

Conversion of units

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Conversion of units is the conversion between different units of measurement for the same quantity, typically through multiplicative **conversion factors**.

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Techniques

Process

The process of conversion depends on the specific situation and the intended purpose. This may be governed by regulation, contract, technical specifications or other published standards. Engineering judgment may include such factors as:

- The precision and accuracy of measurement and the associated uncertainty of measurement.
- The statistical confidence interval or tolerance interval of the initial measurement.
- The number of significant figures of the measurement.
- The intended use of the measurement including the engineering tolerances.
- Historical definitions of the units and their derivatives used in old measurements; e.g., international foot vs. US survey foot.

Some conversions from one system of units to another need to be exact, without increasing or decreasing the precision of the first measurement. This is sometimes called *soft conversion*. It does not involve changing the physical configuration of the item being measured.

By contrast, a *hard conversion* or an *adaptive conversion* may not be exactly equivalent. It changes the measurement to convenient and workable numbers and units in the new system. It sometimes involves a slightly different configuration, or size substitution, of the item. Nominal values are sometimes allowed and used.

Multiplication factors

Conversion between units in the metric system can be discerned by their prefixes (for example, 1 kilogram = 1000 grams, 1 milligram = 0.001 grams) and are thus not listed in this article. Exceptions are made if the unit is commonly known by another name (for example, 1 micron = 10^{-6} metre).

Table ordering

Within each table, the units are listed alphabetically, and the SI units (base or derived) are highlighted.

Tables of conversion factors

This article gives lists of conversion factors for each of a number of physical quantities, which are listed in the index. For each physical quantity, a number of different units (some only of historical interest) are shown and expressed in terms of the corresponding SI unit.

Legend

Symbol	Definition
≡	exactly equal
≈	approximately equal to
<i><u>digits</u></i>	indicates that <i>digits</i> repeat infinitely (e.g. 8.294 <u>369</u> corresponds to 8.294 369 369 369 369 ...)
(H)	of chiefly historical interest

Length

Length

Name of unit	Symbol	Definition	Relation to SI units
ångström	Å	$\equiv 1 \times 10^{-10} \text{ m}$	$\equiv 0.1 \text{ nm}$
astronomical unit	AU	$\equiv 149\,597\,870\,700 \text{ m} \approx$ Distance from Earth to Sun	$\equiv 149\,597\,870\,700 \text{ m}^{[1]}$
barleycorn (H)		$= \frac{1}{3} \text{ in}$ (see note above about rounding)	$\approx 8.46 \times 10^{-3} \text{ m}$
bohr, atomic unit of length	a_0	= Bohr radius of hydrogen	$\approx 5.291\,772\,1092(17) \times 10^{-11} \text{ m}^{[2]}$
cable length (imperial)		$\equiv 608 \text{ ft}$	$\approx 185.3184 \text{ m}$
cable length (International)		$\equiv \frac{1}{10} \text{ nmi}$	$\equiv 185.2 \text{ m}$
cable length (US)		$\equiv 720 \text{ ft}$	$= 219.456 \text{ m}$
chain (Gunter's; Surveyor's)	ch	$\equiv 66 \text{ ft (US)} \equiv 4 \text{ rods}^{[3]}$	$\approx 20.116\,84 \text{ m}$
cubit (H)		\equiv Distance from fingers to elbow $\approx 18 \text{ in}$	$\approx 0.5 \text{ m}$
ell (H)	ell	$\equiv 45 \text{ in}^{[4]}$ (In England usually)	$= 1.143 \text{ m}$
fathom	ftm	$\equiv 6 \text{ ft}^{[4]}$	$= 1.8288 \text{ m}$
fermi	fm	$\equiv 1 \times 10^{-15} \text{ m}^{[4]}$	$\equiv 1 \times 10^{-15} \text{ m}$
finger		$\equiv \frac{7}{8} \text{ in}$	$= 0.022\,225 \text{ m}$
finger (cloth)		$\equiv 4\frac{1}{2} \text{ in}$	$= 0.1143 \text{ m}$
foot (Benoît) (H)	ft (Ben)		$\approx 0.304\,799\,735 \text{ m}$
foot (Cape) (H)		Legally defined as 1.033 English feet in 1859	$\approx 0.314\,858 \text{ m}$
foot (Clarke's) (H)	ft (Cla)		$\approx 0.304\,797\,2654 \text{ m}$
foot (Indian) (H)	ft Ind		$\approx 0.304\,799\,514 \text{ m}$
foot, metric	mf	$\equiv \sqrt{\frac{1}{10}} \text{ m}$	$\approx 0.31622776601 \text{ m}$
foot, metric (long)	lmf	$\equiv \frac{1}{3} \text{ m}$	$\approx 0.\bar{3} \text{ m}$
foot, metric (short)	smf	$\equiv 0.30 \text{ m}$	$\equiv 0.30 \text{ m}$
foot (International)	ft	$\equiv 0.3048 \text{ m} \equiv \frac{1}{3} \text{ yd} \equiv 12 \text{ inches}$	$\equiv 0.3048 \text{ m}$
foot (Sear's) (H)	ft (Sear)		$\approx 0.304\,799\,47 \text{ m}$
foot (US Survey)	ft (US)	$\equiv \frac{1200}{3937} \text{ m}^{[5]}$	$\approx 0.304\,800\,610 \text{ m}$
french; charriere	F	$\equiv \frac{1}{3} \text{ mm}$	$= 0.\bar{3} \times 10^{-3} \text{ m}$
furlong	fur	$\equiv 10 \text{ chains} = 660 \text{ ft} = 220 \text{ yd}^{[4]}$	$= 201.168 \text{ m}$

hand		$\equiv 4 \text{ in}^{[4]}$	$\equiv 0.1016 \text{ m}$
inch (International)	in	$\equiv 2.54 \text{ cm} \equiv \frac{1}{36} \text{ yd} \equiv \frac{1}{12} \text{ ft}$	$\equiv 0.0254 \text{ m}$
league (land)	lea	$\approx 1 \text{ hour walk}$, Currently defined in US as 3 Statute miles, ^[3] but historically varied from 2 to 9 km	$\approx 4828 \text{ m}$
light-day		$\equiv 24 \text{ light-hours}$	$\equiv 2.590\,206\,837\,12 \times 10^{13} \text{ m}$
light-hour		$\equiv 60 \text{ light-minutes}$	$\equiv 1.079\,252\,8488 \times 10^{12} \text{ m}$
light-minute		$\equiv 60 \text{ light-seconds}$	$\equiv 1.798\,754\,748 \times 10^{10} \text{ m}$
light-second		$\equiv \text{Distance light travels in one second in vacuum}$	$\equiv 299\,792\,458 \text{ m}$
light-year	ly	$\equiv \text{Distance light travels in vacuum in 365.25 days}^{[6]}$	$= 9.460\,730\,472\,5808 \times 10^{15} \text{ m}$
line	ln	$\equiv \frac{1}{12} \text{ in}^{[7]}$	$= 0.002\,11\bar{6} \text{ m}$
link (Gunter's; Surveyor's)	lnk	$\equiv \frac{1}{100} \text{ ch}^{[4]} \equiv 0.66 \text{ ft (US)} \equiv 7.92 \text{ in}$	$\approx 0.201\,1684 \text{ m}$
link (Ramsden's; Engineer's)	lnk	$\equiv 1 \text{ ft}^{[4]}$	$= 0.3048 \text{ m}$
metre (SI base unit) (meter)	m	$\equiv \text{Distance light travels in } \frac{1}{299\,792\,458} \text{ of a second in vacuum.}^{[8]}$ $\approx \frac{1}{10\,000\,000}$ of the distance from equator to pole.	$\equiv 1 \text{ m}$
mickey		$\equiv \frac{1}{200} \text{ in}$	$= 1.27 \times 10^{-4} \text{ m}$
micrometre (old: micron)	μ		$\equiv 1 \times 10^{-6} \text{ m}$
mil; thou	mil	$\equiv 1 \times 10^{-3} \text{ in}$	$\equiv 2.54 \times 10^{-5} \text{ m}$
mil (Sweden and Norway)	mil	$\equiv 10 \text{ km}$	$= 10\,000 \text{ m}$
mile (geographical) (H)		$\equiv 6082 \text{ ft}$	$= 1\,853.7936 \text{ m}$
mile (international)	mi	$\equiv 80 \text{ chains} \equiv 5280 \text{ ft} \equiv 1760 \text{ yd}$	$\equiv 1\,609.344 \text{ m}$
mile (tactical or data)		$\equiv 6000 \text{ ft}$	$\equiv 1\,828.8 \text{ m}$
mile (telegraph) (H)	mi	$\equiv 6087 \text{ ft}$	$= 1\,855.3176 \text{ m}$
mile (US Survey)	mi	$\equiv 5280 \text{ US Survey feet} \equiv (5280 \times \frac{1200}{3937}) \text{ m}$	$\approx 1\,609.347\,219 \text{ m}$
nail (cloth)		$\equiv 2\frac{1}{4} \text{ in}^{[4]}$	$= 0.057\,15 \text{ m}$

nanometre	nm	$\equiv 1 \times 10^{-9} \text{ m}$	$\equiv 1 \times 10^{-9} \text{ m}$
nautical league	NL; nl	$\equiv 3 \text{ nmi}$ ^[4]	$= 5556 \text{ m}$
nautical mile (Admiralty)	NM (Adm); nmi (Adm)	$= 6080 \text{ ft}$	$= 1\,853.184 \text{ m}$
nautical mile (international)	NM; nmi	$\equiv 1852 \text{ m}$ ^[9]	$\equiv 1852 \text{ m}$
nautical mile (US pre 1954)		$\equiv 1853.248 \text{ m}$	$\equiv 1853.248 \text{ m}$
pace		$\equiv 2.5 \text{ ft}$ ^[4]	$= 0.762 \text{ m}$
palm		$\equiv 3 \text{ in}$ ^[4]	$= 0.0762 \text{ m}$
parsec	pc	Distance of star with <i>parallax</i> shift of one arc <i>second</i> from a base of one astronomical unit	$\approx 3.085\,677\,581 \times 10^{16} \text{ m}$ ^[10]
pica		$\equiv 12 \text{ points}$	Dependent on point measures.
point (American, English) ^{[11][12]}	pt	$\equiv \frac{1}{72.272} \text{ in}$	$\approx 0.000\,351\,450 \text{ m}$
point (Didot; European) ^{[12][13]}	pt	$\equiv \frac{1}{12} \times \frac{1}{72}$ of pied du roi; After 1878: $\equiv \frac{5}{133} \text{ cm}$	$\approx 0.000\,375\,97 \text{ m};$ After 1878: $\approx 0.000\,375\,939\,85 \text{ m}$
point (PostScript) ^[11]	pt	$\equiv \frac{1}{72} \text{ in}$	$= 0.000\,352\bar{7} \text{ m}$
point (TeX) ^[11]	pt	$\equiv \frac{1}{72.27} \text{ in}$	$= 0.000\,351\,459\bar{8} \text{ m}$
quarter		$\equiv \frac{1}{4} \text{ yd}$	$= 0.2286 \text{ m}$
rod; pole; perch (H)	rd	$\equiv 16\frac{1}{2} \text{ ft}$	$= 5.0292 \text{ m}$
rope (H)	rope	$\equiv 20 \text{ ft}$ ^[4]	$= 6.096 \text{ m}$
shaku (Japan)		$\equiv 10/33 \text{ m}$	$\approx 0.303\,0303 \text{ m}$
span (H)		$\equiv 9 \text{ in}$ ^[4]	$= 0.2286 \text{ m}$
spat ^[14]			$\equiv 1 \times 10^{12} \text{ m}$
stick (H)		$\equiv 2 \text{ in}$	$= 0.0508 \text{ m}$
picometre (old: bicron, stigma)	pm		$\equiv 1 \times 10^{-12} \text{ m}$
twip	twp	$\equiv \frac{1}{1440} \text{ in}$	$= 1.763\bar{8} \times 10^{-5} \text{ m}$
x unit; siegbahn	xu		$\approx 1.0021 \times 10^{-13} \text{ m}$ ^[4]
yard (International)	yd	$\equiv 0.9144 \text{ m}$ ^[5] $\equiv 3 \text{ ft} \equiv 36 \text{ in}$	$\equiv 0.9144 \text{ m}$

