Physical quantity	Name of unit	Value	Symbol
length	metre	base unit	m
	millimetre	0.001 m	mm
	centimetre	0.01 m	cm
	kilometre	1 000 m	km
	international nautical mile (for navigation)	1 852 m	n mile
mass (commonly called ‘weight’)	kilogram	base unit (1 000 g)	kg
	gram	0.001 kg	g
	tonne	1 000 kg	t
time interval	second	base unit	s
	minute	60 s	min
	hour	60 min	h
	day	24 h	d
area	square metre	SI unit	m^2
	square millimetre	0.000 001 m^2	mm^2
	square centimetre	0.000 1 m^2	cm^2
	hectare	10 000 m^2	ha
volume	cubic metre	SI unit	m^3
	cubic millimetre	$10^{-9} m^3$	mm^3
	cubic centimetre	0.000 001 m^3	cm^3
	cubic decimetre	0.001 m^3	dm^3
volume (for fluids only)	litre[§]	0.001 m^3	L
	millilitre	0.001 L	mL
	kilolitre	1 000 L (1 m^3)	kL
velocity and speed	metre per second	SI unit L	m/s or m s^{-1}
	kilometre per hour	0.27 m/s	km/h or km h^{-1}
	knot (for navigation)	1 n mile/h or 0.514 m/s	kn
force	newton*	SI unit	N
energy	joule*	SI unit	J
power	watt*	SI unit	W
density	kilogram per cubic metre	SI unit	kg/m^3 or kg m^{-3}
	tonne per cubic metre	1 000 kg/m^3	t/m^3 or tm^{-3}
	gram per cubic centimetre	1 000 kg/m^3	g/cm^3 or g cm^{-3}
density (for fluids only)	kilogram per litre	1 000 kg/m^3	kg/L or kgL^{-1}
	gram per millilitre	1 000 kg/m^3	g/mL or g mL^{-1}
pressure	pascal	SI unit (N/m^2)	Pa
pressure (for meteorology)	bar	100 000 Pa	b
	millibar	100 Pa	mb
electric current	ampere †	base unit	A
potential difference or electromotive force	volt*, †	SI unit	V
electrical resistance	ohm* †	SI unit	
frequency	hertz*	SI unit	Hz
	revolution per minute	$\frac{1}{60}$ Hz	rpm or rev/min
temperature	kelvin	base unit	K
	degree Celsius[‡]	K	°C
plane angle	radian	SI unit	rad
	milliradian	0.001 rad	mrad

Physical quantity	Nmne of unit	Value	Symbol
	degree	$\pi/180$ rad	°
	minute	$\frac{1^\circ}{60}$	′
	second	$\frac{1'}{60}$	″
amount of substance	mole	base unit	mol

* Decimal multiples commonly associated with this unit are *kilo* (× 1000), *mega* (× 1 000 000) and *giga* (× 1 000 000 000).
† Decimal submultiples commonly associated with this unit are *milli* (× 0.001) and *micro* (× 0.000 001).
‡ The units of temperature on the Celsius scale (°C) and the thermodynamic scale (K) are equal. A temperature t on the Celsius scale is related to a temperature T on the thermodynamic scale by the relationship t = T – 273.15.
§ For use of symbol L see Australian Standard 1000 – 1979.

1. From Metric Conversion Board, 1971. *Metric Conversion for Australia*, pp 15 and 16 (Australian Government Publishing Service: Canberra), by permission.

RECOMMENDED PRACTICE FOR METRIC CONVERSION

UNITS

Precision

Conversion factors have in general been given to seven significant figures, a lesser number of significant figures implying an exact conversion factor. The number of figures used should relate to the required precision.

Care is required when converting any imperial measurements that too much precision is not introduced or implied. Refer to MCB publication *Metric Practice*.

eg 94 ft = 28.7 m
NOT = 28.6512 m

Surveying

Distance

All measurements between survey stations should be recorded in metres (m) to three decimal places.

1 ft = 0.304 8 m
1 yd = 0.9144 m
1 mile = 1609.344 m

Measurements of rock excavations should be to the nearest 0.1 metre.

Area

Lease areas will be expressed in hectares (ha) or square kilometres (km^2) .

10 000 m^2 = 1 ha
100 ha = 1 km^2

Smaller areas will be expressed in square metres (m^2).

1 ft^2 = 0.092 903 04 m^2
1 yd^2 = 0.836 127 4 m^2
1 ac = 0.404 685 6 ha
1 square mile = 2.589 988 km^2
1 rood = 1011.714 m^2
1 perch = 25.292 85 m^2

Volume

Most usual unit will be cubic metres (m^3) although litres (L) may be used for fluid measurement.

