 E + 3*
ton (metric)	kilogram	1.00 E + 3*
ton (short, 2000 pound)	kilogram	9.071 847 4 E + 2*
tonne	kilogram	1.00 E + 3*
Power		
Btu (thermochemical)/second	watt	1.054 350 264 488 E + 3
calorie (thermochemical)/second	watt	4.184 E + 0*
foot lbf/second	watt	1.355 817 9 E + 0
horsepower (550 foot lbf/second)	watt	7.456 998 7 E + 2
kilocalorie (thermochemical)/second	watt	4.184 E + 3*
watt (international of 1948)	watt	1.000 165 E + 0
Pressure		
atmosphere	newton/meter ²	1.013 25 E + 5*
bar	newton/meter ²	1.00 E + 5*
barye	newton/meter ²	1.00 E − 1*
centimeter of mercury (0 °C)	newton/meter ²	1.333 22 E + 3
centimeter of water (4 °C)	newton/meter ²	9.806 38 E + 1
dyne/centimeter ²	newton/meter ²	1.00 E − 1*
foot of water (39.2 °F)	newton/meter ²	2.988 98 E + 3
inch of mercury (32 °F)	newton/meter ²	3.386 389 E + 3
inch of mercury (60 °F)	newton/meter ²	3.376 85 E + 3
inch of water (39.2 °F)	newton/meter ²	2.490 82 E + 2
inch of water (60 °F)	newton/meter ²	2.4884 E + 2
kgf/centimeter ²	newton/meter ²	9.806 65 E + 4*
kgf/meter ²	newton/meter ²	9.806 65 E + 0*
lbf/foot ²	newton/meter ²	4.788 025 8 E + 1
lbf/inch ² (psi)	newton/meter ²	6.894 757 2 E + 3
millibar	newton/meter ²	1.00 E + 2*
millimeter of mercury (0 °C)	newton/meter ²	1.333 224 E + 2
pascal	newton/meter ²	1.00 E + 0*
psi (lbf/inch ²)	newton/meter ²	6.894 757 2 E + 3
torr (0 °C)	newton/meter ²	1.333 22 E + 2
Speed		
foot/second	meter/second	3.048 E − 1*
inch/second	meter/second	2.54 E − 2*
kilometer/hour	meter/second	2.777 777 8 E − 1
knot (international)	meter/second	5.144 444 444 E − 1
mile/hour (U.S. statute)	meter/second	4.4704 E − 1*

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■ Table E.1 (continued)

To convert from	to	Multiply by
Temperature		
Celsius	kelvin	$t_K = t_C + 273.15$
Fahrenheit	kelvin	$t_K = (5/9)(t_F + 459.67)$
Fahrenheit	Celsius	$t_C = (5/9)(t_F - 32)$
Rankine	kelvin	$t_K = (5/9)t_R$
Time		
day (mean solar)	second (mean solar)	8.64 E + 4*
hour (mean solar)	second (mean solar)	3.60 E + 3*
minute (mean solar)	second (mean solar)	6.00 E + 1*
year (calendar)	second (mean solar)	3.1536 E + 7*
Viscosity		
centistoke	meter ² /second	1.00 E - 6*
stoke	meter ² /second	1.00 E - 4*
foot ² /second	meter ² /second	9.290 304 E - 2*
centipoise	newton second/meter ²	1.00 E - 3*
lbm/foot second	newton second/meter ²	1.488 163 9 E + 0
lbf second/foot ²	newton second/meter ²	4.788 025 8 E + 1
poise	newton second/meter ²	1.00 E - 1*
poundal second/foot ²	newton second/meter ²	1.488 163 9 E + 0
slug/foot second	newton second/meter ²	4.788 025 8 E + 1
rhe	meter ² /newton second	1.00 E + 1*
Volume		
acre foot	meter ³	1.233 481 837 547 52 E + 3*
barrel (petroleum, 42 gallons)	meter ³	1.589 873 E - 1
board foot	meter ³	2.359 737 216 E - 3*
bushel (U.S.)	meter ³	3.523 907 016 688 E - 2*
cord	meter ³	3.624 556 3 E + 0
cup	meter ³	2.365 882 365 E - 4*
dram (U.S. fluid)	meter ³	3.696 691 195 312 5 E - 6*
fluid ounce (U.S.)	meter ³	2.957 352 956 25 E - 5*
foot ³	meter ³	2.831 684 659 2 E - 2*
gallon (U.K. liquid)	meter ³	4.546 087 E - 3
gallon (U.S. liquid)	meter ³	3.785 411 784 E - 3*
inch ³	meter ³	1.638 706 4 E - 5*
liter	meter ³	1.00 E - 3*
ounce (U.S. fluid)	meter ³	2.957 352 956 25 E - 5*
peck (U.S.)	meter ³	8.809 767 541 72 E - 3*
pint (U.S. liquid)	meter ³	4.731 764 73 E - 4*
quart (U.S. liquid)	meter ³	9.463 529 5 E - 4
stere	meter ³	1.00 E + 0*
tablespoon	meter ³	1.478 676 478 125 E - 5*
teaspoon	meter ³	4.928 921 593 75 E - 6*
yard ³	meter ³	7.645 548 579 84 E - 1*