

Appendix U. Measurement units

Table U.1. Lengths

meter	m	1 m = 0,001 km = 39,37 in = 3,28 ft = 1,09 yd
centimetre	cm	1 cm = 0,01 m = 0,3937 in = 0,0328 ft = 0,0109 yd
kilometre	km	1 km = 1000 m = 1093,61 yd = 0,5396 naut mi = 0,62137 mi
inch	1", in	1 in = 0,0833 ft = 0,0278 yd = 2,54 cm = 0,0254 m
foot	1', ft	1 ft = 12 in = 0,333 yd = 30,48 cm = 0,3048 m
yard	yd	1 yd = 3 ft = 36 in = 91,44 cm = 0,9144 m
nautical mile	naut mi	1 naut mi = 1,853 km = 1853,18 m = 2026,67 yd = 1,151 mi
mile	mi	1 mi = 1,609 km = 1609,35 m = 1760 yd = 0,868 naut mi
hand	hand	1 hand = 4 in = 0,3332 ft = 0,111 yd = 10,16 cm = 0,1016 m
span	span	1 span = 9 in = 0,7497 ft = 0,25 yd = 22,86 cm = 0,2286 m

Table U.2. Surface

square meter	m ²	1 m ² = 10000 cm ² = 0,0001 ha = 1550 in ² = 10,76 ft ² = 1,196 yd ²
square centimetre	cm ²	1 cm ² = 0,0001 m ² = 0,155 in ² = 0,0011 ft ² = 0,00012 yd ²
square kilometre	km ²	1 km ² = 1000000 m ² = 100 ha = 0,386 mi ² = 247,105 ac
are	a	1 a = 100 m ² = 0,01 ha = 1076,39 ft ² = 119,599 yd ² = 0,0000386 mi ² = 0,024 ac
hectare	ha	1 ha = 100 a = 10000 m ² = 0,01 km ² = 107639,1 ft ² = 0,0039 mi ² = 2,47 ac
square inch	in ²	1 in ² = 0,00694 ft ² = 6,4516 cm ²
square foot	ft ²	1 ft ² = 0,092 m ² = 144 in ² = 0,111 yd ²
square yard	yd ²	1 yd ² = 0,836 m ² = 8361,27 cm ² = 9 ft ² = 1296 in ² = 0,0002 ac
square mile	mi ²	1 mi ² = 2,59 km ² = 259 ha = 640 ac
acre	ac	1 ac = 4046,86 m ² = 0,0040 km ² = 0,40 ha = 40,47 a = 43.560 ft ² = 4840 yd ² = 0,00156 mi ²

Table U.3. Volume

cubic meter	m ³	1 m ³ = 1000 dm ³ = 35,3146 ft ³ = 61023,744 in ³ = 1,308 yd ³ = 264,20 galUS = 219,97 galUK
cubic decimetre; litre	dm ³	1 dm ³ = 1 l = 0,001 m ³ = 61,024 in ³ = 0,0353 ft ³ = 0,00131 yd ³ = 0,26417 galUS = 0,21997 galUK
cubic centimetre	cm ³ , cc	1 cm ³ = 0,001 dm ³ = 0,001 l = 0,061 in ³ = 0,000264 galUS = 0,00022 galUK
cubic inch	in ³	1 in ³ = 0,0000164 m ³ = 0,0164 dm ³ = 0,0005787 ft ³ = 0,0043 galUS = 0,0036 galUK
cubic foot	ft ³	1 ft ³ = 0,02832 m ³ = 28,32 dm ³ = 1728 in ³ = 0,037 yd ³ = 7,48 galUS = 6,23 galUK
cubic yard	yd ³	1 yd ³ = 0,764 m ³ = 764,55 dm ³ = 46656 in ³ = 27 ft ³ = 201,97 galUS = 168,18 galUK
gallon US	galUS	1 galUS = 0,00378 m ³ = 3,785 dm ³ = 231 in ³ = 0,134 ft ³ = 0,0049 yd ³ = 0,833 galUK
gallon UK	galUK	1 galUK = 0,00455 m ³ = 4,546 dm ³ = 277,42 in ³ = 0,16 ft ³ = 0,0059 yd ³ = 1,2 galUS

