



Designation: D1914 – 95 (Reapproved 2022)

# Standard Practice for Conversion Units and Factors Relating to Sampling and Analysis of Atmospheres<sup>1</sup>

This standard is issued under the fixed designation D1914; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This practice provides units and factors useful for members of the air pollution and meteorological communities.

1.2 This practice is used together with [IEEE/ASTM SI-10](#), which discusses SI units and contains selected conversion factors for inter-relation of SI units and some commonly used non-metric units.

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

[D1356 Terminology Relating to Sampling and Analysis of Atmospheres](#)

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D22 on Air Quality and is the direct responsibility of Subcommittee D22.01 on Quality Control.

Current edition approved Sept. 1, 2022. Published September 2022. Originally approved in 1961. Last previous edition approved in 2014 as D1914 – 95 (2014). DOI: 10.1520/D1914-95R22.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves](#)

[IEEE/ASTM SI-10 Standard for Use of the International System of Units \(SI\): The Modern Metric System](#)

## 3. Significance and Use

3.1 ASTM requires the use of SI units in all its publications and their use in reporting atmospheric measurement data. However, there are historic data and even data currently reported that are based on a variety of units of measurement. This practice tabulates factors that are necessary to convert such data to SI and other units of measurement.

3.2 [IEEE/ASTM SI-10](#) does not list all the conversion factors commonly used in air pollution and meteorological fields. This practice supplements [IEEE/ASTM SI-10](#).

3.3 The values reported here were obtained from a number of standard publications. They were adjusted to five figures and organized in a rational order. All values reflect the latest information from the 16th General Conference on Weights and Measurements held in 1979.

3.4 The factors in [Table 1](#) are provided to change units of measurement from one system to related units in other systems, as well as to smaller or larger units in the same system.

3.5 Values of units in the left column may be converted to values of units in the right column merely by multiplying by the conversion factor provided in the center column.

**TABLE 1 Conversion Units**

Multiply	By	To Obtain
<b>Temperature</b>		
Degrees Fahrenheit (F) + 459.72	1	Degrees Fahrenheit Absolute or Rankine (R)
Degrees Fahrenheit (F) – 32	$\frac{5}{9}$	Degrees Celsius (C)
Degrees Celsius (C) + 273.15	1	Kelvins (K)
Degrees Celsius (C) + 17.78	1.8	Degrees Fahrenheit (F)
Degrees Rankine (R) – 459.72	1	Degrees Fahrenheit (F)
Kelvins (K) – 273.15	1	Degrees Celsius (C)
<b>Pressure</b>		
Dynes per square centimetre	$1.4504 \times 10^{-5}$	Pounds per square inch
	$10.197 \times 10^{-4}$	Grams per square centimetre
	$1 \times 10^{-6}$	Bars
Pounds per square inch absolute (psia)	0.1	Pascals
	70.307	Grams per square centimetre absolute
	51.715	Millimetres of mercury absolute
	144	Pounds per square foot absolute
	1	Pounds per square inch gage + 14.696
Pounds per square inch gage (psig)	6894.8	Pascals
	70.307	Grams per square centimetre
	51.715	Millimetres of mercury at 0 °C
	27.673	Inches of water at 4 °C
	1	Pounds per square inch absolute – 14.696
Inches of water (at 4 °C)	6894.8	Pascals
	0.03614	Pounds per square inch
	0.07355	Inches of mercury
	0.57818	Ounces per square inch
	25.399	Kilograms per square metre
Inches of mercury (at 0 °C)	2490.8	Dynes per square centimetre
	249.2	Pascals
	0.49116	Pounds per square inch
	13.595	Inches of water at 4 °C
	345.31	Kilograms per square metre
Millimetres of mercury (at 0 °C)	$3.3864 \times 10^4$	Dynes per square centimetre
	3386.4	Pascals
	0.01934	Pounds per square inch
	1.3595	Grams per square centimetre
	1333.2	Dynes per square centimetre
Centimetres of mercury (at 0 °C)	133.32	Pascals
	$1.3332 \times 10^4$	Dynes per square centimetre
	135.95	Kilograms per square metre
	27.845	Pounds per square foot
	1333.2	Pascals
Atmosphere (normal)	760	Millimetres of mercury at 0 °C
	1.0133	Bars
	14.696	Pounds per square inch
	29.921	Inches of mercury at 0 °C
	1033.2	Grams per square centimetre
Bars	$1.0133 \times 10^6$	Dynes per square centimetre
	$1.0132 \times 10^5$	Pascals
	14.504	Pounds per square inch
	$1.0197 \times 10^4$	Kilograms per square metre
	$1.000 \times 10^6$	Dynes per square centimetre
Pascals	750.06	Millimetres of mercury (0 °C)
	0.98692	Atmospheres
	$10^5$	Pascals
	10	Dynes per square centimetre
	$1.4504 \times 10^{-4}$	Pounds per square inch absolute
	$4.0128 \times 10^{-3}$	Inches of water (at 4 °C)
	$2.9530 \times 10^{-4}$	Inches of mercury (at 0 °C)
$7.5007 \times 10^{-3}$	Millimetre of mercury (at 0 °C)	
Density	$9.8692 \times 10^{-6}$	Atmosphere (normal)
	$10^{-5}$	Bars
<b>Density</b>		
Grams per cubic centimetre	1	Grams per millilitre
	0.03613	Pounds per cubic inch
	8.3452	Pounds per gallon (U.S.)
	62.428	Pounds per cubic foot
Pounds per cubic foot	0.01602	Grams per cubic centimetre
	$5.7870 \times 10^{-4}$	Pounds per cubic inch
<b>Concentration</b> (See also Section 4.)		
<i>Gases in Gas:</i>		
Parts per million by volume (ppm(v))	1	Micromoles of gas per mole of gas
	$1 \times 10^{-4}$	Percent by volume