Area

Area

Name of unit	Symbol	Definition	Relation to SI units
acre (international)	ac	$\equiv 1 \text{ ch} \times 10 \text{ ch} = 4840 \text{ sq yd}$	$\equiv 4\,046.856\,4224 \text{ m}^2$
acre (US survey)	ac	$\equiv 10 \text{ sq ch} = 4840 \text{ sq yd}$, also 43 560 sq ft	$\approx 4\,046.873 \text{ m}^2$ ^[15]
are	a	$\equiv 100 \text{ m}^2$	$= 100 \text{ m}^2$
barn	b	$\equiv 10^{-28} \text{ m}^2$	$= 10^{-28} \text{ m}^2$
barony		$\equiv 4000 \text{ ac}$	$\approx 1.618\,742 \times 10^7 \text{ m}^2$
board	bd	$\equiv 1 \text{ in} \times 1 \text{ ft}$	$= 7.741\,92 \times 10^{-3} \text{ m}^2$
boiler horsepower equivalent direct radiation	bhp EDR	$\equiv 1 \text{ ft}^2 \times 1 \text{ bhp} / (240 \text{ BTU}_{\text{IT}}/\text{h})$	$\approx 12.958\,174 \text{ m}^2$
circular inch	circ in	$\equiv \pi/4 \text{ sq in}$	$\approx 5.067\,075 \times 10^{-4} \text{ m}^2$
circular mil; circular thou	circ mil	$\equiv \pi/4 \text{ mil}^2$	$\approx 5.067\,075 \times 10^{-10} \text{ m}^2$
cord		$\equiv 192 \text{ bd}$	$= 1.486\,448\,64 \text{ m}^2$
cuerda (PR Survey)	cda	$\equiv 1 \text{ cda} \times 1 \text{ cda} = 0.971\,222 \text{ acre}$	$\equiv 3\,930.395\,625 \text{ m}^2$
dunam		$\equiv 1000 \text{ m}^2$	$= 1000 \text{ m}^2$
guntha (India)		$\equiv 121 \text{ sq yd}$	$\approx 101.17 \text{ m}^2$
hectare	ha	$\equiv 10\,000 \text{ m}^2$	$\equiv 10\,000 \text{ m}^2$
hide		$\approx 120 \text{ ac}$ (variable)	$\approx 5 \times 10^5 \text{ m}^2$
rood	ro	$\equiv 1/4 \text{ ac}$	$= 1\,011.714\,1056 \text{ m}^2$
section		$\equiv 1 \text{ mi} \times 1 \text{ mi}$	$= 2.589\,988\,110\,336 \times 10^6 \text{ m}^2$
shed		$\equiv 10^{-52} \text{ m}^2$	$= 10^{-52} \text{ m}^2$
square (roofing)		$\equiv 10 \text{ ft} \times 10 \text{ ft}$	$= 9.290\,304 \text{ m}^2$
square chain (international)	sq ch	$\equiv 66 \text{ ft} \times 66 \text{ ft} = 1/10 \text{ ac}$	$\equiv 404.685\,642\,24 \text{ m}^2$
square chain (US Survey)	sq ch	$\equiv 66 \text{ ft (US)} \times 66 \text{ ft (US)} = 1/10 \text{ US survey acre}$	$\approx 404.6873 \text{ m}^2$
square foot	sq ft	$\equiv 1 \text{ ft} \times 1 \text{ ft}$	$\equiv 9.290\,304 \times 10^{-2} \text{ m}^2$
square foot (US Survey)	sq ft	$\equiv 1 \text{ ft (US)} \times 1 \text{ ft (US)}$	$\approx 9.290\,341\,161\,3275 \times 10^{-2} \text{ m}^2$
square inch	sq in	$\equiv 1 \text{ in} \times 1 \text{ in}$	$\equiv 6.4516 \times 10^{-4} \text{ m}^2$
square kilometre	km ²	$\equiv 1 \text{ km} \times 1 \text{ km}$	$= 10^6 \text{ m}^2$
square link (Gunter's) (International)	sq lnk	$\equiv 1 \text{ lnk} \times 1 \text{ lnk} \equiv 0.66 \text{ ft} \times 0.66 \text{ ft}$	$= 4.046\,856\,4224 \times 10^{-2} \text{ m}^2$

square link (Gunter's)(US Survey)	sq lnk	$\equiv 1 \text{ lnk} \times 1 \text{ lnk} \equiv 0.66 \text{ ft (US)} \times 0.66 \text{ ft (US)}$	$\approx 4.046\,872 \times 10^{-2} \text{ m}^2$
square link (Ramsden's)	sq lnk	$\equiv 1 \text{ lnk} \times 1 \text{ lnk} \equiv 1 \text{ ft} \times 1 \text{ ft}$	$= 0.092\,903\,04 \text{ m}^2$
square metre (SI unit)	m^2	$\equiv 1 \text{ m} \times 1 \text{ m}$	$= 1 \text{ m}^2$
square mil; square thou	sq mil	$\equiv 1 \text{ mil} \times 1 \text{ mil}$	$= 6.4516 \times 10^{-10} \text{ m}^2$
square mile	sq mi	$\equiv 1 \text{ mi} \times 1 \text{ mi}$	$= 2.589\,988\,110\,336 \times 10^6 \text{ m}^2$
square mile (US Survey)	sq mi	$\equiv 1 \text{ mi (US)} \times 1 \text{ mi (US)}$	$\approx 2.589\,998\,47 \times 10^6 \text{ m}^2$
square rod/pole/perch	sq rd	$\equiv 1 \text{ rd} \times 1 \text{ rd}$	$= 25.292\,852\,64 \text{ m}^2$
square yard (International)	sq yd	$\equiv 1 \text{ yd} \times 1 \text{ yd}$	$\equiv 0.836\,127\,36 \text{ m}^2$
stremma		$\equiv 1000 \text{ m}^2$	$= 1000 \text{ m}^2$
township		$\equiv 36 \text{ sq mi (US)}$	$\approx 9.323\,994 \times 10^7 \text{ m}^2$
yardland		$\approx 30 \text{ ac}$	$\approx 1.2 \times 10^5 \text{ m}^2$

Volume

Volume

Name of unit	Symbol	Definition	Relation to SI units
acre-foot	ac ft	$\equiv 1 \text{ ac} \times 1 \text{ ft} = 43\,560 \text{ cu ft}$	$= 1\,233.481\,837\,547\,52 \text{ m}^3$
acre-inch		$\equiv 1 \text{ ac} \times 1 \text{ in}$	$= 102.790\,153\,128\,96 \text{ m}^3$
barrel (imperial)	bl (imp)	$\equiv 36 \text{ gal (imp)}$	$= 0.163\,659\,24 \text{ m}^3$
barrel (petroleum)	bl; bbl	$\equiv 42 \text{ gal (US)}$	$= 0.158\,987\,294\,928 \text{ m}^3$
barrel (US dry)	bl (US)	$\equiv 105 \text{ qt (US)} = 105/32 \text{ bu (US lvl)}$	$= 0.115\,628\,198\,985\,075 \text{ m}^3$
barrel (US fluid)	fl bl (US)	$\equiv 31\frac{1}{2} \text{ gal (US)}$	$= 0.119\,240\,471\,196 \text{ m}^3$
board-foot	fbm	$\equiv 144 \text{ cu in}$	$\equiv 2.359\,737\,216 \times 10^{-3} \text{ m}^3$
bucket (imperial)	bkt	$\equiv 4 \text{ gal (imp)}$	$= 0.018\,184\,36 \text{ m}^3$
bushel (imperial)	bu (imp)	$\equiv 8 \text{ gal (imp)}$	$= 0.036\,368\,72 \text{ m}^3$
bushel (US dry heaped)	bu (US)	$\equiv 1\frac{1}{4} \text{ bu (US lvl)}$	$= 0.044\,048\,837\,7086 \text{ m}^3$
bushel (US dry level)	bu (US lvl)	$\equiv 2\,150.42 \text{ cu in}$	$= 0.035\,239\,070\,166\,88 \text{ m}^3$
butt, pipe		$\equiv 126 \text{ gal (wine)}$	$= 0.476\,961\,884\,784 \text{ m}^3$
coomb		$\equiv 4 \text{ bu (imp)}$	$= 0.145\,474\,88 \text{ m}^3$
cord (firewood)		$\equiv 8 \text{ ft} \times 4 \text{ ft} \times 4 \text{ ft}$	$= 3.624\,556\,363\,776 \text{ m}^3$
cord-foot		$\equiv 16 \text{ cu ft}$	$= 0.453\,069\,545\,472 \text{ m}^3$
cubic fathom	cu fm	$\equiv 1 \text{ fm} \times 1 \text{ fm} \times 1 \text{ fm}$	$= 6.116\,438\,863\,872 \text{ m}^3$
cubic foot	cu ft	$\equiv 1 \text{ ft} \times 1 \text{ ft} \times 1 \text{ ft}$	$\equiv 0.028\,316\,846\,592 \text{ m}^3$
cubic inch	cu in	$\equiv 1 \text{ in} \times 1 \text{ in} \times 1 \text{ in}$	$\equiv 16.387\,064 \times 10^{-6} \text{ m}^3$
cubic metre (SI unit)	m ³	$\equiv 1 \text{ m} \times 1 \text{ m} \times 1 \text{ m}$	$\equiv 1 \text{ m}^3$
cubic mile	cu mi	$\equiv 1 \text{ mi} \times 1 \text{ mi} \times 1 \text{ mi}$	$\equiv 4\,168\,181\,825.440\,579\,584 \text{ m}^3$
cubic yard	cu yd	$\equiv 27 \text{ cu ft}$	$\equiv 0.764\,554\,857\,984 \text{ m}^3$
cup (breakfast)		$\equiv 10 \text{ fl oz (imp)}$	$= 284.130\,625 \times 10^{-6} \text{ m}^3$
cup (Canadian)	c (CA)	$\equiv 8 \text{ fl oz (imp)}$	$= 227.3045 \times 10^{-6} \text{ m}^3$
cup (metric)	c	$\equiv 250.0 \times 10^{-6} \text{ m}^3$	$= 250.0 \times 10^{-6} \text{ m}^3$
cup (US customary)	c (US)	$\equiv 8 \text{ US fl oz} \equiv \frac{1}{16} \text{ gal (US)}$	$= 236.588\,2365 \times 10^{-6} \text{ m}^3$
cup (US food nutrition labeling)	c (US)	$\equiv 240 \text{ mL}$ ^[16]	$= 2.4 \times 10^{-4} \text{ m}^3$
dash (imperial)		$\equiv \frac{1}{384} \text{ gi (imp)} = \frac{1}{2} \text{ pinch (imp)}$	$= 369.961\,751\,302\,08\bar{3} \times 10^{-9} \text{ m}^3$

