
Appendix E. General Tables of Units of Measurement

These tables have been prepared for the benefit of those requiring tables of units for occasional ready reference. In Section 4. Tables of Units of Measurement of this Appendix, the tables are carried out to a large number of decimal places and exact values are indicated by underlining. In most of the other tables, only a limited number of decimal places are given, therefore making the tables better adapted to the average user.

Section 1. Tables of Metric Units of Measurement

In the metric system of measurement, designations of multiples and subdivisions of any unit may be arrived at by combining with the name of the unit the prefixes deka, hecto, and kilo meaning, respectively, 10, 100, and 1000, and deci, centi, and milli, meaning, respectively, one-tenth, one-hundredth, and one-thousandth. In some of the following metric tables, some such multiples and subdivisions have not been included for the reason that these have little, if any currency in actual usage.

In certain cases, particularly in scientific usage, it becomes convenient to provide for multiples larger than 1000 and for subdivisions smaller than one-thousandth. Accordingly, the following prefixes have been introduced and these are now generally recognized:

yotta, (Y)	meaning 10^{24}	deci, (d),	meaning 10^{-1}
zetta, (Z),	meaning 10^{21}	centi, (c),	meaning 10^{-2}
exa, (E),	meaning 10^{18}	milli, (m),	meaning 10^{-3}
peta, (P),	meaning 10^{15}	micro, (μ),	meaning 10^{-6}
tera, (T),	meaning 10^{12}	nano, (n),	meaning 10^{-9}
giga, (G),	meaning 10^9	pico, (p),	meaning 10^{-12}
mega, (M),	meaning 10^6	femto, (f),	meaning 10^{-15}
kilo, (k),	meaning 10^3	atto, (a),	meaning 10^{-18}
hecto, (h),	meaning 10^2	zepto, (z),	meaning 10^{-21}
deka, (da),	meaning 10^1	yocto, (y),	meaning 10^{-24}

Thus a kilometer is 1000 meters and a millimeter is 0.001 meter.

Units of Length

10 millimeters (mm)	= 1 centimeter (cm)
10 centimeters	= 1 decimeter (dm) = 100 millimeters
10 decimeters	= 1 meter (m) = 1000 millimeters
10 meters	= 1 dekameter (dam)
10 dekameters	= 1 hectometer (hm) = 100 meters
10 hectometers	= 1 kilometer (km) = 1000 meters

Units of Area

100 square millimeters (mm ²)	= 1 square centimeter (cm ²)
100 square centimeters	= 1 square decimeter (dm ²)
100 square decimeters	= 1 square meter (m ²)
100 square meters	= 1 square dekameter (dam ²) = 1 are
100 square dekameters	= 1 square hectometer (hm ²) = 1 hectare (ha)
100 square hectometers	= 1 square kilometer (km ²)

Units of Liquid Volume

10 milliliters (mL)	= 1 centiliter (cL)
10 centiliters	= 1 deciliter (dL) = 100 milliliters
10 deciliters	= 1 liter ¹ = 1000 milliliters
10 liters	= 1 dekaliter (daL)
10 dekaliters	= 1 hectoliter (hL) = 100 liters
10 hectoliters	= 1 kiloliter (kL) = 1000 liters

Units of Volume

1000 cubic millimeters (mm ³)	= 1 cubic centimeter (cm ³)
1000 cubic centimeters	= 1 cubic decimeter (dm ³)
	= 1 000 000 cubic millimeters
1000 cubic decimeters ¹	= 1 cubic meter (m ³)
	= 1 000 000 cubic centimeters
	= 1 000 000 000 cubic millimeters

¹By action of the 12th General Conference on Weights and Measures (1964), the liter is a special name for the cubic decimeter.

Units of Mass

10 milligrams (mg)	= 1 centigram (cg)
10 centigrams	= 1 decigram (dg) = 100 milligrams
10 decigrams	= 1 gram (g) = 1000 milligrams
10 grams	= 1 dekagram (dag)
10 dekagrams	= 1 hectogram (hg) = 100 grams
10 hectograms	= 1 kilogram (kg) = 1000 grams
1000 kilograms	= 1 megagram (Mg) or 1 metric ton(t)

Section 2. Tables of U.S. Units of Measurement²

In these tables where foot or mile is underlined, it is survey foot or U.S. statute mile rather than international foot or mile that is meant.

