

(March 25, 1942)

GENERAL TABLES OF WEIGHTS AND MEASURES

This Letter Circular has been prepared to meet requests from the general public for information on the systems of weights and measures in use in the United States. It is divided into four parts, as follows:

- I.--Tables of United States Customary Weights and Measures pages 2-4
- II.--Tables of Metric Weights and Measures pages 5-6
- III.--Tables of Interrelation of Units of Measurement pages 7-8
- IV.--Tables of Equivalents pages 9-15

Other and more detailed information on standards and units of weights and measures will be found in the following publications of the National Bureau of Standards:

Miscellaneous Publication M 64, "History of the Standard Weights and Measures of the United States." (15 cents per copy.)*

Miscellaneous Publication M 121, "Units of Weight and Measure--Definitions and Tables of Equivalents." (15 cents per copy.)*

Miscellaneous Publication M 122, "Weights and Measures in Congress." (5 cents per copy.)*

Letter Circular LC 449, "Standards of Length, Mass, and Time."**

Letter Circular LC 517, "Motorists' Manual of Weights and Measures."**

Letter Circular LC 681, "Units and Systems of Weights and Measures."**

*Sold by the Superintendent of Documents, Government Printing Office, Washington, D. C., at the price shown.

**Available from the National Bureau of Standards, Washington, D. C., upon request.

I.--TABLES OF UNITED STATES CUSTOMARY WEIGHTS AND MEASURES

LINEAR MEASURE

12 inches (in.)	= 1 foot (ft)
3 feet	= 1 yard (yd)
5 1/2 yards	= 1 rod (rd), pole, or perch = 16 1/2 feet
40 rods	= 1 furlong (fur.) = 220 yards = 660 feet
8 furlongs	= 1 statute mile (mi) = 1 760 yards = 5 280 feet
3 miles	= 1 league = 5 280 yards = 15 840 feet
* * * * *	
6 080.20 feet	= 1 nautical, geographical, or sea mile

AREA MEASURE*

144 square inches (sq in.)	= 1 square foot (sq ft)
9 square feet	= 1 square yard (sq yd) = 1 296 square inches
30 1/4 square yards	= 1 square rod (sq rd) = 272 1/4 square feet
160 square rods	= 1 acre = 4 840 square yards = 43 560 square feet
640 acres	= 1 square mile (sq mi)
1 mile square	= 1 section [of land]
36 miles square	= 1 township = 36 sections = 36 square miles

CUBIC MEASURE*

1 728 cubic inches (cu in.)	= 1 cubic foot (cu ft)
27 cubic feet	= 1 cubic yard (cu yd)

GUNTER'S OR SURVEYORS' CHAIN MEASURE

7.92 inches (in.)	= 1 link (li)
100 links	= 1 chain (ch) = 4 rods = 66 feet
80 chains	= 1 statute mile (mi) = 320 rods = 5 280 feet

LIQUID MEASURE**

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

*Squares and cubes of units are sometimes abbreviated by using "superior" figures. For example, ft² means square foot, and ft³ means cubic foot.

**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' FLUID MEASURE

60 minims (min) = 1 fluid dram (fl dr) [= 0.225 6 cubic inch]
8 fluid drams = 1 fluid ounce (fl oz) [= 1.804 7 cubic inches]
16 fluid ounces = 1 pint (pt) [= 28.875 cubic inches] = 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 = 1 024 fluid drams

DRY MEASURE*

2 pints (pt) = 1 quart (qt) [= 67.200 6 cubic inches]
8 quarts = 1 peck (pk) [= 537.605 cubic inches] = 16 pints
4 pecks = 1 bushel (bu) [= 2 150.42 cubic inches] = 32 quarts

AVOIRDUPOIS WEIGHT**

[The "grain" is the same in avoirdupois, troy, and apothecaries' weight.]