dash (US)		$\equiv \frac{1}{96}$ US fl oz = $\frac{1}{2}$ US pinch	$= 308.057\,599\,609\,375 \times 10^{-9} \text{ m}^3$
dessertspoon (imperial)		$\equiv \frac{1}{12}$ gi (imp)	$= 11.838\,776\,041\bar{6} \times 10^{-6} \text{ m}^3$
drop (imperial)	gtt	$\equiv \frac{1}{288}$ fl oz (imp)	$= 98.656\,467\,013\bar{8} \times 10^{-9} \text{ m}^3$
drop (imperial) (alt)	gtt	$\equiv \frac{1}{1824}$ gi (imp)	$\approx 77.886\,684 \times 10^{-9} \text{ m}^3$
drop (medical)		$\equiv 0.9964\frac{1}{12}$ ml	$= 83.0\bar{3} \times 10^{-9} \text{ m}^3$
drop (medical)		$\equiv \frac{1}{12}$ ml	$= 83.\bar{3} \times 10^{-9} \text{ m}^3$
drop (metric)		$\equiv \frac{1}{20}$ mL	$= 50.0 \times 10^{-9} \text{ m}^3$
drop (US)	gtt	$\equiv \frac{1}{360}$ US fl oz	$= 82.148\,693\,229\,1\bar{6} \times 10^{-9} \text{ m}^3$
drop (US) (alt)	gtt	$\equiv \frac{1}{456}$ US fl oz	$\approx 64.854\,231\,496\,71 \times 10^{-9} \text{ m}^3$
drop (US) (alt)	gtt	$\equiv \frac{1}{576}$ US fl oz	$\approx 51.342\,933\,268\,23 \times 10^{-9} \text{ m}^3$
fifth		$\equiv \frac{1}{5}$ US gal	$= 757.082\,3568 \times 10^{-6} \text{ m}^3$
firkin		$\equiv 9$ gal (imp)	$= 0.040\,914\,81 \text{ m}^3$
fluid drachm (imperial)	fl dr	$\equiv \frac{1}{8}$ fl oz (imp)	$= 3.551\,632\,8125 \times 10^{-6} \text{ m}^3$
fluid dram (US); US fluidram	fl dr	$\equiv \frac{1}{8}$ US fl oz	$= 3.696\,691\,195\,3125 \times 10^{-6} \text{ m}^3$
fluid scruple (imperial)	fl s	$\equiv \frac{1}{24}$ fl oz (imp)	$= 1.183\,877\,604\,1\bar{6} \times 10^{-6} \text{ m}^3$
gallon (beer)	beer gal	$\equiv 282$ cu in	$= 4.621\,152\,048 \times 10^{-3} \text{ m}^3$
gallon (imperial)	gal (imp)	$\equiv 4.546\,09$ L	$\equiv 4.546\,09 \times 10^{-3} \text{ m}^3$
gallon (US dry)	gal (US)	$\equiv \frac{1}{8}$ bu (US lvl)	$= 4.404\,883\,770\,86 \times 10^{-3} \text{ m}^3$
gallon (US fluid; Wine)	gal (US)	$\equiv 231$ cu in	$\equiv 3.785\,411\,784 \times 10^{-3} \text{ m}^3$
gill (imperial); Noggin	gi (imp); nog	$\equiv 5$ fl oz (imp)	$= 142.065\,3125 \times 10^{-6} \text{ m}^3$
gill (US)	gi (US)	$\equiv 4$ US fl oz	$= 118.294\,118\,25 \times 10^{-6} \text{ m}^3$
hogshead (imperial)	hhd (imp)	$\equiv 2$ bl (imp)	$= 0.327\,318\,48 \text{ m}^3$
hogshead (US)	hhd (US)	$\equiv 2$ fl bl (US)	$= 0.238\,480\,942\,392 \text{ m}^3$
jigger (bartending)		$\equiv 1\frac{1}{2}$ US fl oz	$\approx 44.36 \times 10^{-6} \text{ m}^3$
kilderkin		$\equiv 18$ gal (imp)	$= 0.081\,829\,62 \text{ m}^3$
lambda	λ	$\equiv 1$ mm ³	$= 1 \times 10^{-9} \text{ m}^3$
last		$\equiv 80$ bu (imp)	$= 2.909\,4976 \text{ m}^3$
litre (liter)	L	$\equiv 1$ dm ³ [17]	$\equiv 0.001 \text{ m}^3$
load		$\equiv 50$ cu ft	$= 1.415\,842\,3296 \text{ m}^3$

minim (imperial)	min	$\equiv \frac{1}{480} \text{ fl oz (imp)} = \frac{1}{60} \text{ fl dr (imp)}$	$= 59.193\,880\,208\bar{3} \times 10^{-9} \text{ m}^3$
minim (US)	min	$\equiv \frac{1}{480} \text{ US fl oz} = \frac{1}{60} \text{ US fl dr}$	$= 61.611\,519\,921\,875 \times 10^{-9} \text{ m}^3$
ounce (fluid imperial)	fl oz (imp)	$\equiv \frac{1}{160} \text{ gal (imp)}$	$\equiv 28.413\,0625 \times 10^{-6} \text{ m}^3$
ounce (fluid US customary)	US fl oz	$\equiv \frac{1}{128} \text{ gal (US)}$	$\equiv 29.573\,529\,5625 \times 10^{-6} \text{ m}^3$
ounce (fluid US food nutrition labeling)	US fl oz	$\equiv 30 \text{ mL}^{[16]}$	$\equiv 3 \times 10^{-5} \text{ m}^3$
peck (imperial)	pk	$\equiv 2 \text{ gal (imp)}$	$= 9.092\,18 \times 10^{-3} \text{ m}^3$
peck (US dry)	pk	$\equiv \frac{1}{4} \text{ US lvl bu}$	$= 8.809\,767\,541\,72 \times 10^{-3} \text{ m}^3$
perch	per	$\equiv 16\frac{1}{2} \text{ ft} \times 1\frac{1}{2} \text{ ft} \times 1 \text{ ft}$	$= 0.700\,841\,953\,152 \text{ m}^3$
pinch (imperial)		$\equiv \frac{1}{192} \text{ gi (imp)} = \frac{1}{16} \text{ tsp (imp)}$	$= 739.923\,502\,604\,1\bar{6} \times 10^{-9} \text{ m}^3$
pinch (US)		$\equiv \frac{1}{48} \text{ US fl oz} = \frac{1}{16} \text{ US tsp}$	$= 616.115\,199\,218\,75 \times 10^{-9} \text{ m}^3$
pint (imperial)	pt (imp)	$\equiv \frac{1}{8} \text{ gal (imp)}$	$= 568.261\,25 \times 10^{-6} \text{ m}^3$
pint (US dry)	pt (US dry)	$\equiv \frac{1}{64} \text{ bu (US lvl)} \equiv \frac{1}{8} \text{ gal (US dry)}$	$= 550.610\,471\,3575 \times 10^{-6} \text{ m}^3$
pint (US fluid)	pt (US fl)	$\equiv \frac{1}{8} \text{ gal (US)}$	$= 473.176\,473 \times 10^{-6} \text{ m}^3$
pony		$\equiv \frac{3}{4} \text{ US fl oz}$	$= 22.180\,147\,171\,875 \times 10^{-6} \text{ m}^3$
pottle; quartern		$\equiv \frac{1}{2} \text{ gal (imp)} = 80 \text{ fl oz (imp)}$	$= 2.273\,045 \times 10^{-3} \text{ m}^3$
quart (imperial)	qt (imp)	$\equiv \frac{1}{4} \text{ gal (imp)}$	$= 1.136\,5225 \times 10^{-3} \text{ m}^3$
quart (US dry)	qt (US)	$\equiv \frac{1}{32} \text{ bu (US lvl)} = \frac{1}{4} \text{ gal (US dry)}$	$= 1.101\,220\,942\,715 \times 10^{-3} \text{ m}^3$
quart (US fluid)	qt (US)	$\equiv \frac{1}{4} \text{ gal (US fl)}$	$= 946.352\,946 \times 10^{-6} \text{ m}^3$
quarter; pail		$\equiv 8 \text{ bu (imp)}$	$= 0.290\,949\,76 \text{ m}^3$
register ton		$\equiv 100 \text{ cu ft}$	$= 2.831\,684\,6592 \text{ m}^3$
sack (imperial); bag		$\equiv 3 \text{ bu (imp)}$	$= 0.109\,106\,16 \text{ m}^3$
sack (US)		$\equiv 3 \text{ bu (US lvl)}$	$= 0.105\,717\,210\,500\,64 \text{ m}^3$
seam		$\equiv 8 \text{ bu (US lvl)}$	$= 0.281\,912\,561\,335\,04 \text{ m}^3$
shot (US)		usually $1.5 \text{ US fl oz}^{[14]}$	$\approx 44 \times 10^{-6} \text{ m}^3$
strike (imperial)		$\equiv 2 \text{ bu (imp)}$	$= 0.072\,737\,44 \text{ m}^3$
strike (US)		$\equiv 2 \text{ bu (US lvl)}$	$= 0.070\,478\,140\,333\,76 \text{ m}^3$
tablespoon (Australian metric)			$\equiv 20.0 \times 10^{-6} \text{ m}^3$

tablespoon (Canadian)	tbsp	$\equiv \frac{1}{2}$ fl oz (imp)	$= 14.206\,531\,25 \times 10^{-6} \text{ m}^3$
tablespoon (imperial)	tbsp	$\equiv \frac{5}{8}$ fl oz (imp)	$= 17.758\,164\,0625 \times 10^{-6} \text{ m}^3$
tablespoon (metric)			$\equiv 15.0 \times 10^{-6} \text{ m}^3$
tablespoon (US customary)	tbsp	$\equiv \frac{1}{2}$ US fl oz	$= 14.786\,764\,781\,25 \times 10^{-6} \text{ m}^3$
tablespoon (US food nutrition labeling)	tbsp	$\equiv 15 \text{ mL}^{[16]}$	$= 1.5 \times 10^{-5} \text{ m}^3$
teaspoon (Canadian)	tsp	$\equiv \frac{1}{6}$ fl oz (imp)	$= 4.735\,510\,41\bar{6} \times 10^{-6} \text{ m}^3$
teaspoon (imperial)	tsp	$\equiv \frac{1}{24}$ gi (imp)	$= 5.919\,388\,020\,8\bar{3} \times 10^{-6} \text{ m}^3$
teaspoon (metric)		$\equiv 5.0 \times 10^{-6} \text{ m}^3$	$= 5.0 \times 10^{-6} \text{ m}^3$
teaspoon (US customary)	tsp	$\equiv \frac{1}{6}$ US fl oz	$= 4.928\,921\,593\,75 \times 10^{-6} \text{ m}^3$
teaspoon (US food nutrition labeling)	tsp	$\equiv 5 \text{ mL}^{[16]}$	$= 5 \times 10^{-6} \text{ m}^3$
timber foot		$\equiv 1$ cu ft	$= 0.028\,316\,846\,592 \text{ m}^3$
ton (displacement)		$\equiv 35$ cu ft	$= 0.991\,089\,630\,72 \text{ m}^3$
ton (freight)		$\equiv 40$ cu ft	$= 1.132\,673\,863\,68 \text{ m}^3$
ton (water)		$\equiv 28$ bu (imp)	$= 1.018\,324\,16 \text{ m}^3$
tun		$\equiv 252$ gal (wine)	$= 0.953\,923\,769\,568 \text{ m}^3$
wey (US)		$\equiv 40$ bu (US lvl)	$= 1.409\,562\,806\,6752 \text{ m}^3$

Plane angle

Plane angle

Name of unit	Symbol	Definition	Relation to SI units
angular mil	μ	$\equiv 2\pi/6400$ rad	$\approx 0.981\,748 \times 10^{-3}$ rad
arcminute; MOA	'	$\equiv 1^\circ/60$	$\approx 0.290\,888 \times 10^{-3}$ rad
arcsecond	"	$\equiv 1^\circ/3600$	$\approx 4.848\,137 \times 10^{-6}$ rad
centesimal minute of arc	'	$\equiv 1/100$ grad	$\approx 0.157\,080 \times 10^{-3}$ rad
centesimal second of arc	"	$\equiv 1/10\,000$ grad	$\approx 1.570\,796 \times 10^{-6}$ rad
degree (of arc)	$^\circ$	$\equiv 1/360$ of a revolution $\equiv \pi/180$ rad	$\approx 17.453\,293 \times 10^{-3}$ rad
grad; gradian; gon	grad	$\equiv 1/400$ of a revolution $\equiv \pi/200$ rad $\equiv 0.9^\circ$	$\approx 15.707\,963 \times 10^{-3}$ rad
octant		$\equiv 45^\circ$	$\approx 0.785\,398$ rad
quadrant		$\equiv 90^\circ$	$\approx 1.570\,796$ rad
radian (SI unit)	rad	The angle subtended at the center of a circle by an arc whose length is equal to the circle's radius. One full revolution encompasses 2π radians.	= 1 rad
sextant		$\equiv 60^\circ$	$\approx 1.047\,198$ rad
sign		$\equiv 30^\circ$	$\approx 0.523\,599$ rad

Solid angle

Solid angle

Name of unit	Symbol	Definition	Relation to SI units
square degree	deg ² ; sq.deg.; ($^\circ$) ²	$\equiv (\pi/180)^2$ sr	$\approx 0.304\,62 \times 10^{-3}$ sr
steradian (SI unit)	sr	The solid angle subtended at the center of a sphere of radius r by a portion of the surface of the sphere having an area r^2 . A sphere encompasses 4π sr. ^[14]	= 1 sr

Mass

Notes:

- See Weight for detail of mass/weight distinction and conversion.
- Avoirdupois is a system of mass based on a pound of 16 ounces, while Troy weight is the system of mass where 12 troy ounces equals one troy pound.