Units of Length

12 inches (in)	= 1 foot (ft)
3 feet	= 1 yard (yd)
16½ <u>feet</u>	= 1 rod (rd), pole, or perch
40 rods	= 1 furlong (fur) = 660 <u>feet</u>
8 furlongs	= 1 U.S. statute mile (mi) = 5280 <u>feet</u>
1852 meters (m)	= 6076.115 49 feet (approximately)
	= 1 international nautical mile

Units of Area³

144 square inches (in ²)	= 1 square foot (ft ²)
9 square feet	= 1 square yard (yd ²)
	= 1296 square inches
272¼ square <u>feet</u>	= 1 square rod (rd ²)
160 square rods	= 1 acre = 43 560 square <u>feet</u>
640 acres	= 1 square <u>mile</u> (mi ²)

² This section lists units of measurement that have traditionally been used in the United States. In keeping with the Omnibus Trade and Competitiveness Act of 1988, the ultimate objective is to make the International System of Units the primary measurement system used in the United States.

³ Squares and cubes of customary but not of metric units are sometimes expressed by the use of abbreviations rather than symbols. For example, sq ft means square foot, and cu ft means cubic foot.

Units of Area³

1 <u>mile</u> square	= 1 section of land
6 <u>miles</u> square	= 1 township
	= 36 sections = 36 square <u>miles</u>

Units of Volume³

1728 cubic inches (in ³)	= 1 cubic foot (ft ³)
27 cubic feet	= 1 cubic yard (yd ³)

Gunter's or Surveyors Chain Units of Measurement

0.66 <u>foot</u> (ft)	= 1 link (li)
100 links	= 1 chain (ch)
	= 4 rods = 66 <u>feet</u>
80 chains	= 1 U.S. statute mile (mi)
	= 320 rods = 5280 <u>feet</u>

Units of Liquid Volume⁴

4 gills (gi)	= 1 pint (pt) = 28.875 cubic inches (in ³)
2 pints	= 1 quart (qt) = 57.75 cubic inches
4 quarts	= 1 gallon (gal) = 231 cubic inches
	= 8 pints = 32 gills

Apothecaries Units of Liquid Volume

60 minims	= 1 fluid dram (fl dr or <i>f</i> ʒ)
	= 0.225 6 cubic inch (in ³)
8 fluid drams	= 1 fluid ounce (fl oz or <i>f</i> ʒ)
	= 1.804 7 cubic inches
16 fluid ounces	= 1 pint (pt)
	= 28.875 cubic inches

³ Squares and cubes of customary but not of metric units are sometimes expressed by the use of abbreviations rather than symbols. For example, sq ft means square foot, and cu ft means cubic foot.

⁴ When necessary to distinguish the liquid pint or quart from the dry pint or quart, the word "liquid" or the abbreviation "liq" should be used in combination with the name or abbreviation of the liquid unit.

Apothecaries Units of Liquid Volume

	= 128 fluid drams
2 pints	= 1 quart (qt) = 57.75 cubic inches
	= 32 fluid ounces = 256 fluid drams
4 quarts	= 1 gallon (gal) = 231 cubic inches
	= 128 fluid ounces = 1024 fluid drams

Units of Dry Volume⁵

2 pints (pt)	= 1 quart (qt) = 67.200 6 cubic inches (in ³)
8 quarts	= 1 peck (pk) = 537.605 cubic inches
	= 16 pints
4 pecks	= 1 bushel (bu) = 2150.42 cubic inches
	= 32 quarts

Avoirdupois Units of Mass⁶

(The “grain” is the same in avoirdupois, troy, and apothecaries units of mass.)

1 μlb	= 0.000 001 pound (lb)
27 ¹¹ / ₃₂ grains (gr)	= 1 dram (dr)
16 drams	= 1 ounce (oz)
	= 437½ grains
16 ounces	= 1 pound (lb)
	= 256 drams
	= 7000 grains
100 pounds	= 1 hundredweight (cwt) ⁷
20 hundredweights	= 1 ton (tn) ⁸
	= 2000 pounds ⁷

⁵ When necessary to distinguish dry pint or quart from the liquid pint or quart, the word “dry” should be used in combination with the name or abbreviation of the dry unit.