27 11/32 grains	= 1 dram (dr)
16 drams	= 1 ounce (oz) = 437 1/2 grains
16 ounces	= 1 pound (lb) = 256 drams = 7 000 grains
100 pounds	= 1 hundredweight (cwt)***
20 hundredweights	= 1 ton (tn) = 2 000 pounds***

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

112 pounds = 1 gross or long hundredweight***
 20 gross or long
 hundredweights = 1 gross or long ton = 2 240 pounds***

*When necessary to distinguish the 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.

**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.

***When the terms "hundredweight" and "ton" are used unmodified, they are commonly understood to mean the 100-pound hundredweight and the 2 000-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.

TROY WEIGHT

[The "grain" is the same in avoirdupois, troy, and apothecaries' weight.]

24 grains = 1 pennyweight (dwt)
20 pennyweights = 1 ounce troy (oz t) = 480 grains
12 ounces troy = 1 pound troy (lb t) = 240 pennyweights = 5 760 grains

APOTHECARIES' WEIGHT

[The "grain" is the same in avoirdupois, troy, and apothecaries' weight.]

20 grains = 1 scruple (s ap)
3 scruples = 1 dram apothecaries' (dr ap) = 60 grains
8 drams apothecaries' = 1 ounce apothecaries' (oz ap) = 24 scruples = 480 grains
12 ounces apothecaries' = 1 pound apothecaries' (lb ap) = 96 drams apothecaries' = 288 scruples = 5 760 grains

II.--TABLES OF METRIC WEIGHTS AND MEASURES

LINEAR MEASURE

10 millimeters (mm)	= 1 centimeter (cm)
10 centimeters	= 1 decimeter (dm) = 100 millimeters
10 decimeters	= 1 meter (m) = 1 000 millimeters
10 meters	= 1 dekameter (dkm)
10 dekameters	= 1 hectometer (hm) = 100 meters
10 hectometers	= 1 kilometer (km) = 1 000 meters

AREA MEASURE

100 square millimeters (mm ²)	= 1 square centimeter (cm ²)
10 000 square centimeters	= 1 square meter (m ²) = 1 000 000 square millimeters
100 square meters	= 1 are (a)
100 ares	= 1 hectare (ha) = 10 000 square meters
100 hectares	= 1 square kilometer (km ²) = 1 000 000 square meters

VOLUME MEASURE

10 milliliters (ml)	= 1 centiliter (cl)
10 centiliters	= 1 deciliter (dl) = 100 milliliters
10 deciliters	= 1 liter* (l) = 1 000 milliliters
10 liters	= 1 dekaliter (dkl)
10 dekaliters	= 1 hectoliter (hl) = 100 liters
10 hectoliters	= 1 kiloliter (kl) = 1 000 liters

CUBIC MEASURE

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

*The liter is defined as the volume occupied, under standard conditions, by a quantity of pure water having a mass of 1 kilogram. This volume is very nearly equal to 1 000 cubic centimeters or 1 cubic decimeter; the actual metric equivalent is, 1 liter = 1 000.028 cubic centimeters. (The change in this equivalent from the previously published value of 1 000.027 is based on a recomputation of earlier data, carried out at the International Bureau of Weights and Measures.) Thus the milliliter and the liter are larger than the cubic centimeter and the cubic decimeter, respectively, by 28 parts in 1 000 000; except for determinations of high precision, this difference is so small as to be of no consequence.

