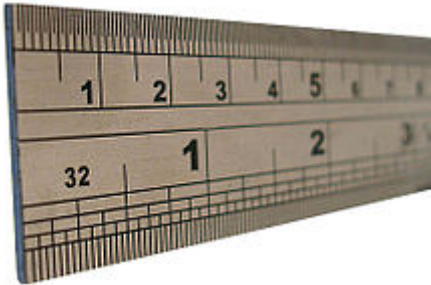


Unit of length

A **unit of length** refers to any discrete, pre-established length or distance having a constant magnitude which is used as a reference or convention to express linear dimension. The most common units in modern use are U.S. customary units in the United States and metric units elsewhere. British Imperial units are still used for some purposes in the United Kingdom and some other countries. The metric system is sub-divided into SI and non-SI units.^{[1][2][3]}



A ruler, depicting two customary units of length, the centimetre and the inch

Contents

Metric system

SI

Non-SI

Imperial/US

Marine

Aviation

Surveying

Science

Astronomy

Physics

Archaic

Informal

Other

See also

References

Further reading

Metric system

SI

The base unit in the International System of Units (SI) is the metre, defined as "the length of the path travelled by light in vacuum during a time interval of ¹/₂₉₉₇₉₂₄₅₈ seconds."^[4] It is approximately equal to 1.0936 yd. Other units are derived from the metre by adding prefixes from the table below:

Standard prefixes for the SI units of measure

Multiples	Prefix name		<u>deca</u>	<u>hecto</u>	<u>kilo</u>	<u>mega</u>	<u>giga</u>	<u>tera</u>	<u>peta</u>	<u>exa</u>	<u>zetta</u>	<u>yotta</u>
	Prefix symbol		da	h	k	M	G	T	P	E	Z	Y
	Factor	10^0	10^1	10^2	10^3	10^6	10^9	10^{12}	10^{15}	10^{18}	10^{21}	10^{24}
Submultiples	Prefix name		<u>deci</u>	<u>centi</u>	<u>milli</u>	<u>micro</u>	<u>nano</u>	<u>pico</u>	<u>femto</u>	<u>atto</u>	<u>zepto</u>	<u>yocto</u>
	Prefix symbol		d	c	m	μ	n	p	f	a	z	y
	Factor	10^0	10^{-1}	10^{-2}	10^{-3}	10^{-6}	10^{-9}	10^{-12}	10^{-15}	10^{-18}	10^{-21}	10^{-24}

For example, a kilometre is 1000 m.

Non-SI

In the Centimetre–gram–second system of units, the basic unit of length is the centimetre, or $\frac{1}{100}$ of a metre. Other non-SI units are derived from decimal multiples of the metre.

Name	Symbol	SI value
fermi	fm	<u>femtometre</u>
<u>ångström</u>	Å	100 <u>picometres</u>
micron	μm	1 <u>micrometre</u>
<u>Norwegian/Swedish mil</u> or <u>myriametre</u>		10,000 metres
<u>x unit</u>	xu	0.1 picometre

Imperial/US

The basic unit of length in the Imperial and U.S. customary systems is the yard, defined as exactly 0.9144 m by international treaty in 1959.^{[2][5]}

Common Imperial units and U.S. customary units of length include^[6]

- thou or mil ($\frac{1}{1000}$ of an inch)
- line ($\frac{1}{12}$ of an inch)
- inch (2.54 cm)
- foot (12 inches, 0.3048 m)
- yard 3 feet (0.91 m)
- (terrestrial) mile 5,280 feet (1,610 m)
- (land) league 3 miles (4,800 m)

Marine

In addition, the following are used by sailors:

- fathom (for depth; only in non-metric countries) (2 yards = 1.8288 m)
- nautical mile (one minute of arc of latitude ≈1852 m)

Aviation

Aviators use feet for altitude worldwide (except in Russia and China) and nautical miles for distance.