1 ft^3 = 0.028 316 85 m^3
1 yd^2 = 0.764 5544 9 m^3
1000 litres = 1 m^3

Note: Two symbols for litre (L and 1) are legally prescribed in regulations under the Commonwealth Weights and Measures (National Standards) Act. However, the Metric Conversion Board recommends L as the preferred symbol. It is the only officially recommended symbol in USA and is preferred in Canada. It is also being used increasingly in other countries (from AS 1000-1979).

Angles

No change is involved.

Angles will continue to be recorded in degrees, minutes and seconds.

Levelling

Four and five metre staffs are available graduated at metre (m) and 10 millimetre (mm) intervals.

Note: Estimate millimetres

Graduated facings can be obtained.

Mine datum

At all new mining developments the reduced level should be started in terms of a datum which is 10 000 metres (m) below the Australian Height Datum determined by National Mapping.

Contours—select from range 0.5 m, 1.0 m, 2.0 m, 5.0 m depending on degree of detail.

Density

Density is expressed as tonnes per cubic metre (t/m^3) or kilograms per cubic metre (kg/m^3).

Note: The term specific gravity should be phased out (Refer AS 1376 – 1973)

Mine plans

For mine planing, recommended scales are specified in Australian Standard AS 1100.7.

Co-ordinate grid lines 100 or 200 millimetres (mm) apart are recommended.

Grid lines at these spacing suit the recommended scales by giving suitably rounded numbers for major co-ordinate lines and are not so far apart that major scale errors are introduced due to paper shrinkage.

Sampling

Precious metal grades (gold, silver)

Express in grams per tonne (g/t).

Note 1: This is numerically equal to parts per million.

It is recommended that grades be converted now in grams per tonne, with a conversion of mass back to ounces troy being made prior to sale. If grades are converted to ounces per tonne, a later conversion would undoubtedly be necessary to grams per tonne. The consequent confusion of two conversions is to be avoided.

Note 2: Until London Bullion Market changes to SI units, gold and silver bullion will be marketed in ounce troy.

Uranium grade

Express in kilograms per tonne (kg/t).

Note 3: This is numerically equal to parts per 1000.

Grade of diamonds and other gem deposits

Express as metric carats per cubic metre (CM/m^3).

Note 4: The General Conference on Weights and Measures has deprecated the use of the metric carat. However its use still prevails in international gem trade. It is hoped that the trade will ultimately adopt the gram in place of the metric carat.

1 CM = 0.2g.

1 carat (1877) = 1.028 CM

At this stage, in New South Wales, Victoria, Queensland, and Tasmania, diamonds and other precious stones may only be sold by reference to the metric carat.

Alluvial deposits

Alluvial deposits at present expressed in terms of pounds, ounces, pennyweights or grams per cubic yard will be expressed as grams per cubic metre (g/m^3).

Ore grades

Grades of some ore eg tungstic oxide, antimony ore, manganese ore, beryllium ore, have been expressed as a percentage of a ton (a ton of material at one per cent). These will be expressed as a percentage of a tonne (t).

All other grades will continue to be expressed as percentages.

Specific energy for coal

Express as megajoules per kilogram (MJ/kg).

Relevant conversion factors

Mass (precious metals)	
1 dwt	= 1.555 174 g
1 oz tr	= 31.103 48 g
Mass (ore, etc)	
1 ton	= 1.016 047 t
1 sh tn	= 0.907 184 7 t
Grade	
1 dwt/sh tn	= 1.714 286 g/t
1 dwt/ton	= 1.530 612 g/t
1 oz tr/ton	= 30.612 24 g/t
1 oz tr/sh tn	= 34.285 71 g/t
1 lb/ton	= 0.446 428 6 kg/t
1 lb/yd^3	= 593.276 3 g/m^3
1 oz (avoirdupois)/yd^3	= 37.079 78 g/m^3
1 dwt/yd^3	= 2.034 906 g/m^3
1 gr/yd^3	= 0.084 753 78 g/m^3
Specific energy	
1 Btu/lb	= 0.002 326 MJ/kg

Mine ventilation

Velocity of air

Use metres per second (m/s).

1 ft/min = 0.005 08 m/s

Useful rule of thumb:

200 ft/min = 1 m/s

Flow of air

Use cubic metres per second (m^3/s).

1 ft^3/min = 0.000 471 947 4 m^3/s

Note: Useful rule of thumb for conversion: 2000 ft^3/min = 1 m^3/s

Density

Use kilograms per cubic metre (kg/m^3), tonnes per cubic metre (t/m^3).