WEIGHT

10 milligrams (mg)	= 1 centigram (cg)
10 centigrams	= 1 decigram (dg) = 100 milligrams
10 decigrams	= 1 gram (g) = 1 000 milligrams
10 grams	= 1 dekagram (dkg)
10 dekagrams	= 1 hectogram (hg) = 100 grams
10 hetograms	= 1 kilogram (kg) = 1 000 grams
1 000 kilograms	= 1 metric ton (t)

NOTE.--In the metric system of weights and measures, 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 1 000, and deci, centi, and milli, meaning, respectively, one-tenth, one-hundredth, and one-thousandth. In some of the foregoing 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 1 000 and for subdivisions smaller than one-thousandth. Accordingly, the following prefixes have been introduced and these are now generally recognized.

myria, meaning 10 000
mega, meaning 1 000 000
micro, meaning one-millionth

A special case is found in the term "micron" (abbreviated as μ [the Greek letter mu]), a coined word meaning one-millionth of a meter (equivalent to one-thousandth of a millimeter); a milli-micron (abbreviated as $m\mu$) is one-thousandth of a micron (equivalent to one-millionth of a millimeter), and a micromicron (abbreviated as $\mu\mu$) is one-millionth of a micron (equivalent to one-thousandth of a millimicron or to 0.000 000 001 millimeter.)

III.—TABLES OF INTERRELATION OF UNITS OF MEASUREMENT

1. UNITS OF LENGTH

Units	Inches	Links	Feet	Yards	Rods	Chains	Miles	Centimeters	Meters	Units
1 inch	1	0.126 263	0.083 333 3	0.027 777 8	0.005 050 51	0.001 262 63	0.000 015 762 8	2.540 005	0.025 400 05	= 1 inch
1 link	7.92	1	0.06	0.023	0.04	0.01	0.000 125	20.116 84	0.201 168 4	= 1 link
1 foot	12	1.515 152	1	0.333 333	0.060 606 1	0.000 189 393 9	0.000 189 393 9	30.480 06	0.304 800 6	= 1 foot
1 yard	36	4.545 45	3	1	0.181 818	0.045 454 5	0.000 568 182	91.440 18	0.914 401 8	= 1 yard
1 rod	198	25	16.5	5.5	1	0.25	0.003 125	502.9210	5.029 210	= 1 rod
1 chain	792	100	66	22	4	1	0.0125	20.116 84	20.116 84	= 1 chain
1 mile	63 360	8000	5280	1760	320	80	1	160 934.72	1609.3472	= 1 mile
1 centimeter	0.3937	0.049 709 60	0.032 808 33	0.010 936 111	0.001 988 384	0.000 497 096 0	0.000 006 213 699	1	0.01	= 1 centimeter
1 meter	39.37	4.970 960	3.280 833	1.093 611 1	0.198 838 4	0.049 709 60	0.000 621 369 9	100	1	= 1 meter

2. UNITS OF AREA

Units	Square inches	Square links	Square feet	Square yards	Square rods	Square chains	Acres	Square miles	Square centimeters	Square meters	Hectares	Units
1 square inch	1	0.015 942 3	0.006 944 44	0.000 771 605	0.000 025 507 6	0.000 001 594 23	0.000 000 159 423	0.000 000 000 249 1	6.451 626	0.000 645 162 6	0.000 003 064 516	= 1 square inch
1 square link	62.7264	1	0.4356	0.0484	0.0016	0.000 1	0.000 01	0.000 000 015 625	404.6873	0.040 468 73	0.000 004 046 87	= 1 square link
1 square foot	144	2.295 684	1	0.111 111 1	0.003 673 09	0.000 229 568	0.000 022 956 8	0.000 000 035 870 1	929.0341	0.092 903 41	0.000 009 290 34	= 1 square foot
1 square yard	1296	20.6612	9	1	0.033 057 85	0.002 066 12	0.000 206 612	0.000 000 322 831	8361.307	0.836 130 7	0.000 083 613 1	= 1 square yard
1 square rod	39 204	625	272.25	30.25	1	0.0625	0.006 25	0.000 009 705 625	252.929.5	25.292 95	0.002 529 295	= 1 square rod
1 square chain	627 264	10 000	4356	484	16	1	0.1	0.000 156 25	4 046.873	404.6873	0.040 468 7	= 1 square chain
1 acre	6 272 640	100 000	43 560	4840	160	10	640	0.001 562 5	40 468 726	4046.873	0.404 687	= 1 acre
1 square mile	4 014 489 600	64 000 000	27 878 400	3 097 600	102 400	6400	0.000 000 024 710 4	0.000 000 000 038 610 06	25 899 984 703	2 589 998	258.9998	= 1 square mile
1 square centimeter	0.154 999 7	0.002 471 04	0.001 076 387	0.000 119 598 5	0.000 003 953 67	0.000 000 247 104	0.000 000 247 104	0.000 000 386 100 6	1	0.0001	0.000 000 01	= 1 square centimeter
1 square meter	1549.9969	24.7104	10.763 87	1.195 985	0.039 536 7	0.002 471 04	0.000 247 104	0.000 000 861 006	10 000	1	0.0001	= 1 square meter
1 hectare	15 499 969	247 104	107 638.7	11 959.85	395.367	24.7104	2.471 04		100 000 000	10 000	1	= 1 hectare