Table U.4. Pressure

pascal	Pa	1 Pa = 1 N/m ² , 1 kPa = 0,01 bar = 0,1 N/cm ² = 0,10 mH ₂ O = 7,5 mmHg = 0,0099 atm = 0,145 psi = 0,02088 lbf/ft ² = 0,334 ftH ₂ O
bar	bar	1 bar = 100000 Pa = 100 kPa = 1,0197 kg/cm ² = 10,198 mH ₂ O = 750 mmHg = 0,987 atm = 14,5 psi = 33,455 ftH ₂ O
millibar	mbar	1 mbar = 100 Pa = 0,010 mH ₂ O = 0,750 mmHg = 0,00102 kg/cm ² = 0,0145 psi = 2,088 lbf/ft ² = 0,033 ftH ₂ O
millimetres of mercury	mmHg	1 mmHg = 133,322 Pa = 0,133 kPa = 0,00133 bar = 0,0136 mH ₂ O = 0,00131 atm = 0,00136 kg/cm ² = 0,01934 psi = 2,78 lbf/ft ² = 0,045 ftH ₂ O
technical atmosphere=kgf/cm ²	at, kg/cm ²	1 at = 1 kg/cm ² = 735,56 mmHg = 10 mH ₂ O = 98066,50 Pa = 98,067 kPa = 0,981 bar = 0,968 atm = 14,22 psi = 2048,16 lbf/ft ² = 32,81 ftH ₂ O
metric atmosphere	atm	1 atm = 101325 Pa = 760 mmHg = 1,033 at = 10,33 mH ₂ O = 1,01 bar = 14,696 psi = 2116,22 lbf/ft ² = 33,9 ftH ₂ O
meters column of water	mH ₂ O	1 mH ₂ O = 9806 Pa = 0,09806 bar = 73,55 mmHg = 0,9806 N/cm ² = 0,09678 atm = 0,0999 at = 1,4224 psi = 204,8 lbf/ft ² = 3,28 ftH ₂ O
foot of water	ftH ₂ O	1 ftH ₂ O = 2988,87 Pa = 0,0299 bar = 0,3048 mH ₂ O = 22,419 mmHg = 0,0295 atm = 0,03048 kg/cm ² = 0,4335 psi = 62,42 lbf/ft ²
pounds per square inch	psi	1 psi = 6894,76 Pa = 6,894 kPa = 0,069 bar = 0,703 mH ₂ O = 51,715 mmHg = 0,689 N/cm ² = 0,068 atm = 0,0703 kg/cm ² = 144 lbf/ft ² = 2,31 ftH ₂ O
pounds per square foot	lbf/ft ²	1 lbf/ft ² = 2988,87 Pa = 2,99 kPa = 0,0299 bar = 0,3048 mH ₂ O = 22,418 mmHg = 0,299 N/cm ² = 0,0295 atm = 0,0305 at = 0,433 psi = 62,424 lbf/ft ²

Table U.5. Capacity and volume

cubic meters per second	m ³ /s	1 m ³ /s = 60 m ³ /min = 3600 m ³ /ora = 1000 l/s = 60000 l/min = 6102374,42 in ³ /s = 2118,88 ft ³ /min = 15850,32 gpm = 13198,13 l gpm
cubic meters per minute	m ³ /min	1 m ³ /min = 0,0167 m ³ /s = 60 m ³ /h = 16,67 l/s = 1000 l/min = 35,31 ft ³ /min = 264,17 gpm = 219,97 l gpm
cubic meters per hour	m ³ /h	1 m ³ /h = 0,000278 m ³ /s = 0,0167 m ³ /min = 0,28 l/s = 16,67 l/min = 1017,06 in ³ /min = 0,588 ft ³ /min = 4,40 gpm = 3,66 l gpm
litres per second	l/s	1 l/s = 0,001 m ³ /s = 0,06 m ³ /min = 3,6 m ³ /h = 60 l/min = 3661,42 in ³ /min = 2,12 ft ³ /min = 15,85 gpm = 13,198 l gpm