1 lb/ft^3 = 16.018 46 kg/m^3

Note: Correct for temperature and pressure

Density air (dry) =

$$\left(1.205 \times \frac{\text{pressure (kPa)}}{101.325} \quad \frac{293.15}{\text{temp (K)}}\right) \text{kg/m}^3$$

Density air (dry) at 20°C and 101.325 kPa = 1.205 kg/m^3.

Density moist air (50 per cent r.h.) at 20°C and 101.325 kPa = 1.184 kg/m^3.

Temperature

Use degrees Celsius (°C). Record to one decimal point. For thermodynamic calculations use kelvin (K).

K = °C + 273.15.

Pressure units

Use pascals (Pa), kilopascals (kPa) or megapascals (MPa). Reference will be found to the millibar in UK practice. The pascal is the SI unit of pressure and its use in Australia is recommended. The millibar (mb) is retained for meteorological use only.

1 inH_2O at 20°C and

9.806 65 m/s^2 = 0.248 641 6 kPa

1 inHg at 0°C and

9.806 65 m/s^2 = 3.386 384 kPa

1 mmHg at 0°C and

9.806 65 m/s^2 = 0.133 322 2 kPa

1 mmH_2O at 20°C and

9.806 65 m/s^2 = 9.789 039 Pa

1 lbf/in^2 = 6.894 757 kPa

Notes

I. Gauge and absolute pressure

The distinction between gauge and absolute pressure should be made clear by following the convention that unless otherwise stated pressures refer to gauge pressures: if an absolute pressure is intended it must be specified eg an absolute pressure of 4.2 kPa.

2. Conversion of columns of liquids

All factors relating columns of liquids to pascals are dependent on fluid density, the local value of *'g'* and temperature. Factors given are for the conditions as nominated in Australian Standard 1376-1973.

Differential pressure

Fluids in glass manometers are commonly used to measure pressure differences. Results should be expressed in pascals.

Where $p = h \times \rho \times g_n$

p = differential pressure (Pa)

h = manometer reading (m)

ρ = fluid density (kg/m^3)

g_n = acceleration due to gravity

= 9.806 65 m/s^2

Velocity pressure

Use pascals (Pa)

Where $P_v = \frac{1}{2} Cv^2\rho$

P_v = measured velocity pressure (Pa)

C = dimensionless coefficient for the pitot-static tube (normally close to unity)

v = air velocity (m/s)

p = air density (kg/m^3)

Airway resistance (Formula and 'K' factors) Based on Chezy Darcy and Atkinson's relationships.

Expressed in pascals (Pa)

$$P = \frac{f\rho}{2} \frac{CLQ^2}{A^3} \left(= \frac{f\rho}{2} \frac{Sv^2}{A}\right)$$

$$= \frac{KCLQ^2}{A^3}$$

$$= PQ^2$$

$$\text{'K'} = \frac{f\rho}{2}$$

$$\text{'R'} = \frac{KCL}{A^3} \left(= \frac{P}{Q^2}\right)$$

where P = frictional pressure loss (Pa)

f = dimensionless coefficient

ρ = air density (kg/m^3)
C = airway circumference (m)
L = length of airway (m)
A = cross-section area of airway (m^2)
S = rubbing surface area C × L (m^2)
V = airflow velocity (m/s)
Q = airflow quantity (m^3/s)
'K' = friction factor (kg/m^3)
'R' = resistance (kg/m^3)

Note (1)

The 'K'– and 'R'–factors include a density term. For general understanding and communication their values will be quoted for air at standard density ('K_S'). For other conditions the correct values can be obtained thus—

$$\text{'K'} = \text{'}K_S\text{'} \times \frac{\rho}{1.205}$$

$$\text{'R'} = \text{'}R_S\text{'} \times \frac{\rho}{1.205}$$

Both South Africa and Great Britain are using 'K' and 'R' as above. The metric unit for 'K' is kg/m^3. The imperial unit for 'K' is lbf.min^2/ft^4.

'K' metric = 1.855 364 × 'K' imperial at standard gravity.

Note (2)

'K' imperial relates to volume flow in thousands of cubic feet per minute.

'K' metric relates to volume flow in cubic metres per second.

Refrigeration

Use watts (W) or multiples

1 ton (refrigeration) = 12 000 Btu/h
= 3.516 853 kW

Compressed Air

Volume flow—compressor capacity

Express as cubic metres per second (m^3/s), litres per second (L/s).