3. UNITS OF VOLUME

Units	Cubic inches	Cubic feet	Cubic yards	Cubic centimeters	Cubic decimeters	Cubic meters	Units
1 cubic inch	1	0.000 578 704	0.000 021 433 47	16.387 162	0.016 387 16	0.000 016 387 16	= 1 cubic inch
1 cubic foot	1728	1	0.037 037 0	28 317. 016	0.028 317 016	0.028 317 016	= 1 cubic foot
1 cubic yard	46 656	27	1	764.559.4	0.764 559 4	0.764 559 4	= 1 cubic yard
1 cubic centimeter	0.061 023 38	0.000 035 314 45	0.000 001 307 94	1	0.001	0.000 001	= 1 cubic centimeter
1 cubic decimeter	61.023-38	0.035 314 45	0.001 307 943	1 000	1	0.001	= 1 cubic decimeter
1 cubic meter	61 023.38	35.314 45	1.307 942 8	1 000 000	1000	1	= 1 cubic meter

4. UNITS OF CAPACITY LIQUID MEASURE

Units	Minims	Fluid drams	Fluid ounces	Gills	Liquid pints	Liquid quarts	Gallons	Milliliters	Liters	Cubic inches	Units
1 minim	1	0.016 666 7	0.002 083 33	0.000 520 833	0.000 130 208	0.000 065 104	0.000 016 276	0.061 610 2	0.000 061 610 2	0.003 759 77	= 1 minim
1 fluid dram	60	1	0.125	0.031 25	0.007 812 5	0.003 906 25	0.000 976 562	3.996 61	0.003 696 61	0.225 586	= 1 fluid dram
1 fluid ounce	480	8	1	0.25	0.0625	0.031 25	0.007 812 5	29.5729	0.029 572 9	1.804 69	= 1 fluid ounce
1 gill	1920	32	16	1	0.25	0.125	0.031 25	118.292	0.118 292	7.218 75	= 1 gill
1 liquid pint	7680	128	64	4	1	0.5	0.125	473.167	0.473 167	28.875	= 1 liquid pint
1 liquid quart	15 360	256	128	8	2	1	0.25	946.333	0.946 333	57.75	= 1 liquid quart
1 gallon	61 440	1024	128	32	8	4	1	3785.332	3.785 332	231	= 1 gallon
1 milliliter	16.2311	0.270 518	0.033 814 7	0.008 453 68	0.002 113 42	0.001 056 71	0.000 264 178	1	0.001	0.061 025 0	= 1 milliliter
1 liter	16 231.1	270.518	33.8147	8.453 68	2.113 42	1.056 71	0.264 178	1000	1	61.0250	= 1 liter
1 cubic inch	265.974	4.432 90	0.554 113	0.138 528	0.034 632 0	0.017 316 0	0.004 329 00	16.3867	0.016 386 7	1	= 1 cubic inch