**TABLE 1** *Continued*

Multiply	By	To Obtain
	Molecular weight/24 450	Milligrams of substance per litre of air (at 25 °C and 101.3 kPa pressure)
	$1 \times 10^{-6}$	<u>Partial pressure of one constituent</u> Total pressure of mixture
Parts per billion by volume (ppb(v))	$1 \times 10^{-3}$	Parts per million by volume
One percent by volume	10 000	Parts per million by volume
Milligrams per litre	1000	Milligrams per cubic metre
Milligrams per cubic metre	$1 \times 10^6$	Micrograms per cubic metre
Micrograms per cubic metre	$1 \times 10^{-3}$	Milligrams per litre
<i>Liquid and Solid Particles in Gas:</i>		Milligrams per litre
Milligrams per litre	$1 \times 10^3$	Milligrams per cubic metre
	$1 \times 10^6$	Micrograms per cubic metre
Milligrams per cubic metre	$1 \times 10^{-3}$	Milligrams per litre
Micrograms per cubic metre	$1 \times 10^{-6}$	Milligrams per litre
Ounces per thousand cubic feet	1.0012	Grams per cubic metre
Grains per cubic foot	2.2883	Grams per cubic metre
Particles per cubic centimetre	$2.8317 \times 10^4$	Particles per cubic foot
	$1 \times 10^6$	Particles per cubic metre
Particles per cubic metre	$1 \times 10^{-6}$	Particles per cubic centimetre
	0.02832	Particles per cubic foot
Millions of particles per cubic foot	35.314	Millions of particles per cubic metre
<i>Gases, Liquids, and Solids in Liquids:</i>		
Gram molecular weight per litre	1	Moles per litre
Parts per million by weight	1	Milligrams per litre (where specific gravity of dispersion medium is 1.00)
<b>Length</b>		
Angstrom units	$1 \times 10^{-10}$	Metres
	$3.9370 \times 10^{-9}$	Inches
	$1 \times 10^{-4}$	Micrometres
	$1 \times 10^{-8}$	Centimetres
	0.1	Nanometres
Nanometres	$1 \times 10^{-9}$	Metres
	$1 \times 10^{-7}$	Centimetres
	10	Angstrom units
Micrometres	$3.9370 \times 10^{-5}$	Inches
	$1 \times 10^{-6}$	Metres
	$1 \times 10^{-4}$	Centimetres
	$1 \times 10^4$	Angstrom units
Millimetres	0.03937	Inches (U.S.)
	1000	Micrometres
Centimetres	0.39370	Inches (U.S.)
	$1 \times 10^4$	Micrometres
	$1 \times 10^7$	Nanometres
	$1 \times 10^8$	Angstrom units
Metres	$6.2137 \times 10^{-4}$	Miles (statute)
	1.0936	Yards (U.S.)
	39.370	Inches (U.S.)
	$1 \times 10^9$	Nanometres
	$1 \times 10^{10}$	Angstrom units
Kilometres	0.53961	Miles (nautical)
	0.62137	Miles (statute)
	1093.6	Yards
	3280.8	Feet
Inches (U.S.)	0.02778	Yards
	2.5400	Centimetres
	$2.5400 \times 10^3$	Angstrom units
Feet (U.S.)	0.30480	Metres
	30.480	Centimetres
Yards (U.S.)	$5.6818 \times 10^{-4}$	Miles
	0.91440	Metres
	91.440	Centimetres
Miles (nautical)	1.1516	Statute miles
	2026.8	Yards
	1.8533	Kilometres
Miles (U.S. statute)	320	Rods
	0.86836	Nautical miles
	1.6094	Kilometres
	1609.4	Metres
<b>Area</b>		
Square millimetres	0.00155	Square inches
	$1 \times 10^{-6}$	Square metres
	0.01	Square centimetres
	1.2732	Circular millimetres
Square centimetres	$1.1960 \times 10^{-4}$	Square yards