litres per minute	l/min	1 l/min = 0,001 m ³ /min = 0,06 m ³ /h = 0,0167 l/s = 61,024 in ³ /min = 0,035 ft ³ /min = 0,264 gpm = 0,22 lgpm
cubic inch per minute	in ³ /min	1 in ³ /min = 0,00027 l/s = 0,016 l/min = 0,00058 ft ³ /min = 0,0043 gpm = 0,0036 l gpm
cubic foot per minute	ft ³ /min	1 ft ³ /min = 0,00047 m ³ /s = 0,028 m ³ /min = 1,7 m ³ /h = 0,472 l/s = 28,32 l/min = 1728 in ³ /min = 7,48 gpm = 6,23 l gpm
gallon per minute	gpm	1 gpm = 0,0038 m ³ /min = 0,227 m ³ /h = 0,063 l/s = 3,785 l/min = 231 in ³ /min = 0,134 ft ³ /min = 0,833 l gpm
imperial gallon per minute	l gpm	1 l gpm = 0,000076 m ³ /s = 0,00454 m ³ /min = 0,273 m ³ /h = 0,076 l/s = 4,55 l/min = 277,42 in ³ /min = 0,16 ft ³ /min = 1,2 gpm

Table U.6. Speed

meters per second	m/s	1 m/s = 60 m/min = 3,6 km/h = 39,37 in/s = 2362,2 in/min = 3,28 ft/s = 196,85 ft/min = 2,237 mi/h = 1,94 kn
kilometres per hour	km/h	1 km/h = 0,278 m/s = 16,67 m/min = 10,963 in/s = 656,17 in/min = 0,91 ft/s = 54,68 ft/min = 0,62 mi/h = 0,54 kn
meters per minute	m/min	1 m/min = 0,0167 m/s = 0,06 km/h = 0,66 in/s = 39,37 in/min = 0,0547 ft/s = 3,28 ft/min = 196,85 ft/h = 0,037 mi/h = 0,032 kn
inch per second	in/s	1 in/s = 0,0254 m/s = 1,524 m/min = 0,091 km/h = 60 in /min = 0,083 ft/s = 5 ft/min = 300 ft/h = 0,057 mi/h = 0,049 kn
inch per minute	in/min	1 in/min = 0,0254 m/min = 0,001524 km/h = 0,167 in/s = 0,0014 ft/s = 0,083 ft/min = 5 ft/h
foot per second	ft/s	1 ft/s = 0,305 m/s = 18,288 m/min = 1,097km/h = 12 in/s = 720 in/min = 60 ft/min = 0,68 mi/h = 0,59 kn
foot per minute	ft/min	1 ft/min = 0,00508 m/s = 0,3048 m/min = 0,0183 km/h = 0,2 in/s = 12 in/min = 0,0167 ft/s = 60 ft/h = 0,011 mi/h = 0,0099 kn
foot per hour	ft/h	1 ft/h = 0,005 m/min = 0,0033 in/s = 0,2 in/min = 0,0167 ft/min
mile per hour	mi/h	1 mi/h = 0,447 m/s = 26,82 m/min = 1,609 km/h = 17,6 in/s = 1056 in/min = 1,47 ft/s = 88 ft/min = 0,87 kn
nautical mile per hour = knot	kn	1 kn = 0,51 m/s = 30,89 m/min = 1,85 km/h = 20,27 in/s = 1216 in/min = 1,69 ft/s = 101,33 ft/min = 1,15 mi/h

Table U.7. Angular velocity

radiant per second	rad/s	1 rad/s = 60 rad/min = 0,159 giri/s = 9,55 giri/min
radiant per minute	rad/min	1 rad/min = 0,0167 rad/s = 0,0026 giri/s = 0,159 giri/min
revolutions per second	giri/s	1 giro/s = 60 giri/min = 6,283 rad/s = 376,99 rad/min
revolutions per minute	giri/min	1 giro/min = 0,0167 giri/s = 0,1047 rad/s = 6,283 rad/min