5. UNITS OF CAPACITY DRY MEASURE

Units	Dry pints	Dry quarts	Pecks	Bushels	Liters	Dekalliters	Cubic inches	Units
1 dry pint =	1	0.5	0.0625	0.015 625	0.550 599	0.055 060	33.600 312 5	= 1 dry pint
1 dry quart =	2	1	0.125	0.031 25	1.101 196	0.110 120	67.200 625	= 1 dry quart
1 peck =	16	8	0.25	0.25	8.809 58	0.880 958	537.605	= 1 peck
1 bushel =	64	32	1	1	35.2383	3.523 83	2150.42	= 1 bushel
1 liter =	1.816 20	0.908 102	0.113 513	0.028 378	1	0.1	61.0250	= 1 liter
1 dekaliter =	18.1620	9.081 02	1.135 13	0.283 78	10	1	610.250	= 1 dekaliter
1 cubic inch =	0.029 761 6	0.014 880 8	0.001 860 10	0.000 465 025	0.016 386 7	0.001 638 67	1	= 1 cubic inch

6. UNITS OF MASS LESS THAN POUNDS AND KILOGRAMS

Units	Grains	Apothecaries' scruples	Pennyweights	Avoldupois drams	Apothecaries' drams	Avoldupois ounces	Apothecaries' or troy ounces	Apothecaries' or troy pounds	Avoldupois pounds	Milligrams	Grams	Kilograms	Units
1 grain =	1	0.05	0.041 666 67	0.036 571 43	0.016 666 7	0.002 285 71	0.002 083 33	0.000 173 611 1	0.000 142 857 1	64.798 918	0.064 798 918	0.000 064 798 9	= 1 grain
1 apoth. scruple =	20	1	0.833 333 3	0.731 428 6	0.333 333	0.045 714 3	0.041 666 7	0.003 472 222	0.002 857 143	1295.9784	1.295 978 4	0.001 295 978	= 1 apoth. scruple
1 pennyweight =	24	1.3	1	0.877 714 3	0.4	0.054 857 1	0.05	0.004 166 667	0.003 428 571	1555.1740	1.555 174 0	0.001 555 174	= 1 pennyweight
1 avoird. dram =	27.343 75	1.867 187 5	1.139 323	1	0.455 729 2	0.0625	0.056 966 146	0.004 747 178 8	0.003 906 625	1771.8454	1.771 845 4	0.001 771 845	= 1 avoird. dram
1 apoth. dram =	60	3	2.5	2.194 286	1	0.137 142 9	0.125	0.010 416 667	0.008 571 429	3887.9351	3.887 935 1	0.003 887 935	= 1 apoth. dram
1 avoird. ounce =	437.5	21.875	18.229 17	16	7.291 66	1	0.911 458 3	0.075 954 861	0.0625	28.349 527	28.349 527	0.028 349 53	= 1 avoird. ounce
1 apoth. or troy ounce =	480	24	20	17.554 28	8	1.097 142 9	1	0.075 954 861	0.0625	31.103 481	31.103 481	0.031 103 48	= 1 apoth. or troy ounce
1 apoth. or troy pound =	5760	288	240	210.6514	96	13.165 714	12	0.083 333 33	0.068 571 43	373.241 77	373.241 77	0.373 241 77	= 1 apoth. or troy pound
1 avoird. pound =	7000	350	291.6667	256	116.6667	16	14.583 333	1.215 277 8	0.822 857 1	453.592 427 7	453.592 427 7	0.453 592 427 7	= 1 avoird. pound
1 milligram =	0.015 432 356	0.000 771 618	0.000 643 014 8	0.000 564 383 3	0.000 257 205 9	0.000 035 273 96	0.000 032 150 74	0.000 002 679 23	0.000 002 204 62	1	0.001	0.000 001	= 1 milligram
1 gram =	15.432 356	0.771 618	0.643 014 85	0.564 383 3	0.257 205 9	0.035 273 96	0.032 150 74	0.002 679 23	0.002 204 62	1000	1	0.001	= 1 gram
1 kilogram =	15 432.356	771.6178	643.014 85	564.383 32	257.205 94	35.273 96	32.150 742	2.679 228 5	2.204 622 341	1 000 000	1000	1	= 1 kilogram