Surveying

Surveyors in the United States continue to use:

- chain (22 yards, or 20.1168 m)
- rod (also called pole or perch) (quarter of a chain, 05.0292 m)

Science

Astronomy

Astronomical measure uses:

- Earth radius $R_{\oplus} \approx 6,371 \text{ km}$ ^[7]
- Lunar distance $LD \approx 384\,402 \text{ km}$.^[8] Average distance between the center of Earth and the center of the Moon.
- astronomical unit AU, au or ua. Defined as $149\,597\,870\,700 \text{ m}$.^[9] Approximately the distance between the Earth and Sun.
- light-year ly $\approx 9\,460\,730\,472\,580.8 \text{ km}$. The distance that light travels in avacuum in one Julian year.^[10]
- parsec pc $\approx 30\,856\,775\,814\,671.9 \text{ km}$ or about $3.261\,56 \text{ ly}$
- Hubble length 14.4 billion light-years or 4.55 gigaparsecs



Determination of the rod, using the length of the left foot of 16 randomly chosen people coming from church service

Physics

In atomic physics, sub-atomic physics, and cosmology, the preferred unit of length is often related to a chosen fundamental physical constant, or combination thereof. This is often a characteristic radius or wavelength of a particle. Some common natural units of length are included in this table:

Atomic property	Symbol	Length, in metres	Reference
The classical electron radius	r_e	$2.817\,940\,285(31) \times 10^{-15}$	[11]
The Compton wavelength of the electron	λ_C	$2.426\,310\,215(18) \times 10^{-12}$	[11]
The reduced Compton wavelength of the electron	λ_C	$386.159\,267\,64(18) \times 10^{-15}$	[12]
The Compton wavelength (or reduced Compton wavelength) of any fundamental particle	λ_x		
The <u>Bohr radius</u> of the hydrogen atom (<u>Atomic unit of length</u>)	a_0	$5.291\,772\,083(19) \times 10^{-11}$	[11]
The reduced wavelength of hydrogen radiation	$1 / R_{\infty}$	$9.112\,670\,505\,509(83) \times 10^{-8}$	[11]
The <u>Planck length</u>	ℓ_P	$1.616\,199(97) \times 10^{-35}$	[13]
<u>Stoney unit</u> of length	l_S	1.381×10^{-35}	
Quantum chromodynamics (<u>QCD</u>) unit of length	l_{QCD}	2.103×10^{-16}	
Natural units based on the electronvolt	1 eV^{-1}	1.97×10^{-7}	

Archaic

Archaic units of distance include:

- cana
- cubit
- rope
- league
- li (China)

- pace (the "double pace" of about 5 feet used in Ancient Rome)
- verst (Russia)

Informal

In everyday conversation, and in informal literature, it is common to see lengths measured in units of objects of which everyone knows the approximate width. Common examples are:

- Double-decker bus (9.5–11 metres in length)
- Football field (generally around 110 metres in length)
- Thickness of a human hair (around 80 micrometres)

Other

Horse racing and other equestrian activities keep alive:

- furlong $\approx$ 0.125 miles (201 m)
- horse length $\approx$ 8 feet (2.4 m)

See also

- List of examples of lengths
- Medieval weights and measures
- Orders of magnitude (length)
- System of measurement
- Units of measurement