- In this table, the unit *gee* is used to denote standard gravity in order to avoid confusion with the "g" symbol for grams.
- In physics, the pound of mass is sometimes written **lbm** to distinguish it from the pound-force (**lbf**). It should not be read as the mongrel unit "pound metre".

Mass

Name of unit	Symbol	Definition	Relation to SI units
atomic mass unit, unified	u; AMU		\approx $1.660\,538\,921(73) \times 10^{-27} \text{ kg}^{[18]}$
atomic unit of mass, electron rest mass	m_e		$\approx 9.109\,382\,91(40) \times 10^{-31} \text{ kg}^{[19]}$
bag (coffee)		$\equiv 60 \text{ kg}$	$= 60 \text{ kg}$
bag (Portland cement)		$\equiv 94 \text{ lb av}$	$= 42.637\,682\,78 \text{ kg}$
barge		$\equiv 22\frac{1}{2} \text{ short ton}$	$= 20\,411.656\,65 \text{ kg}$
carat	kt	$\equiv 3\frac{1}{6} \text{ gr}$	$= 205.196\,548\bar{3} \text{ mg}$
carat (metric)	ct	$\equiv 200 \text{ mg}$	$= 200 \text{ mg}$
clove		$\equiv 8 \text{ lb av}$	$= 3.628\,738\,96 \text{ kg}$
crith			$\approx 89.9349 \text{ mg}$
dalton	Da		\approx $1.660\,538\,921(73) \times 10^{-27} \text{ kg}^{[18]}$
dram (apothecary; troy)	dr t	$\equiv 60 \text{ gr}$	$= 3.887\,9346 \text{ g}$
dram (avoirdupois)	dr av	$\equiv 27\frac{11}{32} \text{ gr}$	$= 1.771\,845\,195\,3125 \text{ g}$
electronvolt	eV	$\equiv 1 \text{ eV (energy unit)} / c^2$	$= 1.782\,661\,84(45) \times 10^{-36} \text{ kg}^{[20]}$
gamma	γ	$\equiv 1 \mu\text{g}$	$= 1 \mu\text{g}$
grain	gr	$\equiv \frac{1}{7000} \text{ lb av}$	$\equiv 64.798\,91 \text{ mg}$
grave	gv.	grave was the original name of the kilogram	$\equiv 1 \text{ kg}$
hundredweight (long)	long cwt or cwt	$\equiv 112 \text{ lb av}$	$= 50.802\,345\,44 \text{ kg}$
hundredweight (short); cental	sh cwt	$\equiv 100 \text{ lb av}$	$= 45.359\,237 \text{ kg}$
kilogram (kilogramme)	kg	\equiv mass of the prototype near Paris (\approx mass of 1 L of water)	$\equiv 1 \text{ kg (SI base unit)}^{[8]}$
kip	kip	$\equiv 1000 \text{ lb av}$	$= 453.592\,37 \text{ kg}$
mark		$\equiv 8 \text{ oz t}$	$= 248.827\,8144 \text{ g}$
mite		$\equiv \frac{1}{20} \text{ gr}$	$= 3.239\,9455 \text{ mg}$
mite (metric)		$\equiv \frac{1}{20} \text{ g}$	$= 50 \text{ mg}$
ounce (apothecary; troy)	oz t	$\equiv \frac{1}{12} \text{ lb t}$	$= 31.103\,4768 \text{ g}$
ounce (avoirdupois)	oz av	$\equiv \frac{1}{16} \text{ lb}$	$= 28.349\,523\,125 \text{ g}$

ounce (US food nutrition labelling)	oz	$\equiv 28 \text{ g}$ ^[16]	= 28 g
pennyweight	dwt; pwt	$\equiv \frac{1}{20} \text{ oz t}$	= 1.555 173 84 g
point		$\equiv \frac{1}{100} \text{ ct}$	= 2 mg
pound (avoirdupois)	lb av	$\equiv 0.453\,592\,37 \text{ kg} = 7000 \text{ grains}$	$\equiv 0.453\,592\,37 \text{ kg}$
pound (metric)		$\equiv 500 \text{ g}$	= 500 g
pound (troy)	lb t	$\equiv 5760 \text{ grains}$	= 0.373 241 7216 kg
quarter (imperial)		$\equiv \frac{1}{4} \text{ long cwt} = 2 \text{ st} = 28 \text{ lb av}$	= 12.700 586 36 kg
quarter (informal)		$\equiv \frac{1}{4} \text{ short ton}$	= 226.796 185 kg
quarter, long (informal)		$\equiv \frac{1}{4} \text{ long ton}$	= 254.011 7272 kg
quintal (metric)	q	$\equiv 100 \text{ kg}$	= 100 kg
scruple (apothecary)	s ap	$\equiv 20 \text{ gr}$	= 1.295 9782 g
sheet		$\equiv \frac{1}{700} \text{ lb av}$	= 647.9891 mg
slug; geepound; hyl	slug	$\equiv 1 \text{ } g_0 \times 1 \text{ lb av} \times 1 \text{ s}^2/\text{ft}$	$\approx 14.593\,903 \text{ kg}$
stone	st	$\equiv 14 \text{ lb av}$	= 6.350 293 18 kg
ton, assay (long)	AT	$\equiv 1 \text{ mg} \times 1 \text{ long ton} \div 1 \text{ oz t}$	= 32.6 $\bar{\text{g}}$
ton, assay (short)	AT	$\equiv 1 \text{ mg} \times 1 \text{ short ton} \div 1 \text{ oz t}$	= 29.16 $\bar{\text{g}}$
ton, long	long tn or ton	$\equiv 2240 \text{ lb}$	= 1 016.046 9088 kg
ton, short	sh tn	$\equiv 2000 \text{ lb}$	= 907.184 74 kg
tonne (mts unit)	t	$\equiv 1000 \text{ kg}$	= 1000 kg
wey		$\equiv 252 \text{ lb} = 18 \text{ st}$	= 114.305 277 24 kg (variants exist)
Zentner	Ztr.	Definitions vary. ^{[14][21]}	

Density

Density

Name of unit	Symbol	Definition	Relation to SI units
gram per millilitre	g/mL	≡ g/mL	= 1000 kg/m ³
kilogram per cubic metre (SI unit)	kg/m ³	≡ kg/m ³	= 1 kg/m ³
kilogram per litre	kg/L	≡ kg/L	= 1000 kg/m ³
ounce (avoirdupois) per cubic foot	oz/ft ³	≡ oz/ft ³	≈ 1.001 153 961 kg/m ³
ounce (avoirdupois) per cubic inch	oz/in ³	≡ oz/in ³	≈ 1.729 994 044 × 10 ³ kg/m ³
ounce (avoirdupois) per gallon (imperial)	oz/gal	≡ oz/gal	≈ 6.236 023 291 kg/m ³
ounce (avoirdupois) per gallon (US fluid)	oz/gal	≡ oz/gal	≈ 7.489 151 707 kg/m ³
pound (avoirdupois) per cubic foot	lb/ft ³	≡ lb/ft ³	≈ 16.018 463 37 kg/m ³
pound (avoirdupois) per cubic inch	lb/in ³	≡ lb/in ³	≈ 2.767 990 471 × 10 ⁴ kg/m ³
pound (avoirdupois) per gallon (imperial)	lb/gal	≡ lb/gal	≈ 99.776 372 66 kg/m ³
pound (avoirdupois) per gallon (US fluid)	lb/gal	≡ lb/gal	≈ 119.826 4273 kg/m ³
slug per cubic foot	slug/ft ³	≡ slug/ft ³	≈ 515.378 8184 kg/m ³

Time

Time

Name of unit	Symbol	Definition	Relation to SI units
atomic unit of time	au	$\equiv a_0/(\alpha \cdot c)$	$\approx 2.418\,884\,254 \times 10^{-17} \text{ s}$
Callippic cycle		$\equiv 441 \text{ mo (hollow)} + 499 \text{ mo (full)} = 76 \text{ a of } 365.25 \text{ d}$	$= 2.396\,736 \text{ Gs}$ or $2.398\,3776 \text{ Gs}$ ^[note 1]
century	c	$\equiv 100 \text{ years (100 a)}$	$= 3.155\,6952 \text{ Gs}$ ^{[note 2][note 3]}
day	d	$= 24 \text{ h} = 1440 \text{ min}$	$= 86.4 \text{ ks}$ ^[note 3]
day (sidereal)	d	\equiv Time needed for the Earth to rotate once around its axis, determined from successive transits of a very distant astronomical object across an observer's meridian (International Celestial Reference Frame)	$\approx 86.1641 \text{ ks}$
decade	dec	$\equiv 10 \text{ years (10 a)}$	$= 315.569\,520 \text{ Ms}$ ^{[note 2][note 3]}
fortnight	fn	$\equiv 2 \text{ wk}$	$= 1.2096 \text{ Ms}$ ^[note 3]
helek		$\equiv \frac{1}{1080} \text{ h}$	$= 3.\bar{3} \text{ s}$
Hipparchic cycle		$\equiv 4 \text{ Callippic cycles} - 1 \text{ d}$	$= 9.593\,424 \text{ Gs}$
hour	h	$\equiv 60 \text{ min}$	$= 3.6 \text{ ks}$ ^[note 3]
jiffy	j	$\equiv \frac{1}{60} \text{ s}$	$= 16.\bar{6} \text{ ms}$
jiffy (alternative)	ja	$\equiv \frac{1}{100} \text{ s}$	$= 10 \text{ ms}$
ke (quarter of an hour)		$\equiv \frac{1}{4} \text{ h} = \frac{1}{96} \text{ d} = 15 \text{ min}$	$= 900 \text{ s}$
ke (traditional)		$\equiv \frac{1}{100} \text{ d} = 14.4 \text{ min}$	$= 864 \text{ s}$
lustre; lustrum		$\equiv 5 \text{ a of } 365 \text{ d}$	$= 157.68 \text{ Ms}$
Metonic cycle; enneadecaeteris		$\equiv 110 \text{ mo (hollow)} + 125 \text{ mo (full)} = 6940 \text{ d} \approx 19 \text{ a}$	$= 599.616 \text{ Ms}$
millennium		$\equiv 1000 \text{ years (1000 a)}$	$= 31.556\,952 \text{ Gs}$ ^{[note 2][note 3]}
milliday	md	$\equiv \frac{1}{1000} \text{ d}$	$= 86.4 \text{ s}$
minute	min	$\equiv 60 \text{ s}$, due to leap seconds sometimes 59 s or 61 s ,	$= 60 \text{ s}$ ^[note 3]
moment		$\equiv 90 \text{ s}$	$= 90 \text{ s}$
month (full)	mo	$\equiv 30 \text{ d}$ ^[22]	$= 2.592 \times 10^6 \text{ s}$ ^[note 3]
month (Greg. av.)	mo	$= 30.436\,875 \text{ d}$	$\approx 2.6297 \text{ Ms}$ ^[note 3]
month (hollow)	mo	$\equiv 29 \text{ d}$ ^[22]	$= 2.5056 \text{ Ms}$ ^[note 3]