7. UNITS OF MASS GREATER THAN AVOIRDUPOIS OUNCES

Units	Avoldupois ounces	Avoldupois pounds	Short hundred-weights	Short tons	Long tons	Kilograms	Metric tons	Units
1 avoldupois ounce =	1	0.0625	0.000 625	0.000 031 25	0.000 027 901 79	0.028 349 53	0.000 028 349 53	= 1 avoldupois ounce
1 avoldupois pound =	16	1	0.01	0.0005	0.000 446 428 6	0.453 592 427 7	0.000 453 592 43	= 1 avoldupois pound
1 short hundredweight =	1600	100	1	0.05	0.041 642 86	45.359 243	0.045 359 243	= 1 short hundredweight
1 short ton =	32 000	2000	20	1	0.892 857 1	907.184 86	0.907 184 86	= 1 short ton
1 long ton =	35 840	2240	22.4	1.12	1	1016.047 04	1.016 047 04	= 1 long ton
1 kilogram =	35.273 957	2.204 622 34	0.022 046 223	0.001 102 311 2	0.000 984 206 4	1	0.001	= 1 kilogram
1 metric ton =	35 273.957	2204.622 34	22.046 223	1.102 311 2	0.984 206 40	1000	1	= 1 metric ton

* "Avoird." is now abbreviated "avdp".

IV.--TABLES OF EQUIVALENTS

NOTES.--When the name of a unit is enclosed in brackets (thus, [1 hand]-----), this indicates (1) that the unit is not in general current use in the United States, or (2) that the unit is believed to be based on "custom and usage" rather than on formal authoritative definition.

Equivalents involving decimals are, in most instances, rounded off to the third decimal place except where they are exact, in which cases these exact equivalents are so designated.

LENGTHS

1 Angstrom (A) -----	(0.1 millimicron (exactly)) (0.000 1 micron (exactly)) (0.000 000 1 millimeter (exactly)) (0.000 000 004 inch
1 cable's length -----	(120 fathoms (720 feet (219.456 meters
1 centimeter (cm) -----	0.393 7 inch (exactly)
1 chain (ch) (Gunter's or surveyors') --	(66 feet (20.117 meters
[1 chain (engineers')] -----	(100 feet (30.480 meters
1 decimeter (dm) -----	3.937 inches (exactly)
1 dekameter (dkm) -----	32.808 feet
1 fathom -----	(6 feet (1.829 meters
1 foot (ft) -----	0.305 meter
1 furlong (fur.) -----	(10 chains (surveyors')) (660 feet (220 yards (1/8 statute mile (201.168 meters
[1 hand] -----	4 inches

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1 inch (in.) -----	2.540 centimeters
1 kilometer (km) -----	0.621 mile
1 league (land)-----	(3 statute miles 4.828 kilometers)
1 link (li) (Gunter's or surveyors') --	(7.92 inches (exactly) 0.201 meter
[1 link (li) (engineers')] -----	(1 foot 0.305 meter
1 meter (m) -----	(39.37 inches (exactly) 1.094 yards
1 micron (μ [the Greek letter mu]) ---	(0.001 millimeter (exactly) 0.000 039 37 inch (exactly)
1 mil -----	(0.001 inch (exactly) 0.025 4 millimeter
1 mile (mi) (statute or land) -----	(5 280 feet 1.609 kilometers
1 mile (mi) (nautical, geographical, or sea, U. S.) -----	(1.152 statute miles 6 080.20 feet 1.853 kilometers
[1 mile (mi) (nautical, inter- national)] -----	(1.852 kilometers (exactly) 1.151 statute miles 0.999 U. S. nautical miles
1 millimeter (mm) -----	0.039 37 inch (exactly)
1 millimicron ($m\mu$ [the English letter m in combination with the Greek letter mu]) -----	(0.001 micron (exactly) 0.000 000 039 37 inch (exactly)
1 point (typography) -----	(0.013 837 inch (exactly) 0.351 millimeter
1 rod (rd), pole, or perch -----	(16 1/2 feet 5 1/2 yards 5.029 meters
1 yard (yd) -----	0.914 meter