⁶ When necessary to distinguish the avoirdupois dram from the apothecaries dram, or to distinguish the avoirdupois dram or ounce from the fluid dram or ounce, or to distinguish the avoirdupois ounce or pound from the troy or apothecaries ounce or pound, the word “avoirdupois” or the abbreviation “avdp” should be used in combination with the name or abbreviation of the avoirdupois unit.

⁷ When the terms “hundredweight” and “ton” are used unmodified, they are commonly understood to mean the 100-pound hundredweight and the 2000-pound ton, respectively; these units may be designated “net” or “short” when necessary to distinguish them from the corresponding units in gross or long measure.

⁸ As of January 1, 2014, “tn” is the required abbreviation for short ton. Devices manufactured between January 1, 2008, and December 31, 2013, may use an abbreviation other than “tn” to specify short ton. This provision is a NIST Handbook 44, “Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices” in Appendix C. General Table of Units of Measurement.

In “gross” or “long” measure, the following values are recognized:

112 pounds (lb)	= 1 gross or long hundredweight (cwt) ⁷
20 gross or long hundredweights	= 1 gross or long ton
	= 2240 pounds ⁷

Troy Units of Mass

(The “grain” is the same in avoirdupois, troy, and apothecaries units of mass.)

24 grains (gr)	= 1 pennyweight (dwt)
20 pennyweights	= 1 ounce troy (oz t) = 480 grains
12 ounces troy	= 1 pound troy (lb t)
	= 240 pennyweights = 5760 grains

Apothecaries Units of Mass

(The “grain” is the same in avoirdupois, troy, and apothecaries units of mass.)

20 grains (gr)	= 1 scruple (s ap or ℥)
3 scruples	= 1 dram apothecaries (dr ap or ℥)
	= 60 grains
8 drams apothecaries	= 1 ounce apothecaries (oz ap or ℥)
	= 24 scruples = 480 grains
12 ounces apothecaries	= 1 pound apothecaries (lb ap)
	= 96 drams apothecaries
	= 288 scruples = 5760 grains

⁷ When the terms “hundredweight” and “ton” are used unmodified, they are commonly understood to mean the 100-pound hundredweight and the 2000-pound ton, respectively; these units may be designated “net” or “short” when necessary to distinguish them from the corresponding units in gross or long measure.

⁸ As of January 1, 2014, “tn” is the required abbreviation for short ton. Devices manufactured between January 1, 2008, and December 31, 2013, may use an abbreviation other than “tn” to specify short ton. This provision is a NIST Handbook 44, “Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices” in Appendix C. General Table of Units of Measurement.

Section 3. Notes on British Units of Measurement

In Great Britain, the yard, the avoirdupois pound, the troy pound, and the apothecaries pound are identical with the units of the same names used in the United States. The tables of British linear measure, troy mass, and apothecaries mass are the same as the corresponding United States tables, except for the British spelling “drachm” in the table of apothecaries mass. The table of British avoirdupois mass is the same as the United States table up to 1 pound; above that point the table reads:

14 pounds	= 1 stone
2 stones	= 1 quarter = 28 pounds
4 quarters	= 1 hundredweight = 112 pounds
20 hundredweight	= 1 ton = 2240 pounds

The present British gallon and bushel – known as the “Imperial gallon” and “Imperial bushel” – are, respectively, about 20 % and 3 % larger than the United States gallon and bushel. The Imperial gallon is defined as the volume of 10 avoirdupois pounds of water under specified conditions, and the Imperial bushel is defined as 8 Imperial gallons. Also, the subdivision of the Imperial gallon as presented in the table of British apothecaries fluid measure differs in two important respects from the corresponding United States subdivision, in that the Imperial gallon is divided into 160 fluid ounces (whereas the United States gallon is divided into 128 fluid ounces), and a “fluid scruple” is included. The full table of British measures of capacity (which are used alike for liquid and for dry commodities) is as follows:

4 gills	= 1 pint
2 pints	= 1 quart
4 quarts	= 1 gallon
2 gallons	= 1 peck
8 gallons (4 pecks)	= 1 bushel
8 bushels	= 1 quarter

The full table of British apothecaries measure is as follows:

20 minims	= 1 fluid scruple
3 fluid scruples	= 1 fluid drachm
	= 60 minims
8 fluid drachms	= 1 fluid ounce
20 fluid ounces	= 1 pint
8 pints	= 1 gallon (160 fluid ounces)

Section 4. Tables of Units of Measurement

Unit conversion is a multi-step process that involves multiplication or division by a numerical factor; selection of the correct number of significant digits; and rounding. Accurate unit conversions are obtained by selecting an appropriate conversion factor (a ratio which converts one unit of measure into another without changing the quantity), which are supplied in these tables.

Some unit conversions may be exact, without increasing or decreasing the precision of the original quantity. Exact unit conversion factors are underlined in these tables. It is good practice to keep all the digits, especially if other mathematical operations or conversions will follow. Rounding should be the last step of the conversion process and should be performed only once.

To convert a value from one unit of measurement to different unit of measurement follow the steps below.

- Find the table corresponding to the general category of measurement; for example, the table titled “Units of Volume” includes conversion factors for volume measurements.
- Locate the “starting unit” of measurement in the far, left column.
- Proceed horizontally to the right on the same row until you reach the column with the heading of the “ending unit” of measurement.
- The unit conversion factor is located at the intersection of the row and column.
- Multiply the quantity value of the starting unit of measurement by the conversion factor.
- The result is the equivalent quantity value in the ending unit of measurement.

Units of Length – International Measure⁹

(All underlined figures are exact.)

Starting Unit ↓	Multiply by the Conversion Factor Below the Ending Unit:						
	Ending Unit →	Inches	Feet	Yards	Miles	Centimeters	Meters
1 inch =		<u>1</u>	0.083 333 33	0.027 777 78	0.000 015 782 83	<u>2.54</u>	<u>0.025 4</u>
1 foot =		<u>12</u>	<u>1</u>	0.333 333 3	0.000 189 393 9	<u>30.48</u>	<u>0.304 8</u>
1 yard =		<u>36</u>	<u>3</u>	<u>1</u>	0.000 568 181 8	<u>91.44</u>	<u>0.914 4</u>
1 mile =		<u>63 360</u>	<u>5 280</u>	<u>1 760</u>	<u>1</u>	<u>160 934.4</u>	<u>1609.344</u>
1 centimeter =		0.393 700 8	0.032 808 40	0.010 936 13	0.000 006 213 712	<u>1</u>	<u>0.01</u>
1 meter =		39.370 08	3.280 840	1.093 613	0.000 621 371 2	<u>100</u>	<u>1</u>

⁹ One international foot = 0.999 998 survey foot (exactly)

One international mile = 0.999 998 survey mile (exactly)

Units of Length – Thickness Measurement

(All underlined figures are exact.)

Starting Unit ↓	Multiply by the Conversion Factor Below the Ending Unit:			
	Ending Unit →	Inches	Millimeters	Micrometers
1 mil =		<u>0.001</u>	<u>0.025 4</u>	<u>25.4</u>
		NOTE: The unit “mil” is a unit traditionally used by industry for the measurement of thickness.		

Units of Length – Survey Measure⁹

(All underlined figures are exact.)

Starting Unit ↓	Multiply by the Conversion Factor Below the Ending Unit:						
	Ending Unit →	Links	Feet	Rods	Chains	Miles	Meters
1 link =		<u>1</u>	<u>0.66</u>	<u>0.04</u>	<u>0.01</u>	<u>0.000 125</u>	0.201 168 4
1 foot =		1.515 152	<u>1</u>	0.060 606 06	0.015 151 52	0.000 189 393 9	0.304 800 6
1 rod =		<u>25</u>	<u>16.5</u>	<u>1</u>	<u>0.25</u>	<u>0.003 125</u>	5.029 210
1 chain =		<u>100</u>	<u>66</u>	<u>4</u>	<u>1</u>	<u>0.0125</u>	20.116 84
1 mile =		<u>8 000</u>	<u>5 280</u>	<u>320</u>	<u>80</u>	<u>1</u>	1609.347
1 meter =		4.970 960	3.280 833	0.198 838 4	0.049 709 60	0.000 621 369 9	<u>1</u>

Units of Area – International Measure ¹⁰(All underlined figures are exact.)