month (synodic)	mo	Cycle time of moon phases $\approx 29.530\,589$ d (average)	≈ 2.551 Ms
octaeteris		= 48 mo (full) + 48 mo (hollow) + 3 mo (full) [23][24] = 8 a of 365.25 d = 2922 d	= 252.4608 Ms ^[note 3]
Planck time		$\equiv (G\hbar/c^5)^{1/2}$	$\approx 1.351\,211\,868 \times 10^{-43}$ s
second	s	time of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom at 0 K ^[8] (but other seconds are sometimes used in astronomy). Also that time it takes for light to travel a distance of 299 792 458 metres.	(SI base unit)
shake		$\equiv 10^{-8}$ s	= 10 ns
sigma		$\equiv 10^{-6}$ s	= 1 μ s
Sothic cycle		$\equiv 1461$ a of 365 d	= 460.740 96 Ts
svedberg	S	$\equiv 10^{-13}$ s	= 100 fs
week	wk	$\equiv 7$ d = 168 h = 10 080 min	= 604.8 ks ^[note 3]
year (common)	a, y, <i>or</i> yr	365 d	= 31.536 Ms ^{[note 3][note 3][25]}
year (Gregorian)	a, y, <i>or</i> yr	= 365.2425 d average, calculated from common years (365 d) plus leap years (366 d) on most years divisible by 4. See leap year for details.	= 31.556 952 Ms ^[note 3]
year (Julian)	a, y, <i>or</i> yr	= 365.25 d average, calculated from common years (365 d) plus one leap year (366 d) every four years	= 31.5576 Ms
year (leap)	a, y, <i>or</i> yr	366 d	= 31.6224 Ms ^{[note 3][25]}
year (mean tropical)	a, y, <i>or</i> yr	conceptually, the length of time it takes for the Sun to return to the same position in the cycle of seasons, ^[Converter 1] approximately 365.242 19 d, each day being 86 400 SI seconds ^[26]	$\approx 31.556\,925$ Ms
year (sidereal)	a, y, <i>or</i> yr	\equiv time taken for Sun to return to the same position with respect to the stars of the celestial sphere, approximately 365.256 363 d	$\approx 31.558\,149\,7632$ Ms

Notes:

1. see Callippic cycle for explanation of the differences
2. This is based on the average Gregorian year. See above for definition of year lengths.
3. Where UTC is observed, the length this unit may increase or decrease depending on the number of leap seconds which occur during the time interval in question.

Frequency

Frequency

Name of unit	Symbol	Definition	Relation to SI units
hertz (SI unit)	Hz	≡ Number of cycles per second	= 1 Hz = 1/s
revolutions per minute	rpm	≡ One unit rpm equals one rotation completed around a fixed axis in one minute of time.	≈ 0.104 719 755 rad/s

Speed or velocity

Speed

Name of unit	Symbol	Definition	Relation to SI units
foot per hour	fph	≡ 1 ft/h	= 8.46×10^{-5} m/s
foot per minute	fpm	≡ 1 ft/min	= 5.08×10^{-3} m/s
foot per second	fps	≡ 1 ft/s	= 3.048×10^{-1} m/s
furlong per fortnight		≡ furlong/fortnight	≈ $1.663\ 095 \times 10^{-4}$ m/s
inch per hour	iph	≡ 1 in/h	= 7.05×10^{-6} m/s
inch per minute	ipm	≡ 1 in/min	= 4.23×10^{-4} m/s
inch per second	ips	≡ 1 in/s	= 2.54×10^{-2} m/s
kilometre per hour	km/h	≡ 1 km/h	= 2.7×10^{-1} m/s
knot	kn	≡ 1 nmi/h = 1.852 km/h	= 0.514 m/s
knot (Admiralty)	kn	≡ 1 NM (Adm)/h = 1.853 184 km/h	= $0.514\ 773$ m/s
mach number	<i>M</i>	Ratio of the speed to the speed of sound ^[note 1] in the medium (unitless).	≈ 340 to 295 m/s
metre per second (SI unit)	m/s	≡ 1 m/s	= 1 m/s
mile per hour	mph	≡ 1 mi/h	= 0.447 04 m/s
mile per minute	mpm	≡ 1 mi/min	= 26.8224 m/s
mile per second	mps	≡ 1 mi/s	= 1 609.344 m/s
speed of light in vacuum	<i>c</i>	≡ 299 792 458 m/s	= 299 792 458 m/s
speed of sound in air	<i>s</i>	1225 to 1062 km/h (761–660 mph or 661–574 kn) ^[note 1]	≈ 340 to 295 m/s

Note

- The speed of sound varies especially with temperature and pressure from about 1225 km/h (761 mph or 661 kn) in air at sea level to about 1062 km/h (660 mph or 570 kn) at jet altitudes (12 200 m or 40 000 ft).^[27]

A velocity consists of a speed combined with a direction; the speed part of the velocity takes units of speed.

Flow (volume)

Flow

Name of unit	Symbol	Definition	Relation to SI units
cubic foot per minute	CFM	$\equiv 1 \text{ ft}^3/\text{min}$	$= 4.719\,474\,432 \times 10^{-4} \text{ m}^3/\text{s}$
cubic foot per second	ft^3/s	$\equiv 1 \text{ ft}^3/\text{s}$	$= 0.028\,316\,846\,592 \text{ m}^3/\text{s}$
cubic inch per minute	in^3/min	$\equiv 1 \text{ in}^3/\text{min}$	$= 2.731\,177\bar{3} \times 10^{-7} \text{ m}^3/\text{s}$
cubic inch per second	in^3/s	$\equiv 1 \text{ in}^3/\text{s}$	$= 1.638\,7064 \times 10^{-5} \text{ m}^3/\text{s}$
cubic metre per second (SI unit)	m^3/s	$\equiv 1 \text{ m}^3/\text{s}$	$= 1 \text{ m}^3/\text{s}$
gallon (US fluid) per day	GPD	$\equiv 1 \text{ gal}/\text{d}$	$= 4.381\,263\,63\bar{8} \times 10^{-8} \text{ m}^3/\text{s}$
gallon (US fluid) per hour	GPH	$\equiv 1 \text{ gal}/\text{h}$	$= 1.051\,503\,27\bar{3} \times 10^{-6} \text{ m}^3/\text{s}$
gallon (US fluid) per minute	GPM	$\equiv 1 \text{ gal}/\text{min}$	$= 6.309\,019\,64 \times 10^{-5} \text{ m}^3/\text{s}$
litre per minute	LPM	$\equiv 1 \text{ L}/\text{min}$	$= 1.\bar{6} \times 10^{-5} \text{ m}^3/\text{s}$

Acceleration

Acceleration

Name of unit	Symbol	Definition	Relation to SI units
foot per hour per second	fph/s	$\equiv 1 \text{ ft}/(\text{h}\cdot\text{s})$	$= 8.4\bar{6} \times 10^{-5} \text{ m}/\text{s}^2$
foot per minute per second	fpm/s	$\equiv 1 \text{ ft}/(\text{min}\cdot\text{s})$	$= 5.08 \times 10^{-3} \text{ m}/\text{s}^2$
foot per second squared	fps^2	$\equiv 1 \text{ ft}/\text{s}^2$	$= 3.048 \times 10^{-1} \text{ m}/\text{s}^2$
gal; galileo	Gal	$\equiv 1 \text{ cm}/\text{s}^2$	$= 10^{-2} \text{ m}/\text{s}^2$
inch per minute per second	ipm/s	$\equiv 1 \text{ in}/(\text{min}\cdot\text{s})$	$= 4.2\bar{3} \times 10^{-4} \text{ m}/\text{s}^2$
inch per second squared	ips^2	$\equiv 1 \text{ in}/\text{s}^2$	$= 2.54 \times 10^{-2} \text{ m}/\text{s}^2$
knot per second	kn/s	$\equiv 1 \text{ kn}/\text{s}$	$\approx 5.1\bar{4} \times 10^{-1} \text{ m}/\text{s}^2$
metre per second squared (SI unit)	m/s^2	$\equiv 1 \text{ m}/\text{s}^2$	$= 1 \text{ m}/\text{s}^2$
mile per hour per second	mph/s	$\equiv 1 \text{ mi}/(\text{h}\cdot\text{s})$	$= 4.4704 \times 10^{-1} \text{ m}/\text{s}^2$
mile per minute per second	mpm/s	$\equiv 1 \text{ mi}/(\text{min}\cdot\text{s})$	$= 26.8224 \text{ m}/\text{s}^2$
mile per second squared	mps^2	$\equiv 1 \text{ mi}/\text{s}^2$	$= 1.609\,344 \times 10^3 \text{ m}/\text{s}^2$
standard gravity	g_0	$\equiv 9.806\,65 \text{ m}/\text{s}^2$	$= 9.806\,65 \text{ m}/\text{s}^2$

Force

Force

Name of unit	Symbol	Definition	Relation to SI units
atomic unit of force		$\equiv m_e \cdot a^2 \cdot c^2 / a_0$	$\approx 8.238\,722\,06 \times 10^{-8} \text{ N}$ ^[28]
dyne (cgs unit)	dyn	$\equiv \text{g} \cdot \text{cm/s}^2$	$= 10^{-5} \text{ N}$
kilogram-force; kilopond; grave-force	kgf; kp; Gf	$\equiv g_0 \times 1 \text{ kg}$	$= 9.806\,65 \text{ N}$
kip; kip-force	kip; kipf; klbf	$\equiv g_0 \times 1000 \text{ lb}$	$= 4.448\,221\,615\,2605 \times 10^3 \text{ N}$
milligrave-force, gravet-force	mGf; gf	$\equiv g_0 \times 1 \text{ g}$	$= 9.806\,65 \text{ mN}$
long ton-force	tnf	$\equiv g_0 \times 1 \text{ short ton}$	$= 9.964\,016\,418\,183\,52 \times 10^3 \text{ N}$
newton (SI unit)	N	A force capable of giving a mass of one kilogram an acceleration of one metre per second per second. ^[29]	$= 1 \text{ N} = 1 \text{ kg} \cdot \text{m/s}^2$
ounce-force	ozf	$\equiv g_0 \times 1 \text{ oz}$	$= 0.278\,013\,850\,953\,781\,25 \text{ N}$
pound-force	lbf	$\equiv g_0 \times 1 \text{ lb}$	$= 4.448\,221\,615\,2605 \text{ N}$
poundal	pdl	$\equiv 1 \text{ lb} \cdot \text{ft/s}^2$	$= 0.138\,254\,954\,376 \text{ N}$
short ton-force	tnf	$\equiv g_0 \times 1 \text{ short ton}$	$= 8.896\,443\,230\,521 \times 10^3 \text{ N}$
sthene (mts unit)	sn	$\equiv 1 \text{ t} \cdot \text{m/s}^2$	$= 10^3 \text{ N}$