Table U.8. Acceleration

meter per square second	m/s ²	1 m/s ² = 100 cm/s ² = 0,001 km/s ² = 3,28 ft/s ² = 39,37 in/s ² = 0,00062 mi/s ²
centimetre per square second	cm/s ²	1 cm/s ² = 0,01 m/s ² = 0,00001 km/s ² = 0,0328 ft/s ² = 0,394 in/s ²
kilometre per square second	km/s ²	1 km/s ² = 1000 m/s ² = 100000 cm/s ² = 3280,84 ft/s ² = 39370,08 in/s ² = 0,621 mi/s ²
foot per square second	ft/s ²	1 ft/s ² = 0,3048 m/s ² = 30,48 cm/s ² = 12 in/s ²
inch per square second	in/s ²	1 in/s ² = 0,0254 m/s ² = 2,54 cm/s ² = 0,083 ft/s ²
mile per square second	mi/s ²	1 mi/s ² = 1609,34 m/s ² = 1,609 km/s ² = 5280 ft/s ² = 63360 in/s ²

Table U.9. Force - Weight

Newton	N	1 N = 0,102 kgf = 0,0001 t = 0,2248 lbf = 3,597 ozf
kilogram force; kilogram weight	kgf; kgp	1 kgf = 9,81 N = 0,001 t = 2,204 lbf = 35,27 ozf
ton weight	t	1 t = 9'806,65 N = 1'000 kgf = 2'204,62 lbf = 35'274 ozf
kilopound	kp	1 kp = 4'448 N = 453,59 kgf = 1'000 lbf = 16'000 ozf
pound force	lbf	1 lbf = 4,448 N = 0,454 kgf = 16 ozf
ounce force	ozf	1 ozf = 0,278 N = 0,028kgf = 0,0625 lbf
pound feet	lbf/ft	1 lbf/ft = 1,4881 kg/m

Table U.10. Power

kilowatt	kW	1 kW = 1,36 CV = 1,34 hp = 737,56 lbf·ft/s = 44253,7 lbf·ft/min = 859,84 kcal/h = 3412,14 btu/h = 101,97 kgf·m/s
horsepower	CV	1 CV = 0,735 kW = 0,986 hp = 75 kg·m/s = 542,47 lbf·ft/s = 632,41 kcal/h = 2509,62 btu/h = 75 kgf·m/s
kilogram force per meter per second	kgf·m/s	1 kgf·m/s = 0,01 kW = 0,013 CV = 0,013 hp = 7,23 lbf·ft/s = 433,98 lbf·ft/min = 8,43 kcal/h = 33,46 btu/h
kilogram calorie per hour	kcal/h	1 kcal/h = 0,0012 kW = 0,0016 CV = 0,00156 hp = 0,8578 lbf·ft/s = 51,47 lbf·ft/min = 3,97 btu/h = 0,12 kgf·m/s
horsepower	HP	1 HP = 1,014 CV = 0,746 kW = 550 lbf·ft/s = 33000 lbf·ft/min = 641,19 kcal/h = 2544,43 btu/h = 76,04 kgf·m/s
foot pound force per second	lbf·ft/s	1 lbf·ft/s = 0,0013 kW = 0,0018 CV = 0,0018 hp = 60 lbf·ft/min = 1,166 kcal/h = 4,63 btu/h = 0,138 kgf·m/s
foot pound force per minute	lbf·ft/min	1 lbf·ft/min = 0,000023 kW = 0,0167 lbf·ft/s = 0,019 kcal/h = 0,077 btu/h = 0,0023 kgf·m/s
british thermal unit per hour	BTU/h	1 btu/h = 0,00029 kW = 0,216 lbf·ft/s = 12,97 lbf·ft/min = 0,25 kcal/h = 0,030 kgf·m/s