Starting Unit ↓	Multiply by the Conversion Factor Below the Ending Unit:			
	Ending Unit →	Square Inches	Square Feet	Square Yards
1 square inch =		<u>1</u>	0.006 944 444	0.000 771 604 9
1 square foot =		<u>144</u>	<u>1</u>	0.111 111 1
1 square yard =		<u>1 296</u>	<u>9</u>	<u>1</u>
1 square mile =		<u>4 014 489 600</u>	<u>27 878 400</u>	<u>3 097 600</u>
1 square centimeter =		0.155 000 3	0.001 076 391	0.000 119 599 0
1 square meter =		1550.003	10.763 91	1.195 990
Note: 1 survey foot = $\frac{1200}{3937}$ meter (exactly) 1 international foot = 12×0.0254 meter (exactly) 1 international foot = 0.0254×39.37 survey foot (exactly)				

Starting Unit ↓	Multiply by the Conversion Factor Below the Ending Unit:			
	Ending Unit →	Square Miles	Square Centimeters	Square Meters
1 square inch =		0.000 000 000 249 097 7	<u>6.451 6</u>	<u>0.000 645 16</u>
1 square foot =		0.000 000 035 870 06	<u>929.030 4</u>	<u>0.092 903 04</u>
1 square yard =		0.000 000 322 830 6	<u>8361.273 6</u>	<u>0.836 127 36</u>
1 square mile =		<u>1</u>	<u>25 899 881 103.36</u>	<u>2 589 988.110 336</u>
1 square centimeter =		0.000 000 000 038 610 22	<u>1</u>	<u>0.0001</u>
1 square meter =		0.000 000 386 102 2	<u>10 000</u>	<u>1</u>

¹⁰ One square survey foot = 1.000 004 square international feet
 One square survey mile = 1.000 004 square international miles

Units of Area – Survey Measure^{10, 11}

(All underlined figures are exact.)

Starting Unit ↓	Multiply by the Conversion Factor Below the Ending Unit:				
	Ending Unit →	Square Feet	Square Rods	Square Chains	Acres
1 square foot =		<u>1</u>	0.003 673 095	0.000 229 568 4	0.000 022 956 84
1 square rod =		<u>272.25</u>	<u>1</u>	<u>0.062 5</u>	<u>0.006 25</u>
1 square chain =		<u>4 356</u>	<u>16</u>	<u>1</u>	<u>0.1</u>
1 acre =		<u>43 560</u>	<u>160</u>	<u>10</u>	<u>1</u>
1 square mile =		<u>27 878 400</u>	<u>102 400</u>	<u>6 400</u>	<u>640</u>
1 square meter =		10.763 87	0.039 536 70	0.002 471 044	0.000 247 104 4
1 hectare =		107 638.7	395.367 0	24.710 44	2.471 044

Starting Unit ↓	Multiply by the Conversion Factor Below the Ending Unit:			
	Ending Unit →	Square Miles	Square Meters	Hectares
1 square foot =		0.000 000 035 870 06	0.092 903 41	0.000 009 290 341
1 square rod =		<u>0.000 009 765 625</u>	25.292 95	0.002 529 295
1 square chain =		<u>0.000 156 25</u>	404.687 3	0.040 468 73
1 acre =		<u>0.001 562 5</u>	4 046.873	0.404 687 3
1 square mile =		<u>1</u>	2 589 998	258.999 8
1 square meter =		0.000 000 386 100 6	<u>1</u>	<u>0.000 1</u>
1 hectare =		0.003 861 006	<u>10 000</u>	<u>1</u>

¹¹ One square survey foot = 1.000 004 square international feet
 One square survey mile = 1.000 004 square international miles

¹¹ One international foot = 0.999 998 survey foot (exactly)
 One international mile = 0.999 998 survey mile (exactly)