Useful rules of thumb:

2000 ft^3/min = 1 m^3/s

2 ft^3/min = 1 L/s

ie A 30 000 ft^3/min compressor will be known as a 15 m^3/s compressor.

A 100 ft^3/min compressor will be known as a 50 L/s compressor.

Mass flow

Expressed as kilograms per second (kg/s), grams per second (g/s).

1 lb/s = 0.453 592 4 kg/s
1 lb/min = 7.559 873 g/s

Velocity

Express as metres per second (m/s)

1 ft/min = 0.005 08 m/s

Pressure

Express as kilopascals (kPa) .

Useful rules of thumb:

100 lbf/in^2 = 700 kPa
1 inH_2O = 0.25 kPa
1 inHg = 3.5 kPa

For marking of pressure gauges refer to Australian Standard 1349—1973.

Rockdrill penetration speed

Expressed in millimetres per minute (mm/min) to nearest ten millimetres. For high penetration rates in very soft rock express as metres per minute (m/min) to nearest 0.1 metre.

Useful rule of thumb:

1 ft/ min = 300 mm/min.

Pipe diameter and wall thickness

Express in millimetres (mm).

Note: Rounded nominal dimensions are used to describe pipe; ie six inch diameter becomes 150 mm pipe.

Pressure loss (frictional)

Express as kilopascals per kilometre (kPa/km), pascals per metre (Pa/m).

Relevant conversion factors

Volume flow
1 ft^3/min = 0.000 471 947 4 m^3/s
= 0.471 947 4 L/s
Mass flow
1 lb/min = 7.559 873 g/s
1 lb/s 0.453 592 4 kg/s
Velocity
1 ft/min = 0.005 08 m/s
Pressure
1 lbf/in^2 = 6.894 757 kPa

1 inH_2O = 248.641 6 Pa at 20°C and 9.806 65 m/s^2

1 inHg = 3.386 384 kPa at 0°C and 9.806 65 m/s^2

Rockdrill penetration rate

1 ft/min = 304.8 mm/min

Pressure loss

1 lbf/in^2 .1000 ft = 22.620 59 Pa/m

Water supply and pumping

Quantity of water

Express in terms of litres (L), kilolitres (kL), megalitres (ML) or cubic metres.

1 ac. ft = 1 233.482 m^3
or 1.233 482 ML

Volume flow

(i) Pumping rates previously expressed as gallons per minute to be expressed as litres per second (L/s).

Useful rule of thumb:
100 gal/min= 7.5 L/s

(ii) Daily water supply to towns or plants previously expressed in gallons to be expressed in megalitres.

Useful rule of thumb:
1×10^6 gal = 4.5 ML

Head

While the SI unit of pressure is the pascal, it may be necessary in certain circumstances to talk in terms of head of liquid.

Useful rule of thumb:
1 mH_2O = 10 kPa

Pump power

Express in/kilowatts (kW)

Relevant conversion factors

Quantity of water

1 gal = 4.546 09 litres

1 US gal = 3.785 412 litres

Flow

1 gal/min = 0.075 768 17 L/s

Power

1 hp = 0.745 699 9 kW

Pumping solids (pulp flow)

Diameter of pipe

Describe in millimetres (mm)

Note: Express in metres (m) in calculations.

Diameter of solid particles

Describe in millimetres (mm), micrometres (μm)

Note 1: Express in metres (m) in calculations.

Note 2: The term ‘micron’ should no longer be used as a synonym for ‘micrometre’.

Force or resistance

Express as newtons (N).

1 lbf = 4.448 222 N at standard gravity.

Pressure, head of liquid or slurry

Express as pascals (Pa), kilopascals (kPa) .

1 mm H_2O (20°C and 9.806 65 m/s^2)
= 9.789 039 Pa.

Hydraulic gradient

Express as kilopascals per metre (kPa/m) of pipe.

Flow rate

Describe in litres per second (L/s) but use cubic metres per second (m^3/s) in calculations.

Velocity of flow or settling velocity

Express in metres per second (m/s).

Density

Express as tonnes per cubic metre (t/m^3) or kilograms per litre (kg/L).

Note 1: The term ‘specific gravity’ should be phased out (Refer AS 1376—1973).

Note 2: 1 t/m^3 = 1 kg/L

Viscosity

(i) *Dynamic viscosity.* Express as pascal second (Pa.s), millipascal second (mPa.s).

Note: It is expected that the poise (P) will be used by certain industries for some time, although this practice should be phased out as soon as possible.

1 P = 0.1 Pa.s

1 cP = 1 mPa.s

(ii) *Kinematic viscosity*. Express as square metres per second (m^2/s) or square millimetres per second (mm^2/s).

