

CONVERSION FACTORS

TO CONVERT	INTO	MULTIPLY BY	TO CONVERT	INTO	MULTIPLY BY
atm (standard atmosphere)	inHg*	29.921 3	inHg (inch of mercury)*	inH ₂ O (inch of water)**	13.595 1
atm	lbf/ft ²	2.116 22 × 10 ³	inHg*	lbf/ft ²	70.726 2
atm	mb	1.013 25 × 10³	inHg*	N/m ²	3.386 39 × 10 ³
atm	mmHg (millimetre of mercury)*	760.001	J (joule)	kW h	0.277 778 × 10 ⁻⁶
atm	N/m ²	101.325 × 10³	J	N m	1
atm	torr	760	J	W s	1
Btu (British thermal unit)***	cal (international table calorie) [†]	251.996	kgf (kilogramme-force)	N	9.806 65
Btu***	Chu****	0.555 6	kn (international knot) [‡]	km/h	1.852
Btu***	ft lbf	778.169	kn [‡]	mile/h ^{††}	1.150 78
Btu***	J	1.055 06 × 10 ³	kn [‡]	m/s	0.514 444
Btu/s****	hp	1.414 85	kn ^{2‡}	(km/h) ²	3.429 904
Btu/s****	kW (kilowatt)	1.055 06	kn ^{2‡}	(m/s) ²	0.264 653
Btu/ft ² h***	W/m ²	3.154 59	kp (kilopond) ^{‡‡}	N	9.806 65
Btu/lb °F***	J/kg K	4.186 8 × 10³	kW h	N m	3.6 × 10⁶
Btu/ft h °F***	W/m K	1.730 73			
Chu (Celsius heat unit)****	cal [†]	453.6	1 (litre)	m ³	1.000 × 10 ⁻³
Chu****	ft lbf	1.401 × 10 ³	lb (pound)	kg (kilogramme)	0.453 592 37
Chu****	J	1.899 × 10 ³	lbf (pound-force)	N	4.448 22
Chu/s****	hp	2.547	lb/ft	kg/m	1.488 16
Chu/s****	kW	1.899	lb/ft ³	kg/m ³	16.018 5
Chu/ft ² s****	W/m ²	20.44 × 10 ³	lbf/ft ²	mb	0.478 803
Chu/slug K****	J/kg K	130.1	lbf/ft ²	N/m ²	47.880 3
Chu/ft s K****	W/m K	6.231 × 10 ³			
ch (cheval vapeur)	hp	0.986 320	mb (millibar)	N/m ²	100
ch	N m/s	735.499	mile ^{††}	km	1.609 344
degree	rad (radian)	0.017 453 3	mile/gal ^{††}	km/m ³	354.006
degree (temp.)	(see TEMPERATURE DATA)		mile/h ^{††}	km/h	1.609 344
dyn (dyne)	N (newton)	10 × 10⁻⁶	mile/h ^{††}	m/s	0.447 04
erg	J	0.1 × 10⁻⁶			
			n mile (international nautical mile) ^{†††}	km (kilometre)	1.852
ft (foot)	m (metre)	0.304 8	n mile ^{†††}	mile	1.150 78
ft ²	m ²	0.092 903 04	n mile/gal ^{†††}	km/m ³	407.383
ft ³	in ³	1.728 × 10³			
ft ³	l	28.32	P (poise)	kg/m s	0.1
ft ³	m ³	0.028 316 8	P	lb/ft s	0.067 196 9
ft/s	km/h	1.097 28	PS (Pferdestärke)	(see ch)	
ft/s	kn [‡]	0.592 484	pdl (poundal)	lbf	0.031 081 0
ft/s	m/s	0.304 8	pdl	N	0.138 255
ft/s	mile/h ^{††}	0.681 818			
(ft/s) ²	(kn) ^{2‡}	0.351 037	St (stokes)	m ² /s	0.1 × 10 ⁻³
(ft/s) ²	(m/s) ²	0.092 903 04	slug (slug)	kg	14.593 9
ft ² /s	m ² /s	0.092 903 04	slug	lb	32.174 0
ft/s ²	m/s ²	0.304 8	slug/ft ³	kg/m ³	515.379
ft lbf	N m	1.355 82	slug/ft s	kg/m s	47.880 3
ft lbf/ft ²	N/m	14.593 9			
gal (gallon)	ft ³	0.160 544	ton ^{†††}	t (tonne)	1.016 05
gal	1	4.546	tonf (ton-force)	N	9.964 02 × 10 ³
gal	US gal	1.200 95	tonf/ft ²	N/m ²	107.252 × 10 ³
			tonf/ft ²	N/m ²	133.322
hp (horsepower)	ft lbf/s	550			
hp	kW	0.745 700	USgal (US gallon)	1	3.785
hp	N m/s (W)	745.700			
in (inch)	mm (millimetre)	25.4			
in ²	mm ²	645.16	yd (yard)	m	0.914 4

NOTES

The symbols used here are largely those recommended in Reference 3. The definitions of the units used in SI will be found in Reference 3. Definitions of the other units used will be found either in Reference 1 or Reference 3.