Units of Volume
(all underlined figures are exact)

Starting Unit ↓	Multiply by the Conversion Factor Below the Ending Unit:			
	Ending Unit →	Cubic Inches	Cubic Feet	Cubic Yards
1 cubic inch =		<u>1</u>	0.000 578 703 7	0.000 021 433 47
1 cubic foot =		<u>1 728</u>	<u>1</u>	0.037 037 04
1 cubic yard =		<u>46 656</u>	<u>27</u>	<u>1</u>
1 cubic centimeter =		0.061 023 74	0.000 035 314 67	0.000 001 307 951
1 cubic decimeter =		61.023 74	0.035 314 67	0.001 307 951
1 cubic meter =		61 023.74	35.314 67	1.307 951

Starting Unit ↓	Multiply by the Conversion Factor Below the Ending Unit:			
	Ending Unit →	Milliliters (Cubic Centimeters)	Liters (Cubic Decimeters)	Cubic Meters
1 cubic inch =		<u>16.387 064</u>	<u>0.016 387 064</u>	<u>0.000 016 387 064</u>
1 cubic foot =		<u>28 316.846 592</u>	<u>28.316 846 592</u>	<u>0.028 316 846 592</u>
1 cubic yard =		<u>764 554.857 984</u>	<u>764.554 857 984</u>	<u>0.764 554 857 984</u>
1 cubic centimeter =		<u>1</u>	<u>0.001</u>	<u>0.000 001</u>
1 cubic decimeter =		<u>1 000</u>	<u>1</u>	<u>0.001</u>
1 cubic meter =		<u>1 000 000</u>	<u>1 000</u>	<u>1</u>

Units of Capacity or Volume – Dry Volume Measure

(All underlined figures are exact.)

Starting Unit ↓	Multiply by the Conversion Factor Below the Ending Unit:				
	Ending Unit →	Dry Pints	Dry Quarts	Pecks	Bushels
1 dry pint =		<u>1</u>	<u>0.5</u>	<u>0.062 5</u>	<u>0.015 625</u>
1 dry quart =		<u>2</u>	<u>1</u>	<u>0.125</u>	<u>0.031 25</u>
1 peck =		<u>16</u>	<u>8</u>	<u>1</u>	<u>0.25</u>
1 bushel =		<u>64</u>	<u>32</u>	<u>4</u>	<u>1</u>
1 cubic inch =		0.029 761 6	0.014 880 8	0.001 860 10	0.000 465 025
1 cubic foot =		51.428 09	25.714 05	3.214 256	0.803 563 95
1 liter =		1.816 166	0.908 083 0	0.113 510 4	0.028 377 59
1 cubic meter =		1 816.166	908.083 0	113.510 4	28.377 59

Starting Unit ↓	Multiply by the Conversion Factor Below the Ending Unit:				
	Ending Unit →	Cubic Inches	Cubic Feet	Liters	Cubic Meters
1 dry pint =		<u>1.12</u>	0.019 444 63	0.550 610 5	0.000 550 610 5
1 dry quart =		<u>67.200 625</u>	0.038 889 25	1.101 221	0.001 101 221
1 peck =		<u>537.605</u>	0.311 114	8.809 768	0.008 809 768
1 bushel =		<u>2 150.42</u>	1.244 456	<u>35.239 070 166 88</u>	<u>0.035 239 070 166 88</u>
1 cubic inch =		<u>1</u>	0.000 578 703 7	<u>0.016 387 064</u>	<u>0.000 016 387 064</u>
1 cubic foot =		<u>1728</u>	<u>1</u>	28.316 846 592	<u>0.028 316 846 592</u>
1 liter =		61.023 74	0.035 314 67	<u>1</u>	<u>0.001</u>
1 cubic meter =		61 023.74	35.314 67	<u>1000</u>	<u>1</u>

Units of Capacity or Volume – Liquid Volume Measure

(All underlined figures are exact.)