AREAS OR SURFACES

1 acre -----	(43 560 square feet 4 840 square yards 0.405 hectare
1 are (a) -----	(119.596 square yards 0.025 acre
1 hectare (ha) -----	2.471 acres
[1 square (building)] -----	100 square feet
1 square centimeter (cm ²) -----	0.155 square inch
1 square decimeter (dm ²) -----	15.500 square inches
1 square foot (sq ft) -----	929.034 square centimeters
1 square inch (sq in.) -----	6.452 square centimeters
1 square kilometer (km ²) -----	(247.104 acres 0.386 square mile
1 square meter (m ²) -----	(1.196 square yards 10.764 square feet
1 square mile (sq mi) -----	259.000 hectares
1 square millimeter (mm ²) -----	0.002 square inch
1 square rod (sq rd), sq pole, or sq perch -----	25.293 square meters
1 square yard (sq yd) -----	0.836 square meter

CAPACITIES OR VOLUMES

1 barrel (bbl), liquid -----	31 to 42 gallons*
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*There are a variety of "barrels", established by law or usage. For example, Federal taxes on fermented liquors are based on a barrel of 31 gallons; many State laws fix the "barrel for liquids" as 31 1/2 gallons; one State fixes a 36-gallon barrel for cistern measurement; Federal law recognizes a 40-gallon barrel for "proof spirits"; by custom, 42 gallons comprise a barrel of crude oil or petroleum products for statistical purposes, and this equivalent is recognized "for liquids" by four States.

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1 barrel (bbl), standard, for fruits, vegetables, and other dry commodities except cranberries -----	(7 056 cubic inches (105 dry quarts (3.281 bushels, struck (measure
1 barrel (bbl), standard, cranberry -----	(5 826 cubic inches (86 45/64 dry quarts (2.709 bushels, struck (measure
1 bushel (bu) (U. S.) (struck measure) -----	(2 150.42 cubic inches (exactly) (35.238 liters
[1 bushel, heaped (U. S.)] -----	(2 747.715 cubic inches (1.278 bushels, struck (measure*
[1 bushel (bu) (British Imperial) (struck measure)] -----	(1.032 U. S. bushels, (struck measure (2 219.360 cubic inches
1 cord (cd) (firewood) -----	128 cubic feet
1 cubic centimeter (cm ³) -----	0.061 cubic inch
1 cubic decimeter (dm ³) -----	61.023 cubic inches
1 cubic foot (cu ft) -----	(7.481 gallons (28.317 cubic decimeters
1 cubic inch (cu in.) -----	(0.554 fluid ounce (4.433 fluid drams (16.387 cubic centimeters
1 cubic meter (m ³) -----	1.308 cubic yards
1 cubic yard (cu yd) -----	0.765 cubic meter
1 cup, measuring -----	(8 fluid ounces (1/2 liquid pint
1 dram, fluid (or liquid) (fl dr) (U. S.) -----	(1/8 fluid ounce (0.226 cubic inch (3.697 milliliters
[1 dram, fluid (fl dr) (British)] -----	(0.961 U. S. fluid dram (0.217 cubic inch (3.552 milliliters

*Frequently recognized as 1 1/4 bushels, struck measure.