The conversion factors given are largely obtained from References 1 and 3. Those given in bold type are exact. Six significant figures are used in general except where such accuracy is not justified.

* Pressures given in inHg or mmHg are assumed to be corrected to 0°C.

** Pressures given in inH₂O are assumed to be corrected to 4°C.

*** The definition of the Btu (see Reference 1) is 1 Btu/lb = **2.326 × 10³** J/kg.

**** The definition of the Chu used here is 1 Chu = **1.8** Btu.

† The definition of the cal (international table calorie) (see Reference 1) is 1 cal = **4.1868** J.

†† The statute mile is defined as 1 mile = **5.280 × 10³** ft = **1.609 344 × 10³** m.

††† The international nautical mile is defined as (see Reference 1) 1 n mile = **1.852 × 10³** m = 6.076 12 × 10³ ft. (This supersedes the UK nautical mile, **6.080 × 10³** ft = 1.853 18 × 10³ m.)

‡ The definition of the knot used here is that of the international knot (see Reference 1), i.e. 1 kn = **1** n mile/h.

‡‡ The kilopond is the name adopted in Germany and some other countries for the kilogramme-force.

‡‡‡ The ton used here is defined as 1 ton = **2.240 × 10³** lb = 1.016 05 × 10³ kg.

TEMPERATURE DATA

Temperature Scales in Common Use

	<i>Absolute zero</i>	<i>Freezing point of water</i>	<i>Boiling point of water</i>
Celsius	-273.15°C	0°C	100°C
Fahrenheit	-459.67°F	32°F	212°F
kelvin	0 K	273.15 K	373.15 K
Rankine	0°R	491.67°R	671.67°R

Conversion Formulae

If C , F , K and R represent the same temperature value on the Celsius, Fahrenheit, kelvin and Rankine scales, respectively,

$$\frac{C}{5} = \frac{F - 32}{9} = \frac{K - 273.15}{5} = \frac{R - 491.67}{9}.$$

MISCELLANEOUS DATA

General

e	=	base of natural logarithms = 2.718 28.
$\log_{10} e$	=	0.434 294.
π	=	3.141 59.
$\log_{10} \pi$	=	0.497 150
$\log_e x / \log_{10} x$	=	2.302 58.
g	=	acceleration due to gravity = 9.806 65 m/s ² = 32.174 0 ft/s ² .

This is the international standard value of g which corresponds to Lat. 45°N and has been used for the conversion factors. The value at the Equator is decreased by 0.25 per cent, and the decrease due to height above sea level is approximately 0.03 per cent per 1000 m.

J = mechanical equivalent of heat = 1 N m/J = 1.401 $\times 10^3$ ft lbf/Chu = 778.169 ft lbf/Btu.

Some Useful Data for Air

Pr	=	Prandtl number = 0.72 for dry air at 1 atm and 0°C.
$Pr^{1/2}$	=	0.85.
$Pr^{1/3}$	=	0.90.
$Pr^{2/3}$	=	0.80.
R	=	gas constant = 287.1 J/kg K = 96.03 ft lbf/lb K = 3.090 $\times 10^3$ ft lbf/slug K for dry air at 1 atm and 0°C (see Reference 2).
γ	=	ratio of specific heat capacities = 1.4 for dry air at 1 atm and 0°C.

Sea Level Data for the International Standard Atmosphere (Reference 2)

a_0	=	speed of sound	=	340.294 m/s = 1.116 45 $\times 10^3$ ft/s = 661.479 kn.
p_0	=	pressure	=	101.325 $\times 10^3$ N/m ² = 2.116 22 $\times 10^3$ lbf/ft ² .
T_0	=	temperature	=	288.15 K.
μ_0	=	dynamic viscosity	=	17.894 $\times 10^{-6}$ kg/m s = 373.718 $\times 10^{-9}$ slug/ft s
ρ_0	=	density	=	1.225 0 kg/m ³ = 2.376 89 $\times 10^{-3}$ slug/ft ³ .

Some Useful Data for Water

- 1 l of water at 4°C and 1 atm weighs 1.000 kgf = 2.205 lbf.
- 1 ft³ of water at 4°C and 1 atm weighs 28.32 kgf = 62.43 lbf.
- 1 gal of water at 62°F and 30 inHg weighs 4.536 kgf = 10 lbf.

REFERENCES

1. BSI Conversion factors and tables. British Standards Institution, BS 350: Part 1, 1959. (With amendments to 1965.)
2. ICAO Manual of the ICAO Standard Atmosphere. International Civil Aviation Organization Document 7488/2, 1964.
3. ANDERTON, P. BIGG, P.H. Changing to the metric system. Conversion factors, symbols and definitions. 3rd Edition. HMSO, 1969.