Starting Unit ↓	Multiply by the Conversion Factor Below the Ending Unit:				
	Ending Unit →	Minims	Fluid Drams	Fluid Ounces	Gills
1 minim =		<u>1</u>	0.016 666 67	0.002 083 333	0.000 520 833 3
1 fluid dram =		<u>60</u>	<u>1</u>	<u>0.125</u>	<u>0.031 25</u>
1 fluid ounce =		<u>480</u>	<u>8</u>	<u>1</u>	<u>0.25</u>
1 gill =		<u>1 920</u>	<u>32</u>	<u>4</u>	<u>1</u>
1 liquid pint =		<u>7 680</u>	<u>128</u>	<u>16</u>	<u>4</u>
1 liquid quart =		<u>15 360</u>	<u>256</u>	<u>32</u>	<u>8</u>
1 gallon =		<u>61 440</u>	<u>1 024</u>	<u>128</u>	<u>32</u>
1 cubic inch =		265.974 0	4.432 900	0.554 112 6	0.138 528 1
1 cubic foot =		459 603.1	7660.052	957.506 5	239.376 6
1 milliliter =		16.230 73	0.270 512 2	0.033 814 02	0.008 453 506
1 liter =		16 230.73	270.512 2	33.814 02	8.453 506

Starting Unit ↓	Multiply by the Conversion Factor Below the Ending Unit:				
	Ending Unit →	Liquid Pints	Liquid Quarts	Gallons	Cubic Inches
1 minim =		0.000 130 208 3	0.000 065 104 17	0.000 016 276 04	0.003 759 766
1 fluid dram =		<u>0.007 812 5</u>	<u>0.003 906 25</u>	<u>0.000 976 562 5</u>	0.225 585 94
1 fluid ounce =		<u>0.062 5</u>	<u>0.031 25</u>	<u>0.007 812 5</u>	<u>1.804 687 5</u>
1 gill =		<u>0.25</u>	<u>0.125</u>	<u>0.031 25</u>	<u>7.218 75</u>
1 liquid pint =		<u>1</u>	<u>0.5</u>	<u>0.125</u>	<u>28.875</u>
1 liquid quart =		<u>2</u>	<u>1</u>	<u>0.25</u>	<u>57.75</u>
1 gallon =		<u>8</u>	<u>4</u>	<u>1</u>	<u>231</u>
1 cubic inch =		0.034 632 03	0.017 316 02	0.004 329 004	<u>1</u>
1 cubic foot =		59.844 16	29.922 08	7.480 519	<u>1 728</u>
1 milliliter =		0.002 113 376	0.001 056 688	0.000 264 172 1	0.061 023 74
1 liter =		2.113 376	1.056 688	0.264 172 1	61.023 74

Starting Unit ↓	Multiply by the Conversion Factor Below the Ending Unit:			
	Ending Unit →	Cubic Feet	Milliliters	Liters
1 minim =		0.000 002 175 790	0.061 611 52	0.000 061 611 52
1 fluid dram =		0.000 130 547 4	3.696 691	0.003 696 691
1 fluid ounce =		0.001 044 379	29.573 53	0.029 573 53
1 gill =		0.004 177 517	118.294 1	0.118 294 1
1 liquid pint =		0.016 710 07	473.176 5	0.473 176 5
1 liquid quart =		0.033 420 14	946.352 9	0.946 352 9
1 gallon =		0.133 680 6	<u>3785.411 784</u>	<u>3.785 411 784</u>
1 cubic inch =		0.000 578 703 7	16.387 06	0.016 387 06
1 cubic foot =		<u>1</u>	28 316.85	28.316 85
1 milliliter =		0.000 035 314 67	<u>1</u>	<u>0.001</u>
1 liter =		0.035 314 67	<u>1 000</u>	<u>1</u>

Units of Mass Not Less Than Avoirdupois Ounces

(All underlined figures are exact.)