**TABLE 1** *Continued*

Multiply	By	To Obtain
	0.00108	Square feet
	0.15500	Square inches
	$1 \times 10^{-4}$	Square metres
	100	Square millimetres
Square kilometres	0.38610	Square miles (U.S.)
	$1.1960 \times 10^6$	Square yards
	$1.0764 \times 10^7$	Square feet
	$1 \times 10^6$	Square metres
Square inches (U.S.)	247.10	Acres (U.S.)
	0.00694	Square feet
	0.00077	Square yards
	$6.4516 \times 10^{-4}$	Square metres
	6.4516	Square centimetres
	645.16	Square millimetres
Square feet (U.S.)	$3.5870 \times 10^{-8}$	Square miles
	0.11111	Square yards
	144	Square inches
	0.09290	Square metres
	929.03	Square centimetres
Square miles	$2.2957 \times 10^{-5}$	Acres
	640	Acres
	$3.0976 \times 10^6$	Square yards
	$2.7878 \times 10^7$	Square feet
	2.5900	Square kilometres
	$2.5900 \times 10^6$	Square metres
	Volume	
Cubic millimetres	$6.1023 \times 10^{-5}$	Cubic inches
	$1 \times 10^{-9}$	Cubic metres
	0.001	Cubic centimetres
Millilitres	0.03381	Ounces (fluid, U.S.)
	0.06102	Cubic inches
	0.001	Litres
	1	Cubic centimetres
Litres	0.00131	Cubic yards
	0.26418	Gallons (U.S.)
	0.03532	Cubic feet
	33.815	Ounces (fluid, U.S.)
	61.025	Cubic inches
	0.00100	Cubic metres
	1000	Cubic centimetres
Cubic metres	1.3079	Cubic yards (U.S.)
	35.314	Cubic feet (U.S.)
	264.17	Gallons (U.S.)
	$6.1023 \times 10^4$	Cubic inches
	1000	Litres
	$1 \times 10^6$	Cubic centimetres
	$1 \times 10^9$	Cubic millimetres
Gallons (U.S.)	0.00495	Cubic yards
	0.13368	Cubic feet
	128	Ounces (fluid)
	231	Cubic inches
	0.00378	Cubic metres
	3.7854	Litres
	3785.4	Millilitres
	3785.4	Cubic centimetres
Cubic inches (U.S.)	$2.1433 \times 10^{-5}$	Cubic yards
	$5.7870 \times 10^{-4}$	Cubic feet
	0.00433	Gallons (U.S.)
	0.55410	Ounces (fluid)
	$1.6387 \times 10^{-5}$	Cubic metres
	0.01639	Litres
	16.387	Millilitres
	16.387	Cubic centimetres
	$1.6387 \times 10^4$	Cubic millimetres
Cubic feet (U.S.)	0.03704	Cubic yards
	7.4810	Gallons (U.S.)
	1728.0	Cubic inches
	0.02832	Cubic metres
	28.316	Litres
	$2.8316 \times 10^4$	Cubic centimetres
Cubic centimetres	1	Millilitres
	$1.3079 \times 10^{-6}$	Cubic yards
	$3.5314 \times 10^{-5}$	Cubic feet (U.S.)
	$2.6417 \times 10^{-4}$	Gallons (U.S.)
	0.03381	Ounces (fluid, U.S.)