See also: Conversion between weight (force) and mass

Pressure or mechanical stress

Pressure

Name of unit	Symbol	Definition	Relation to SI units
atmosphere (standard)	atm		$\equiv 101\,325\text{ Pa}^{[30]}$
atmosphere (technical)	at	$\equiv 1\text{ kgf/cm}^2$	$= 9.806\,65 \times 10^4\text{ Pa}^{[30]}$
bar	bar		$\equiv 10^5\text{ Pa}$
barye (cgs unit)		$\equiv 1\text{ dyn/cm}^2$	$= 0.1\text{ Pa}$
centimetre of mercury	cmHg	$\equiv 13\,595.1\text{ kg/m}^3 \times 1\text{ cm} \times g_0$	$\approx 1.333\,22 \times 10^3\text{ Pa}^{[30]}$
centimetre of water (4 °C)	cmH ₂ O	$\approx 999.972\text{ kg/m}^3 \times 1\text{ cm} \times g_0$	$\approx 98.0638\text{ Pa}^{[30]}$
foot of mercury (conventional)	ftHg	$\equiv 13\,595.1\text{ kg/m}^3 \times 1\text{ ft} \times g_0$	$\approx 4.063\,666 \times 10^4\text{ Pa}^{[30]}$
foot of water (39.2 °F)	ftH ₂ O	$\approx 999.972\text{ kg/m}^3 \times 1\text{ ft} \times g_0$	$\approx 2.988\,98 \times 10^3\text{ Pa}^{[30]}$
inch of mercury (conventional)	inHg	$\equiv 13\,595.1\text{ kg/m}^3 \times 1\text{ in} \times g_0$	$\approx 3.386\,389 \times 10^3\text{ Pa}^{[30]}$
inch of water (39.2 °F)	inH ₂ O	$\approx 999.972\text{ kg/m}^3 \times 1\text{ in} \times g_0$	$\approx 249.082\text{ Pa}^{[30]}$
kilogram-force per square millimetre	kgf/mm ²	$\equiv 1\text{ kgf/mm}^2$	$= 9.806\,65 \times 10^6\text{ Pa}^{[30]}$
kip per square inch	ksi	$\equiv 1\text{ kipf/sq in}$	$\approx 6.894\,757 \times 10^6\text{ Pa}^{[30]}$
long ton per square foot		$\equiv 1\text{ long ton} \times g_0 / 1\text{ sq ft}$	\approx $1.072\,517\,801\,1595 \times 10^5\text{ Pa}$
micrometre of mercury	μmHg	$\equiv 13\,595.1\text{ kg/m}^3 \times 1\ \mu\text{m} \times g_0 \approx$ 0.001 torr	$\approx 0.133\,3224\text{ Pa}^{[30]}$
millimetre of mercury	mmHg	$\equiv 13\,595.1\text{ kg/m}^3 \times 1\text{ mm} \times g_0 \approx 1$ torr	$\approx 133.3224\text{ Pa}^{[30]}$
millimetre of water (3.98 °C)	mmH ₂ O	$\approx 999.972\text{ kg/m}^3 \times 1\text{ mm} \times g_0 =$ $0.999\,972\text{ kgf/m}^2$	$= 9.806\,38\text{ Pa}$
pascal (SI unit)	Pa	$\equiv \text{N/m}^2 = \text{kg}/(\text{m}\cdot\text{s}^2)$	$= 1\text{ Pa}^{[31]}$
pièze (mts unit)	pz	$\equiv 1000\text{ kg/m}\cdot\text{s}^2$	$= 10^3\text{ Pa} = 1\text{ kPa}$
pound per square foot	psf	$\equiv 1\text{ lbf/ft}^2$	$\approx 47.880\,26\text{ Pa}^{[30]}$
pound per square inch	psi	$\equiv 1\text{ lbf/in}^2$	$\approx 6.894\,757 \times 10^3\text{ Pa}^{[30]}$
poundal per square foot	pdl/sq ft	$\equiv 1\text{ pdl/sq ft}$	$\approx 1.488\,164\text{ Pa}^{[30]}$
short ton per square foot		$\equiv 1\text{ short ton} \times g_0 / 1\text{ sq ft}$	$\approx 9.576\,0518 \times 10^4\text{ Pa}$
torr	torr	$\equiv 101\,325/760\text{ Pa}$	$\approx 133.3224\text{ Pa}^{[30]}$

Torque or moment of force

Torque

Name of unit	Symbol	Definition	Relation to SI units
foot-pound force	ft·lbf	$\equiv g_0 \times 1 \text{ lb} \times 1 \text{ ft}$	$= 1.355\,817\,948\,331\,4004 \text{ N}\cdot\text{m}$
foot-poundal	ft·pdl	$\equiv 1 \text{ lb}\cdot\text{ft}^2/\text{s}^2$	$= 4.214\,011\,009\,380\,48 \times 10^{-2} \text{ N}\cdot\text{m}$
inch-pound force	in·lbf	$\equiv g_0 \times 1 \text{ lb} \times 1 \text{ in}$	$= 0.112\,984\,829\,027\,6167 \text{ N}\cdot\text{m}$
metre kilogram-force	m·kgf	$\equiv g_0 \times \text{N} \times \text{m}$	$= 9.806\,65 \text{ N}\cdot\text{m}$
Newton metre (SI unit)	N·m	$\equiv \text{N} \times \text{m} = \text{kg}\cdot\text{m}^2/\text{s}^2$	$= 1 \text{ N}\cdot\text{m}$

Energy

Energy

Name of unit	Symbol	Definition	Relation to SI units
barrel of oil equivalent	boe	$\approx 5.8 \times 10^6 \text{ BTU}_{59\text{ °F}}$	$\approx 6.12 \times 10^9 \text{ J}$
British thermal unit (ISO)	BTU_{ISO}	$\equiv 1.0545 \times 10^3 \text{ J}$	$= 1.0545 \times 10^3 \text{ J}$
British thermal unit (International Table)	BTU_{IT}		$= 1.055\,055\,852\,62 \times 10^3 \text{ J}$
British thermal unit (mean)	BTU_{mean}		$\approx 1.055\,87 \times 10^3 \text{ J}$
British thermal unit (thermochemical)	BTU_{th}		$\approx 1.054\,350 \times 10^3 \text{ J}$
British thermal unit (39 °F)	$\text{BTU}_{39\text{ °F}}$		$\approx 1.059\,67 \times 10^3 \text{ J}$
British thermal unit (59 °F)	$\text{BTU}_{59\text{ °F}}$	$\equiv 1.054\,804 \times 10^3 \text{ J}$	$= 1.054\,804 \times 10^3 \text{ J}$
British thermal unit (60 °F)	$\text{BTU}_{60\text{ °F}}$		$\approx 1.054\,68 \times 10^3 \text{ J}$
British thermal unit (63 °F)	$\text{BTU}_{63\text{ °F}}$		$\approx 1.0546 \times 10^3 \text{ J}$
calorie (International Table)	cal_{IT}	$\equiv 4.1868 \text{ J}$	$= 4.1868 \text{ J}$
calorie (mean)	cal_{mean}	$\frac{1}{100}$ of the energy required to warm one gram of air-free water from 0 °C to 100 °C @ 1 atm	$\approx 4.190\,02 \text{ J}$
calorie (thermochemical)	cal_{th}	$\equiv 4.184 \text{ J}$	$= 4.184 \text{ J}$
Calorie (US; FDA)	Cal	$\equiv 1 \text{ kcal} = 1000 \text{ cal}$	$= 4184 \text{ J}$
calorie (3.98 °C)	$\text{cal}_{3.98\text{ °C}}$		$\approx 4.2045 \text{ J}$
calorie (15 °C)	$\text{cal}_{15\text{ °C}}$	$\equiv 4.1855 \text{ J}$	$= 4.1855 \text{ J}$
calorie (20 °C)	$\text{cal}_{20\text{ °C}}$		$\approx 4.1819 \text{ J}$
Celsius heat unit (International Table)	CHU_{IT}	$\equiv 1 \text{ BTU}_{\text{IT}} \times 1 \text{ K}/\text{°R}$	$= 1.899\,100\,534\,716 \times 10^3 \text{ J}$
cubic centimetre of atmosphere; standard cubic centimetre	cc atm; scc	$\equiv 1 \text{ atm} \times 1 \text{ cm}^3$	$= 0.101\,325 \text{ J}$
cubic foot of atmosphere; standard cubic foot	cu ft atm; scf	$\equiv 1 \text{ atm} \times 1 \text{ ft}^3$	$= 2.869\,204\,480\,9344 \times 10^3 \text{ J}$

cubic foot of natural gas		$\equiv 1000 \text{ BTU}_{\text{IT}}$	$= 1.055\,055\,852\,62 \times 10^6 \text{ J}$
cubic yard of atmosphere; standard cubic yard	cu yd atm; scy	$\equiv 1 \text{ atm} \times 1 \text{ yd}^3$	$= 77.468\,520\,985\,2288 \times 10^3 \text{ J}$
electronvolt	eV	$\equiv e \times 1 \text{ V}$	$\approx 1.602\,176\,565(35) \times 10^{-19} \text{ J}$
erg (cgs unit)	erg	$\equiv 1 \text{ g} \cdot \text{cm}^2/\text{s}^2$	$= 10^{-7} \text{ J}$
foot-pound force	ft lbf	$\equiv g_0 \times 1 \text{ lb} \times 1 \text{ ft}$	$= 1.355\,817\,948\,331\,4004 \text{ J}$
foot-poundal	ft pdl	$\equiv 1 \text{ lb} \cdot \text{ft}^2/\text{s}^2$	$= 4.214\,011\,009\,380\,48 \times 10^{-2} \text{ J}$
gallon-atmosphere (imperial)	imp gal atm	$\equiv 1 \text{ atm} \times 1 \text{ gal (imp)}$	$= 460.632\,569\,25 \text{ J}$
gallon-atmosphere (US)	US gal atm	$\equiv 1 \text{ atm} \times 1 \text{ gal (US)}$	$= 383.556\,849\,0138 \text{ J}$
hartree, atomic unit of energy	E_h	$\equiv m_e \cdot \alpha^2 \cdot c^2 (= 2 \text{ Ry})$	$\approx 4.359\,744 \times 10^{-18} \text{ J}$
horsepower-hour	hp·h	$\equiv 1 \text{ hp} \times 1 \text{ h}$	$= 2.684\,519\,537\,696\,172\,792 \times 10^6 \text{ J}$
inch-pound force	in lbf	$\equiv g_0 \times 1 \text{ lb} \times 1 \text{ in}$	$= 0.112\,984\,829\,027\,6167 \text{ J}$
joule (SI unit)	J	The work done when a force of one newton moves the point of its application a distance of one metre in the direction of the force. ^[29]	$= 1 \text{ J} = 1 \text{ m} \cdot \text{N} = 1 \text{ kg} \cdot \text{m}^2/\text{s}^2 = 1 \text{ C} \cdot \text{V} = 1 \text{ W} \cdot \text{s}$
kilocalorie; large calorie	kcal; Cal	$\equiv 1000 \text{ cal}_{\text{IT}}$	$= 4.1868 \times 10^3 \text{ J}$
kilowatt-hour; Board of Trade Unit	kW·h; B.O.T.U.	$\equiv 1 \text{ kW} \times 1 \text{ h}$	$= 3.6 \times 10^6 \text{ J}$
litre-atmosphere	l atm; sl	$\equiv 1 \text{ atm} \times 1 \text{ L}$	$= 101.325 \text{ J}$
quad		$\equiv 10^{15} \text{ BTU}_{\text{IT}}$	$= 1.055\,055\,852\,62 \times 10^{18} \text{ J}$
rydberg	Ry	$\equiv R_\infty \cdot h \cdot c$	$\approx 2.179\,872 \times 10^{-18} \text{ J}$
therm (E.C.)		$\equiv 100\,000 \text{ BTU}_{\text{IT}}$	$= 105.505\,585\,262 \times 10^6 \text{ J}$
therm (US)		$\equiv 100\,000 \text{ BTU}_{59 \text{ }^\circ\text{F}}$	$= 105.4804 \times 10^6 \text{ J}$
thermie	th	$\equiv 1 \text{ Mcal}_{\text{IT}}$	$= 4.1868 \times 10^6 \text{ J}$
ton of coal equivalent	TCE	$\equiv 7 \text{ Gcal}_{\text{th}}$	$= 29.288 \times 10^9 \text{ J}$
tonne of oil equivalent	toe	$\equiv 10 \text{ Gcal}_{\text{IT}}$	$= 41.868 \times 10^9 \text{ J}$
ton of TNT	tTNT	$\equiv 1 \text{ Gcal}_{\text{th}}$	$= 4.184 \times 10^9 \text{ J}$