Starting Unit ↓	Multiply by the Conversion Factor Below the Ending Unit:				
	Ending Unit →	Avoirdupois Ounces	Avoirdupois Pounds	Short Hundred-weights	Short Tons
1 avoirdupois ounce =		<u>1</u>	<u>0.0625</u>	<u>0.000 625</u>	<u>0.000 031 25</u>
1 avoirdupois pound =		<u>16</u>	<u>1</u>	<u>0.01</u>	<u>0.000 5</u>
1 short hundredweight =		<u>1 600</u>	<u>100</u>	<u>1</u>	<u>0.05</u>
1 short ton =		<u>32 000</u>	<u>2 000</u>	<u>20</u>	<u>1</u>
1 long ton =		<u>35 840</u>	<u>2 240</u>	<u>22.4</u>	<u>1.12</u>
1 kilogram =		35.273 96	2.204 623	0.022 046 23	0.001 102 311
1 metric ton =		35 273.96	2204.623	22.046 23	1.102 311

Units of Capacity or Volume	
1 tablespoon, measuring	3 teaspoons (exactly) 15 milliliters 4 fluid drams ½ fluid ounce (exactly)
1 teaspoon, measuring	⅓ tablespoon (exactly) 5 milliliters 1⅓ fluid drams ¹⁸
1 water ton (English)	270.91 U.S. gallons 224 British Imperial gallons (exactly)

Units of Mass	
1 assay ton ¹⁹ (AT)	29.167 grams
1 carat (c)	200 milligrams (exactly) 3.086 grains
1 dram apothecaries (dr ap or ʒ)	60 grains (exactly) 3.888 grams
1 dram avoirdupois (dr avdp)	27 ¹¹ / ₃₂ (= 27.344) grains 1.772 grams
1 gamma (γ)	1 microgram (exactly)
1 grain	64.798 91 milligrams (exactly)
1 gram (g)	15.432 grains 0.035 ounce, avoirdupois
1 hundredweight, gross or long ²⁰ (gross cwt)	112 pounds (exactly) 50.802 kilograms
1 hundredweight, gross or short (cwt or net cwt)	100 pounds (exactly) 45.359 kilograms
1 kilogram (kg)	2.205 pounds
1 microgram (μg) [the Greek letter mu in combination with the letter g]	0.000 001 gram (exactly)
1 milligram (mg)	0.015 grain
1 ounce, avoirdupois (oz avdp)	437.5 grains (exactly) 0.911 troy or apothecaries ounce 28.350 grams

¹⁸ The equivalent “1 teaspoon = 1⅓ fluid drams” has been found by the Bureau to correspond more closely with the actual capacities of “measuring” and silver teaspoons than the equivalent “1 teaspoon = 1 fluid dram,” which is given by a number of dictionaries.

¹⁹ Used in assaying. The assay ton bears the same relation to the milligram that a ton of 2000 pounds avoirdupois bears to the ounce troy; hence the mass in milligrams of precious metal obtained from one assay ton of ore gives directly the number of troy ounces to the net ton.

²⁰ The gross or long ton and hundredweight are used commercially in the United States to only a very limited extent, usually in restricted industrial fields. The units are the same as the British “ton” and “hundredweight.”

Units of Mass	
1 ounce, troy or apothecaries (oz t or oz ap or $\frac{\text{z}}{\text{s}}$)	480 grains (exactly) 1.097 avoirdupois ounces 31.103 grams
1 pennyweight (dwt)	1.555 grams
1 point	0.01 carat 2 milligrams
1 pound, avoirdupois (lb avdp)	7000 grains (exactly) 1.215 troy or apothecaries pounds 453.592 37 grams (exactly)
1 pound, troy or apothecaries (lb t or lb ap)	5760 grains (exactly) 0.823 avoirdupois pound 373.242 grams
1 scruple (s ap or $\text{\textcircled{S}}$)	20 grains (exactly) 1.296 grams
1 ton, gross or long ²¹	2240 pounds (exactly) 1.12 net tons (exactly) 1.016 metric tons
1 ton, metric (t)	2204.623 pounds 0.984 gross ton 1.102 net tons
1 ton, net or short (tn) ²²	2000 pounds (exactly) 0.893 gross ton 0.907 metric ton

²¹ The gross or long ton and hundredweight are used commercially in the United States to a limited extent only, usually in restricted industrial fields. These units are the same as the British “ton” and “hundredweight.”

²² As of January 1, 2014, “tn” is the required abbreviation for a short ton. Devices manufactured between January 1, 2008, and December 31, 2013, may use an abbreviation other than “tn” to specify short ton. This provision is a NIST Handbook 44, “Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices” in Appendix C. General Table of Units of Measurement.