Table U.11. Work - Energy - Moment – Torque - Heat

joule	J	1 J = 1 N·m = 0,102 kgf·m = 0,00024 kcal = 8,85 lbf·in = 0,74 lbf·ft = 0,00095 BTU
kilogram force per meter	kgf·m	1 kgf·m = 9,807 J = 0,0023 kcal = 86,80 lbf·in = 7,233 lbf·ft = 0,0093 BTU
horsepower per hour	CV·h	1 CV·h = 270000 kgf·m = 0,736 kW·h = 632,41 kcal = 2509 BTU
kilogram calorie	kcal	1 kcal = 4,1868 kJ = 426,93 kgf·m = 0,0016 CV·h = 0,0012 kW·h = 37056,3 lbf·in = 3088 lbf·ft = 3,97 BTU
kilowatt per hour	kW·h	1 kW·h = 3600 kJ = 1,36 CV·h = 859,8 kcal = 3412,14 BTU
pound force inch	lbf·in	1 lbf·in = 0,113 J = 0,0115 kgf·m = 0,083 lbf·ft = 0,0001 BTU
pound force foot	lbf·ft	1 lbf·ft = 1,356 J = 0,138 kgf·m = 0,324 cal = 12 lbf·in = 0,0013 BTU
horse power hour	HP·h	1 HP·h = 2,684 MJ = 641,19 kcal = 1,014 CV·h = 0,746 kW·h = 1980000 lbf·ft = 2544,43 BTU
british thermal unit	BTU	1 BTU = 1055,056 J = 107,58 kgf·m = 0,0004 CV·h = 0,252 kcal = 0,00029 kWh = 9338,03 lbf·in = 778,17 lbf·ft

Table U.12. Density

kilogram per cubic meter	kg/m ³	1 kg/m ³ = 0,001 kg/dm ³ = 0,001 t/m ³ = 0,001 g/cm ³ = 0,062 lb/ft ³ = 0,00075 tn/yd ³ = 0,00084 s tn/yd ³ = 0,133 oz/gal
kilogram per cubic decimetre	kg/dm ³	1 kg/dm ³ = 1000 kg/m ³ = 0,001 g/cm ³ = 1 t/m ³ = 1 g/cm ³ = 62,42 lb/ft ³ = 0,036 lb/in ³ = 133,53 oz/gal
ton per cubic meter	t/m ³	1 t/m ³ = 1000 kg/m ³ = 1 kg/dm ³ = 0,001 kg/cm ³ = 1 g/cm ³ = 62,43 lb/ft ³ = 0,036 lb/in ³ = 0,752 tn/yd ³ = 0,843 s tn/yd ³ = 133,53 oz/gal
pound per cubic foot	lb/ft ³	1 lb/ft ³ = 16,018 kg/m ³ = 0,016 kg/dm ³ = 0,016 t/m ³ = 0,016 g/cm ³ = 0,00058 lb/in ³ = 0,012 tn/yd ³ = 0,0135 s tn/yd ³ = 2,14 oz/gal
pound per cubic inch	lb/in ³	1 lb/in ³ = 27,68 kg/dm ³ = 0,02768 kg/cm ³ = 27,68 t/m ³ = 27,68 g/cm ³ = 1728 lb/ft ³ = 20,83 tn/yd ³ = 23,33 s tn/yd ³ = 3696 oz/gal
ounce per gallon	oz/gal	1 oz/gal = 7,489 kg/m ³ = 0,00749 kg/dm ³ = 0,00749 t/m ³ = 0,00749 g/cm ³ = 0,467 lb/ft ³ = 0,00027 lb/in ³ = 0,00563 tn/yd ³ = 0,0063 oz/gal

Table U.13. Temperature

Kelvin	K	K = °C + 273,15, K = 1,8 · °R, K = (5/9) · °F + (459,67/1,8)
Centigrade degree	°C	°C = (°F - 32) · 5/9, °C = K - 273,15 °C = (5/9) · °F - (32/1,8)
Fahrenheit degree	°F	°F = 9/5 · °C + 32, °F = °R - 459,67 °F = (9/5) · K - 459,67
Rankine degree	°R	°R = (5/9) K, °R = 491,67 + (9/5) · °C, °R = 459,67 + °F