Power or heat flow rate

Power

Name of unit	Symbol	Definition	Relation to SI units
atmosphere-cubic centimetre per minute	atm ccm	$\equiv 1 \text{ atm} \times 1 \text{ cm}^3/\text{min}$	$= 1.688\,75 \times 10^{-3} \text{ W}$
atmosphere-cubic centimetre per second	atm ccs	$\equiv 1 \text{ atm} \times 1 \text{ cm}^3/\text{s}$	$= 0.101\,325 \text{ W}$
atmosphere-cubic foot per hour	atm cfh	$\equiv 1 \text{ atm} \times 1 \text{ cu ft/h}$	$= 0.797\,001\,247\,04 \text{ W}$
atmosphere-cubic foot per minute	atm cfm	$\equiv 1 \text{ atm} \times 1 \text{ cu ft/min}$	$= 47.820\,074\,682\,24 \text{ W}$
atmosphere-cubic foot per second	atm cfs	$\equiv 1 \text{ atm} \times 1 \text{ cu ft/s}$	$= 2.869\,204\,480\,9344 \times 10^3 \text{ W}$
BTU (International Table) per hour	BTU _{IT} /h	$\equiv 1 \text{ BTU}_{\text{IT}}/\text{h}$	$\approx 0.293\,071 \text{ W}$
BTU (International Table) per minute	BTU _{IT} /min	$\equiv 1 \text{ BTU}_{\text{IT}}/\text{min}$	$\approx 17.584\,264 \text{ W}$
BTU (International Table) per second	BTU _{IT} /s	$\equiv 1 \text{ BTU}_{\text{IT}}/\text{s}$	$= 1.055\,055\,852\,62 \times 10^3 \text{ W}$
calorie (International Table) per second	cal _{IT} /s	$\equiv 1 \text{ cal}_{\text{IT}}/\text{s}$	$= 4.1868 \text{ W}$
erg per second	erg/s	$\equiv 1 \text{ erg/s}$	$= 10^{-7} \text{ W}$
foot-pound-force per hour	ft·lbf/h	$\equiv 1 \text{ ft lbf/h}$	$\approx 3.766\,161 \times 10^{-4} \text{ W}$
foot-pound-force per minute	ft·lbf/min	$\equiv 1 \text{ ft lbf/min}$	$= 2.259\,696\,580\,552\,334 \times 10^{-2} \text{ W}$
foot-pound-force per second	ft·lbf/s	$\equiv 1 \text{ ft lbf/s}$	$= 1.355\,817\,948\,331\,4004 \text{ W}$
horsepower (boiler)	hp	$\approx 34.5 \text{ lb/h} \times 970.3 \text{ BTU}_{\text{IT}}/\text{lb}$	$\approx 9\,809.5 \text{ W}^{[32]}$
horsepower (European electrical)	hp	$\equiv 75 \text{ kp}\cdot\text{m/s}$	$= 736 \text{ W}$
horsepower (electrical)	hp	$\equiv 746 \text{ W}$	$= 746 \text{ W}^{[32]}$
horsepower (mechanical)	hp	$\equiv 550 \text{ ft}\cdot\text{lbf/s}^{[32]}$	$= 745.699\,871\,582\,270\,22 \text{ W}$
horsepower (metric)	hp or PS	$\equiv 75 \text{ m}\cdot\text{kgf/s}$	$= 735.498\,75 \text{ W}^{[32]}$
litre-atmosphere per minute	L·atm/min	$\equiv 1 \text{ atm} \times 1 \text{ L/min}$	$= 1.688\,75 \text{ W}$
litre-atmosphere per second	L·atm/s	$\equiv 1 \text{ atm} \times 1 \text{ L/s}$	$= 101.325 \text{ W}$
lusec	lusec	$\equiv 1 \text{ L}\cdot\mu\text{mHg/s}^{[14]}$	$\approx 1.333 \times 10^{-4} \text{ W}$

poncelet	p	$\equiv 100 \text{ m}\cdot\text{kgf/s}$	$= 980.665 \text{ W}$
square foot equivalent direct radiation	sq ft EDR	$\equiv 240 \text{ BTU}_{\text{IT}}/\text{h}$	$\approx 70.337\,057 \text{ W}$
ton of air conditioning		$\equiv 2000 \text{ lb of ice melted} / 24 \text{ h}$	$\approx 3504 \text{ W}$
ton of refrigeration (imperial)		$\equiv 2240 \text{ lb} \times \text{ice}_{\text{IT}} / 24 \text{ h}$: $\text{ice}_{\text{IT}} = 144 \text{ }^\circ\text{F} \times 2326 \text{ J/kg}\cdot^\circ\text{F}$	$\approx 3.938\,875 \times 10^3 \text{ W}$
ton of refrigeration (IT)		$\equiv 2000 \text{ lb} \times \text{ice}_{\text{IT}} / 24 \text{ h}$: $\text{ice}_{\text{IT}} = 144 \text{ }^\circ\text{F} \times 2326 \text{ J/kg}\cdot^\circ\text{F}$	$\approx 3.516\,853 \times 10^3 \text{ W}$
watt (SI unit)	W	The power which in one second of time gives rise to one joule of energy. ^[29]	$= 1 \text{ W} = 1 \text{ J/s} = 1 \text{ N}\cdot\text{m/s} = 1 \text{ kg}\cdot\text{m}^2/\text{s}^3$

Action

Action

Name of unit	Symbol	Definition	Relation to SI units
atomic unit of action	au	$\equiv \hbar \equiv h/2\pi$	$\approx 1.054\,571\,68 \times 10^{-34} \text{ J}\cdot\text{s}$ ^[33]

Dynamic viscosity

Dynamic viscosity

Name of unit	Symbol	Definition	Relation to SI units
pascal second (SI unit)	Pa·s	$\equiv \text{N}\cdot\text{s}/\text{m}^2, \text{ kg}/(\text{m}\cdot\text{s})$	$= 1 \text{ Pa}\cdot\text{s}$
poise (cgs unit)	P	$\equiv 1 \text{ barye}\cdot\text{s}$	$= 0.1 \text{ Pa}\cdot\text{s}$
pound per foot hour	lb/(ft·h)	$\equiv 1 \text{ lb}/(\text{ft}\cdot\text{h})$	$\approx 4.133\,789 \times 10^{-4} \text{ Pa}\cdot\text{s}$
pound per foot second	lb/(ft·s)	$\equiv 1 \text{ lb}/(\text{ft}\cdot\text{s})$	$\approx 1.488\,164 \text{ Pa}\cdot\text{s}$
pound-force second per square foot	lbf·s/ft ²	$\equiv 1 \text{ lbf}\cdot\text{s}/\text{ft}^2$	$\approx 47.880\,26 \text{ Pa}\cdot\text{s}$
pound-force second per square inch	lbf·s/in ²	$\equiv 1 \text{ lbf}\cdot\text{s}/\text{in}^2$	$\approx 6\,894.757 \text{ Pa}\cdot\text{s}$

Kinematic viscosity

Kinematic viscosity

Name of unit	Symbol	Definition	Relation to SI units
square foot per second	ft ² /s	$\equiv 1 \text{ ft}^2/\text{s}$	$= 0.092\,903\,04 \text{ m}^2/\text{s}$
square metre per second (SI unit)	m ² /s	$\equiv 1 \text{ m}^2/\text{s}$	$= 1 \text{ m}^2/\text{s}$
stokes (cgs unit)	St	$\equiv 10^{-4} \text{ m}^2/\text{s}$	$= 10^{-4} \text{ m}^2/\text{s}$

Electric current

Electric current

Name of unit	Symbol	Definition	Relation to SI units
ampere (SI base unit)	A	\equiv The constant current needed to produce a force of 2×10^{-7} newton per metre between two straight parallel conductors of infinite length and negligible circular cross-section placed one metre apart in a vacuum. ^[8]	$= 1 \text{ A} = 1 \text{ C/s}$
electromagnetic unit; abampere (cgs unit)	abamp	$\equiv 10 \text{ A}$	$= 10 \text{ A}$
esu per second; statampere (cgs unit)	esu/s	$\equiv 0.1 \text{ A}\cdot\text{m/s}/c$	$\approx 3.335\,641 \times 10^{-10} \text{ A}$

Electric charge

Electric charge

Name of unit	Symbol	Definition	Relation to SI units
abcoulomb; electromagnetic unit (cgs unit)	abC; emu	$\equiv 10 \text{ C}$	$= 10 \text{ C}$
atomic unit of charge	au	$\equiv e$	$\approx 1.602\,176\,462 \times 10^{-19} \text{ C}$
coulomb	C	\equiv The amount of electricity carried in one second of time by one ampere of current. ^[29]	$= 1 \text{ C} = 1 \text{ A}\cdot\text{s}$
faraday	F	$\equiv 1 \text{ mol} \times N_A \cdot e$	$\approx 96\,485.3383 \text{ C}$
milliampere hour	$\text{mA}\cdot\text{h}$	$\equiv 0.001 \text{ A} \times 1 \text{ h}$	$= 3.6 \text{ C}$
statcoulomb; franklin; electrostatic unit (cgs unit)	statC; Fr; esu	$\equiv 0.1 \text{ A}\cdot\text{m}/c$	$\approx 3.335\,641 \times 10^{-10} \text{ C}$

Electric dipole

Electric dipole

Name of unit	Symbol	Definition	Relation to SI units
atomic unit of electric dipole moment	ea_0		$\approx 8.478\,352\,81 \times 10^{-30} \text{ C}\cdot\text{m}$ ^[34]
coulomb meter	$\text{C}\cdot\text{m}$		$= 1 \text{ C} \cdot 1 \text{ m}$
debye	D	$= 10^{-10} \text{ esu}\cdot\text{Å}$	$= 3.335\,640\,95 \times 10^{-30} \text{ C}\cdot\text{m}$ ^[35]

Electromotive force, electric potential difference

Voltage, electromotive force

Name of unit	Symbol	Definition	Relation to SI units
abvolt (cgs unit)	abV	$\equiv 10^{-8} \text{ V}$	$= 10^{-8} \text{ V}$
statvolt (cgs unit)	statV	$\equiv c \cdot (1 \text{ } \mu\text{J/A}\cdot\text{m})$	$= 299.792\,458 \text{ V}$
volt (SI unit)	V	The difference in electric potential across two points along a conducting wire carrying one ampere of constant current when the power dissipated between the points equals one watt. ^[29]	$= 1 \text{ V} = 1 \text{ W/A}$ $= 1 \text{ kg}\cdot\text{m}^2/(\text{A}\cdot\text{s}^3)$

Electrical resistance**Electrical resistance**

Name of unit	Symbol	Definition	Relation to SI units
ohm (SI unit)	Ω	The resistance between two points in a conductor when one volt of electric potential difference, applied to these points, produces one ampere of current in the conductor. ^[29]	$= 1 \text{ } \Omega = 1 \text{ V/A}$ $= 1 \text{ kg}\cdot\text{m}^2/(\text{A}^2\cdot\text{s}^3)$

Capacitance**Capacitor's ability to store charge**

Name of unit	Symbol	Definition	Relation to SI units
farad (SI unit)	F	The capacitance between two parallel plates that results in one volt of potential difference when charged by one coulomb of electricity. ^[29]	$= 1 \text{ F} = 1 \text{ C/V}$ $= 1 \text{ A}^2\cdot\text{s}^4/(\text{kg}\cdot\text{m}^2)$

Magnetic flux**magnetic flux**

Name of unit	Symbol	Definition	Relation to SI units
maxwell (CGS unit)	Mx	$\equiv 10^{-8} \text{ Wb}$ ^[32]	$= 10^{-8} \text{ Wb}$
weber (SI unit)	Wb	Magnetic flux which, linking a circuit of one turn, would produce in it an electromotive force of 1 volt if it were reduced to zero at a uniform rate in 1 second. ^[29]	$= 1 \text{ Wb} = 1 \text{ V}\cdot\text{s}$ $= 1 \text{ kg}\cdot\text{m}^2/(\text{A}\cdot\text{s}^2)$

Magnetic flux density

What physicists call **Magnetic field** is called **Magnetic flux density** by electrical engineers and **magnetic induction** by applied mathematicians and electrical engineers.