1 dekaliter (dkl) -----	(2.642 gallons 1.135 pecks
1 gallon (gal) (U. S.) -----	(231 cubic inches 3.785 liters 0.833 British gallon 128 U.S. fluid ounces
[1 gallon (gal) (British Imperial)] -	(277.42 cubic inches 1.201 U. S. gallons 4.546 liters 160 British fluid ounces
1 gill (gi) -----	(7.219 cubic inches 4 fluid ounces 0.118 liter
1 hectoliter (hl) -----	(26.418 gallons 2.838 bushels
1 liter -----	(1.057 liquid quarts 0.908 dry quart 61.025 cubic inches
1 milliliter (ml) -----	(0.271 fluid dram 16.231 minims 0.061 cubic inch
1 ounce, fluid (or liquid). (fl oz) (U. S.) -----	(1.805 cubic inches 29.573 milliliters 1.041 British fluid ounces
[1 ounce, fluid (fl oz) (British)] --	(0.961 U. S. fluid ounce 1.734 cubic inches 28.412 milliliters
1 peck (pk) -----	8.810 liters
1 pint (pt), dry -----	(33.600 cubic inches 0.551 liter
1 pint (pt), liquid -----	(28.875 cubic inches (exactly) 0.473 liter
1 quart (qt), dry (U. S.) -----	(67.201 cubic inches 1.101 liters 0.969 British quart
1 quart (qt), liquid (U. S.) -----	(57.75 cubic inches (exactly) 0.946 liter 0.833 British quart

	(69.354 cubic inches
[1 quart (qt) (British)] -----	(1.032 U. S. dry quarts
	(1.201 U. S. liquid quarts

	(3 teaspoons*
1 tablespoon -----	(4 fluid drams
	(1/2 fluid ounce
	(1/3 tablespoon*
1 teaspoon -----	(1 1/3 fluid drams*

WEIGHTS OR MASSES

1 assay ton** (AT) -----	29.167 grams
1 carat (c) -----	(200 milligrams
	(3.086 grains
1 dram, apothecaries' (dr ap) -----	(60 grains
	(3.888 grams
1 dram, avoirdupois (dr avdp) -----	(27 11/32 (=27.344) grains
	(1.772 grams

gamma, see microgram

1 grain -----	64.799 milligrams
1 gram (g) -----	(15.432 grains
	(0.035 ounce, avoirdupois
1 hundredweight, gross or long***	(112 pounds
(gross cwt) -----	(50.802 kilograms
1 hundredweight, net or short	(100 pounds
(cwt or net cwt) -----	(45.359 kilograms
1 kilogram (kg) -----	2.205 pounds

*The equivalent "1 teaspoon = 1 1/3 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.

**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 weight in milligrams of precious metal obtained from one assay ton of ore gives directly the number of troy ounces to the net ton.

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

1 microgram (γ [the Greek letter gamma]) -----	0. 000 001 gram (exactly)
1 milligram (mg) -----	0.015 grain
	(437.5 grains (exactly))
1 ounce, avoirdupois (oz avdp) -----	(0.911 troy or apothecaries' ounce)
	(28.350 grams)
1 ounce, troy or apothecaries' (oz t or oz ap) -----	(480 grains)
	(1.097 avoirdupois ounces)
	(31.103 grams)
1 pennyweight (dwt) -----	1.555 grams
	(7 000 grains)
1 pound, avoirdupois (lb avdp) -----	(1.215 troy or apothecaries' pounds)
	(453.592 grams)
1 pound, troy or apothecaries' (lb t or lb ap) -----	(5 760 grains)
	(0.823 avoirdupois pound)
	(373.242 grams)
1 scruple (s ap) -----	(20 grains)
	(1.296 grams)
	(2 240 pounds)
1 ton, gross or long* (gross tn) -----	(1.12 net tons (exactly))
	(1.016 metric tons)
	(2 204.622 pounds)
1 ton, metric (t) -----	(0.984 gross ton)
	(1.102 net tons)
	(2 000 pounds)
1 ton, net or short (tn or net tn) --	(0.893 gross ton)
	(0.907 metric ton)

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