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## 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 D 1914; 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.

### 2. Referenced Documents

#### 2.1 *ASTM Standards:*

D 1356 Terminology Relating to Sampling and Analysis of Atmospheres<sup>2</sup>

E 11 Specification for Wire-Cloth Sieves for Testing Purposes<sup>3</sup>

IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System<sup>3</sup>

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D-22 on Sampling and Analysis of Atmospheres and is the direct responsibility of Subcommittee D22.01 on Quality Control.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 11.03

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 14.02.

### 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	$1.4504 \times 10^{-5}$ $10.197 \times 10^{-4}$ $1 \times 10^{-6}$	Pounds per square inch Grams per square centimetre Bars Pascals
Pounds per square inch absolute (psia)	0.1 70.307 51.715 144 1	Grams per square centimetre absolute Millimetres of mercury absolute Pounds per square foot absolute Pounds per square inch gage + 14.696 Pascals
Pounds per square inch gage (psig)	6894.8 70.307 51.715 27.673 1	Grams per square centimetre Millimetres of mercury at 0°C Inches of water at 4°C Pounds per square inch absolute – 14.696 Pascals
Inches of water (at 4°C)	6894.8 0.03614 0.07355 0.57818	Pounds per square inch Inches of mercury Ounces per square inch
Inches of mercury (at 0°C)	25.399 2490.8 249.2 0.49116 13.595 345.31 $3.3864 \times 10^4$ 3386.4	Kilograms per square metre Dynes per square centimetre Pascals Pounds per square inch Inches of water at 4°C Kilograms per square metre Dynes per square centimetre Pascals
Millimetres of mercury (at 0°C)	0.01934 1.3595 1333.2 133.32	Pounds per square inch Grams per square centimetre Dynes per square centimetre Pascals
Centimetres of mercury (at 0°C)	$1.3332 \times 10^4$ 135.95 27.845 1333.2	Dynes per square centimetre Kilograms per square metre Pounds per square foot Pascals
Atmosphere (normal)	760 1.0133 14.696 29.921 1033.2 $1.0133 \times 10^6$ $1.0132 \times 10^5$	Millimetres of mercury at 0°C Bars Pounds per square inch Inches of mercury at 0°C Grams per square centimetre Dynes per square centimetre Pascals
Bars	14.504 $1.0197 \times 10^4$ $1.000 \times 10^6$ 750.06 0.98692 $10^5$	Pounds per square inch Kilograms per square metre Dynes per square centimetre Millimetres of mercury (0°C) Atmospheres Pascals
Pascals	10 $1.4504 \times 10^{-4}$ $4.0128 \times 10^{-3}$ $2.9530 \times 10^{-4}$ $7.5007 \times 10^{-3}$ $9.8692 \times 10^{-6}$ $10^{-5}$	Dynes per square centimeter Pounds per square inch absolute Inches of water (at 4°C) Inches of mercury (at 0°C) Millimeter of mercury (at 0°C) Atmosphere (normal) Bars
<b>Density</b>		
Grams per cubic centimetre	1 0.03613 8.3452 62.428	Grams per millilitre Pounds per cubic inch Pounds per gallon (U. S.) Pounds per cubic foot
Pounds per cubic foot	0.01602 $5.7870 \times 10^{-4}$	Grams per cubic centimetre Pounds per cubic inch

**TABLE 1** *Continued*

Multiply	By	To Obtain
	Concentration (See also Section 4.)	
<i>Gases in Gas:</i>		
Parts per million by volume (ppm(v))	1 $1 \times 10^{-4}$ Molecular weight/24,450 $1 \times 10^{-6}$	Micromoles of gas per mole of gas Percent by volume Milligrams of substance per litre of air (at 25°C and 101.3 kPa pressure) <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	$1 \times 10^3$	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
Ounces per thousand cubic feet	1.0012	Milligrams per litre
Grains per cubic foot	2.2883	Grams per cubic metre
Particles per cubic centimetre	$2.8317 \times 10^4$	Grams per cubic metre
Particles per cubic metre	$1 \times 10^6$ $1 \times 10^{-6}$	Particles per cubic foot Particles per cubic metre
Millions of particles per cubic foot	0.02832	Particles per cubic centimetre
<i>Gases, Liquids, and Solids in Liquids:</i>	35.314	Particles per cubic foot
Gram molecular weight per litre	1	Millions of particles per cubic metre
Parts per million by weight	1	Moles per litre Milligrams per litre (where specific gravity of dispersion medium is 1.00)
Length		
Angstrom units	$1 \times 10^{-10}$ $3.9370 \times 10^{-9}$ $1 \times 10^{-4}$ $1 \times 10^{-8}$ 0.1	Metres Inches Micrometres Centimetres Nanometres
Nanometres	$1 \times 10^{-9}$ $1 \times 10^{-7}$	Metres Centimetres
Micrometres	10 $3.9370 \times 10^{-5}$ $1 \times 10^{-6}$ $1 \times 10^{-4}$	Angstrom units Inches Metres Centimetres
Millimetres	$1 \times 10^4$ 0.03937	Angstrom units Inches (U. S.)
Centimetres	1000 0.39370 $1 \times 10^4$ $1 \times 10^7$ $1 \times 10^8$	Micrometres Inches (U. S.) Micrometres Nanometres
Metres	$6.2137 \times 10^{-4}$ 1.0936 39.370 $1 \times 10^9$ $1 \times 10^{10}$	Angstrom units Miles (statute) Yards (U. S.) Inches (U. S.) Nanometres
Kilometres	0.53961 0.62137 1093.6 3280.8	Angstrom units Miles (nautical) Miles (statute) Yards
Inches (U. S.)	0.02778 2.5400	Feet Yards Centimetres
Feet (U. S.)	$2.5400 \times 10^3$ 0.30480 30.480	Angstrom units Metres Centimetres
Yards (U. S.)	$5.6818 \times 10^{-4}$ 0.91440 91.440	Miles Metres Centimetres
Miles (nautical)	1.1516 2026.8 1.8533	Statute miles Yards Kilometres
Miles (U. S. statute)	320 0.86836 1.6094	Rods Nautical miles Kilometres