Name of unit	Symbol	Definition	Relation to SI units
gauss (CGS unit)	G	$\equiv \text{Mx}/\text{cm}^2 = 10^{-4} \text{ T}$	$= 10^{-4} \text{ T}$ ^[36]
tesla (SI unit)	T	$\equiv \text{Wb}/\text{m}^2$	$= 1 \text{ T} = 1 \text{ Wb}/\text{m}^2 = 1 \text{ kg}/(\text{A}\cdot\text{s}^2)$

Inductance

Inductance

Name of unit	Symbol	Definition	Relation to SI units
henry (SI unit)	H	The inductance of a closed circuit that produces one volt of electromotive force when the current in the circuit varies at a uniform rate of one ampere per second. ^[29]	$= 1 \text{ H} = 1 \text{ Wb}/\text{A}$ $= 1 \text{ kg}\cdot\text{m}^2/(\text{A}\cdot\text{s})^2$

Temperature

Temperature

Name of unit	Symbol	Definition	Relation to SI units
degree Celsius	°C	$[\text{°C}] \equiv [\text{K}] - 273.15$	$[\text{K}] \equiv [\text{°C}] + 273.15$
degree Delisle	°De		$[\text{K}] = 373.15 - [\text{°De}] \times \frac{2}{3}$
degree Fahrenheit	°F	$[\text{°F}] \equiv [\text{°C}] \times \frac{9}{5} + 32$	$[\text{K}] \equiv ([\text{°F}] + 459.67) \times \frac{5}{9}$
degree Newton	°N		$[\text{K}] = [\text{°N}] \times \frac{100}{33} + 273.15$
degree Rankine	°R;	$[\text{°R}] \equiv [\text{K}] \times \frac{9}{5}$	$[\text{K}] \equiv [\text{°R}] \times \frac{5}{9}$
degree Réaumur	°Ré		$[\text{K}] = [\text{°Ré}] \times \frac{5}{4} + 273.15$
degree Rømer	°Rø		$[\text{K}] = ([\text{°Rø}] - 7.5) \times \frac{40}{21} + 273.15$
Regulo Gas Mark	GM;	$[\text{°F}] \equiv [\text{GM}] \times 25 + 300$	$[\text{K}] \equiv [\text{GM}] \times \frac{125}{9} + 422.038$
kelvin (SI base unit)	K	$\equiv \frac{1}{273.16}$ of the thermodynamic temperature of the triple point of water. ^[8]	$\equiv 1 \text{ K}$

Information entropy

Information entropy

Name of unit	Symbol	Definition	Relation to SI units	Relation to bits
SI unit	J/K	\equiv J/K	= 1 J/K	
nat; nip; nepit	nat	$\equiv k_B$	= $1.380\,6505(23) \times 10^{-23}$ J/K	
bit; shannon	bit; b; Sh	$\equiv \ln(2) \times k_B$	= $9.569\,940(16) \times 10^{-24}$ J/K	= 1 bit
ban; hartley	ban; Hart	$\equiv \ln(10) \times k_B$	= $3.179\,0653(53) \times 10^{-23}$ J/K	
nibble		\equiv 4 bits	= $3.827\,9760(64) \times 10^{-23}$ J/K	= 2^2 bit
byte	B	\equiv 8 bits	= $7.655\,952(13) \times 10^{-23}$ J/K	= 2^3 bit
kilobyte (decimal)	kB	\equiv 1000 B	= $7.655\,952(13) \times 10^{-20}$ J/K	= 8000 bit
kilobyte (kibibyte)	KB; KiB	\equiv 1024 B	= $7.839\,695(13) \times 10^{-20}$ J/K	= 2^{13} bit = 8192 bit

Often, information entropy is measured in shannons, whereas the (discrete) storage space of digital devices is measured in bits. Thus, uncompressed redundant data occupy more than one bit of storage per shannon of information entropy. The multiples of a bit listed above are usually used with this meaning. Other times the bit is used as a measure of information entropy and is thus a synonym of shannon.

Luminous intensity

The candela is the preferred nomenclature for the SI unit.

Luminous intensity

Name of unit	Symbol	Definition	Relation to SI units
candela (SI base unit); candle	cd	The luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540×10^{12} hertz and that has a radiant intensity in that direction of 1/683 watt per steradian. ^[8]	= 1 cd
candlepower (new)	cp	\equiv cd The use of <i>candlepower</i> as a unit is discouraged due to its ambiguity.	= 1 cd
candlepower (old, pre-1948)	cp	Varies and is poorly reproducible. ^[37] Approximately 0.981 cd. ^[14]	\approx 0.981 cd

Luminance

Luminance

Name of unit	Symbol	Definition	Relation to SI units
candela per square foot	cd/ft ²	≡ cd/ft ²	≈ 10.763 910 417 cd/m ²
candela per square inch	cd/in ²	≡ cd/in ²	≈ 1 550.0031 cd/m ²
candela per square metre (SI unit); nit (deprecated ^[14])	cd/m ²	≡ cd/m ²	= 1 cd/m ²
footlambert	fL	≡ (1/π) cd/ft ²	≈ 3.426 259 0996 cd/m ²
lambert	L	≡ (10 ⁴ /π) cd/m ²	≈ 3 183.098 8618 cd/m ²
stilb (CGS unit)	sb	≡ 10 ⁴ cd/m ²	= 10 ⁴ cd/m ²

Luminous flux

Luminous flux

Name of unit	Symbol	Definition	Relation to SI units
lumen (SI unit)	lm	≡ cd·sr	= 1 lm = 1 cd·sr

Illuminance

Illuminance

Name of unit	Symbol	Definition	Relation to SI units
footcandle; lumen per square foot	fc	≡ lm/ft ²	= 10.763 910 417 lx
lumen per square inch	lm/in ²	≡ lm/in ²	≈ 1 550.0031 lx
lux (SI unit)	lx	≡ lm/m ²	= 1 lx = 1 lm/m ²
phot (CGS unit)	ph	≡ lm/cm ²	= 10 ⁴ lx

Radiation - source activity

Radioactivity

Name of unit	Symbol	Definition	Relation to SI units
becquerel (SI unit)	Bq	≡ Number of disintegrations per second	= 1 Bq = 1/s
curie	Ci	≡ 3.7 × 10 ¹⁰ Bq ^[38]	= 3.7 × 10 ¹⁰ Bq
rutherford (H)	rd	≡ 1 MBq	= 10 ⁶ Bq

Please note that although becquerel (Bq) and hertz (Hz) both ultimately refer to the same SI base unit (s^{−1}), Hz is used only for periodic phenomena, and Bq is only used for stochastic processes associated with radioactivity.^[39]

Radiation - exposure

Radiation - exposure

Name of unit	Symbol	Definition	Relation to SI units
roentgen	R	$1 \text{ R} \equiv 2.58 \times 10^{-4} \text{ C/kg}^{[32]}$	$= 2.58 \times 10^{-4} \text{ C/kg}$

The roentgen is not an SI unit and the NIST strongly discourages its continued use.^[40]

Radiation - absorbed dose**Radiation - absorbed dose**

Name of unit	Symbol	Definition	Relation to SI units
gray (SI unit)	Gy	$\equiv 1 \text{ J/kg} = 1 \text{ m}^2/\text{s}^2$ ^[41]	$= 1 \text{ Gy}$
rad	rad	$\equiv 0.01 \text{ Gy}^{[32]}$	$= 0.01 \text{ Gy}$

Radiation - equivalent dose**Radiation - equivalent dose**

Name of unit	Symbol	Definition	Relation to SI units
Röntgen equivalent man	rem	$\equiv 0.01 \text{ Sv}$	$= 0.01 \text{ Sv}$
sievert (SI unit)	Sv	$\equiv 1 \text{ J/kg}^{[39]}$	$= 1 \text{ Sv}$

Although the definitions for sievert (Sv) and gray (Gy) would seem to indicate that they measure the same quantities, this is not the case. The effect of receiving a certain dose of radiation (given as Gy) is variable and depends on many factors, thus a new unit was needed to denote the biological effectiveness of that dose on the body; this is known as the equivalent dose and is shown in Sv. The general relationship between absorbed dose and equivalent dose can be represented as

$$H = Q \cdot D$$

where *H* is the equivalent dose, *D* is the absorbed dose, and *Q* is a dimensionless quality factor. Thus, for any quantity of *D* measured in Gy, the numerical value for *H* measured in Sv may be different.^[42]

Software tools

There are many conversion tools. They are found in the function libraries of applications such as spreadsheets databases, in calculators, and in macro packages and plugins for many other applications such as the mathematical, scientific and technical applications.

There are many standalone applications that offer the thousands of the various units with conversions. For example, the free software movement offers a command line utility GNU units (<https://www.gnu.org/software/units/>) for Linux and Windows.

See also

- Accuracy and precision
- Conversion of units of temperature

- English units
- False precision
- Imperial units
- International System of Units
- Mesures usuelles
- Metric prefix (e.g. "kilo-" prefix)
- Metric system
- Natural units
- Rounding
- Significant figures
- United States customary units
- Units (software)
- Units conversion by factor-label
- Units of measurement

Notes and references

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Notes

1. The technical definition of tropical year is the period of time for the ecliptic longitude of the Sun to increase 360 degrees. (Urban & Seidelmann 2013, Glossary, s.v. year, tropical)

External links

- Statutory Instrument 1995 No. 1804 (<http://legislation.gov.uk/uksi/1995/1804>) *Units of measurement regulations 1995* From legislation.gov.uk (<http://legislation.gov.uk>)
- *How Many? A dictionary of units of measurement*



Wikibooks has a book on the topic of: **FHSST Physics Units:How to Change Units**

(<http://www.unc.edu/~rowlett/units/>)

- "NIST: Fundamental physical constants — Non-SI units" (PDF). (35.7 KB)
- NIST Guide to SI Units (<http://physics.nist.gov/Pubs/SP811/appenB9.html>) Many conversion factors listed.
- Online Unit Conversion Website (<http://www.onlineconversions.org/>) Convert any unit from and to other units.
- The Unified Code for Units of Measure (<http://aurora.rg.iupui.edu/~shadow/units/UCUM/ucum.html>)
- Units, Symbols, and Conversions XML Dictionary (<http://w3.energistics.org/uom/poscUnits22.xml>)
- Units, Symbols, Exchange, Equations, Human Readable (<https://www.unitwolf.com>)
- Units of Measurement Software (https://www.dmoz.org/Science/Reference/Units_of_Measurement/Software/) at DMOZ
- Units of Measurement Online Conversion (https://www.dmoz.org/Science/Reference/Units_of_Measurement/Online_Conversion/) at DMOZ



Wikivoyage has a travel guide for ***Metric and Imperial equivalents.***

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