References

1. Cardarelli, François (2003). *Encyclopaedia of Scientific Units, Weights, and Measures: Their SI Equivalences and Origins*. Springer. ISBN 9781852336820
2. Hinkelman, Edward G.; Sibylla Putzi (2005) *Dictionary Of International Trade: Handbook Of The Global Trade Community*. World Trade Press. p. 245. ISBN 9781885073723
3. Judson, Lewis Van Hagen (1960). *Units of Weight and Measure (United States Customary and Metric): Definitions and Tables of Equivalents, Issue 233* ([https://books.google.com/books?id=Mialg1senzMC&printsec=frontcover&dq=Units+of+Weight+and+Measure+\(United+States+Customary+and+Metric\)&source=bl&ots=0JAs-6uKEu&sig=f8BSRt44JIZPrxDvUklqe9KBrd4&hl=en&sa=X&ei=GHh9UL3hM-TbigKHqYHwDg&ved=0CDEQ6AEwAA#v=onepage&q=Units%20of%20Weight%20and%20Measure%20\(United%20States%20Customary%20and%20Metric\)&f=false](https://books.google.com/books?id=Mialg1senzMC&printsec=frontcover&dq=Units+of+Weight+and+Measure+(United+States+Customary+and+Metric)&source=bl&ots=0JAs-6uKEu&sig=f8BSRt44JIZPrxDvUklqe9KBrd4&hl=en&sa=X&ei=GHh9UL3hM-TbigKHqYHwDg&ved=0CDEQ6AEwAA#v=onepage&q=Units%20of%20Weight%20and%20Measure%20(United%20States%20Customary%20and%20Metric)&f=false)) U.S. Department of Commerce, National Bureau of Standards. pp. 3–4 Retrieved 16 October 2012.
4. "17th General Conference on Weights and Measures (1983), Resolution 1" (<http://www.bipm.org/en/CGPM/db/17/1/>) Retrieved 2012-09-19.
5. Donald Fenna (26 October 2002) *A dictionary of weights, measures, and units* (<https://books.google.com/books?id=SISFRzNPLPsC&pg=PA130>). Oxford University Press. pp. 130–1. ISBN 978-0-19-860522-5 Retrieved 8 January 2012.
6. Cardarelli 2003 pp. 29–30
7. Moritz, H. (March 2000). "Geodetic Reference System 1980" (<http://www.springerlink.com/content/0bgccy5bedgdfu/about/>). *Journal of Geodesy*. **74** (1): 128–133. Bibcode:2000JGeod..74..128. (<http://adsabs.harvard.edu/abs/2000JGeod..74..128>). doi:10.1007/s001900050278 (<https://doi.org/10.1007%2Fs001900050278>)
8. Battat, J. B. R.; Murphy T. W.; Adelberger, E. G. (January 2009). "The Apache Point Observatory Lunar Laser-ranging Operation (APOLLO): Two Years of Millimeter-Precision Measurements of the Earth-Moon Range". *Astronomical Society of the Pacific* **121** (875): 29–40. Bibcode:2009PASP..121...29B (<http://adsabs.harvard.edu/abs/2009PASP..121...29B>). doi:10.1086/596748 (<https://doi.org/10.1086%2F596748>) JSTOR 10.1086/596748 (<https://www.jstor.org/stable/10.1086/596748>)

9. Geoff Brumfiel (14 Sep 2012). "The astronomical unit gets fixed: Earth–Sun distance changes from slippery equation to single number" (<http://www.nature.com/news/the-astronomical-unit-gets-fixed-1.11416>) Retrieved 14 Sep 2012.
10. *The IAU and astronomical units* (http://www.iau.org/public_press/themes/measuring/), International Astronomical Union, retrieved 2008-07-05
11. Quinn, T.J.; Leschiutta, S.; Tavella, P. (August 2000). *Recent advances in metrology and fundamental constants* (http://books.google.com/books?id=WE22Fez60EcC&pg=PA142&lpg=PA142&dq=bohr+ruler&source=bl&ots=9k-FNw3Jtl&sig=F_vF12OYEkkG6ufK7FYAULc8RE&h=en&sa=X&ved=0ahUKEwiF453Gk8bLAhUC32MKHUiKdg0Q6AEIHzAA#v=onepage&q&f=false) Amsterdam ; Washington, DC: IOS Press, 2001. Proceedings of the International School of Physics "Enrico Fermi". pp. 142–143.
12. "Compton wavelength over 2 pi" (<http://physics.nist.gov/cgi-bin/cuu/Value?ecomwlbar>). *The NIST Reference on Constants, Units, and Uncertainty* NIST. Retrieved 15 October 2012.
13. "Planck length" (<http://physics.nist.gov/cgi-bin/cuu/Value?plk>). *The NIST Reference on Constants, Units, and Uncertainty*. NIST. Retrieved 15 October 2012.

Further reading

- Whitelaw, Ian (2007). *A Measure of All Things: The Story of Man and Measurement* Macmillan. ISBN 9780312370268
-

Retrieved from 'https://en.wikipedia.org/w/index.php?title=Unit_of_length&oldid=821449470

This page was last edited on 20 January 2018, at 15:12.

Text is available under the [Creative Commons Attribution-ShareAlike License](#); additional terms may apply. By using this site, you agree to the [Terms of Use](#) and [Privacy Policy](#). Wikipedia® is a registered trademark of the [Wikimedia Foundation, Inc.](#), a non-profit organization.