Note: It is expected that the usages of stokes (St) could continue for some time in certain circumstances although this should also be phased out as soon as possible.

1 St = 100 mm^2/s
1 cSt = 1 mm^2/s

Power

Express as kilowatts (kW), megawatts (MW) and gigawatts (GW).

Metallurgical

Concentration

Reagent consumption is to be expressed in kilograms per tonne or grams per tonne (kg/t, g/t).

Smelting

(i) Metal loss in slag is to be expressed as kilograms per tonne (kg/t).

(ii) Hearth areas are to be expressed in square metres (m^2).

(iii) Furnace thermal efficiency, previously expressed as millions of British thermal units per long ton of solid charge will now be expressed as gigajoules per tonne (GJ/t).

1×10^6 Btu/ton = 1.038 392 GJ/t

Refining

Tankhouse-current density will be expressed as amperes per square metre (A/m^2).

Particle size

(i) Express as millimetres (mm) or micrometres (μm).

Note: The term 'micron' should no longer be used as a synonym for 'micrometre'.

(ii) *Mesh sizes.* Screens will be designated in aperture sizes in millimetres (mm) and micrometres (μm).

Refer to Australian Standard 1152.

Conveyor belts

Tensile strength

Express as kilopascals (kPa), megapascals (MPa).

Belt tension

Express as newtons (N).

Ply adhesion

Express as kilonewtons per metre (kN/m).

Cover tensile strength

Express as kilopascals (kPa).

Tear strength

Express as newtons (N).

Impact

Express as joules (J).

Length

Express as metres (m).

Thickness

Express as millimetres (mm).

Width

Express as millimetres (mm).

Belt speed

Express as metres per second (m/s).

Rock mechanics

Stresses

Express as megapascals (MPa).

1 lbf/in^2 = 0.006 894 757 MPa

Useful rules of thumb:

1 000 lbf/in^2 = 7 MPa

30 000 lbf/in^2 = 210 MPa

45 000 lbf/in^2 = 315 MPa

Young's Modulus

Express as megapascals (MPa)

Compressive strength

Express as megapascals (MPa)

Tensile strength

Express as megapascals (MPa)

Fuel

Specific energy

Express in megajoules per kilogram (MJ/kg).

Heating value

(i) *Gaseous Fuel.* Express in megajoules per cubic metre (MJ/m^3) at stated pressure, temperature and humidity.

(ii) *Liquid Fuel.* Express in megajoules per litre (MJ/L).

Relevant conversion factors

1 Btu/lb = 0.002 326 MJ/kg
1 Btu/ft^3 = 0.037 258 95 MJ/m^3

Note: It is assumed the volumes involved are measured under the same conditions of temperature, pressure and humidity.

Winding Ropes

Rope circumference

Should not be used. Express as millimetres diameter (mm).

Rope diameter

Express as millimetres (mm).

Rope mass

Express as kilograms per 100 metres (kg/100 m). Refer to AS 1426-1973 steel wire ropes for winding and haulage purposes in mines.

Tensile strength

Express as megapascals (MPa) .

Note: that UK catalogues are still quoting as kgf/mm^2.

1 kgf/mm^2 = 9.806 65 MPa

Breaking load

Express as kilonewtons (kN) .

Explosives breaking rate

Express explosives breaking rate as tonnes per kilogram (t/kg) and powder factor as kilograms per tonne (kg/t).

Transport (haulage)

Express

Velocity as kilometres per hour (km/h).
Mass × *distance* as tonne kilometre (t.km).
Fuel consumption as litres per 100 kilometres (L/100 km)
Mass per distance as tonne per kilometre (t/km).

Relevant conversion factors

1 mile/h = 1.609 344 km/h
1 ton.mile = 1.635 169 t.km
1 ton/mile = 0.631 342 3 t/km

To convert x mile/gal to y litre/100 km

$$y = \frac{282.480\ 94}{x}$$

Timber

Express

Width in millimetres (mm).
Thickness in millimetres (mm).
Length in metres (m), standard lengths are in rises of 0.3 m starting at 1.8 m.
Volume in cubic metres (m^3)
100 super feet = 0.235 973 7 m^3

REPORTING RESULTS

It is desirable that a uniform approach be adopted by the mining and metallurgy industry for the reporting of results to statutory authorities and to the press.

Mass of ore, mullock and concentrates	tonnes (t)
Development advance	metres (m)
Volumes of rock	cubic metres (m^3)
Mass of products—such as:	
blister copper, crude lead, coal or ilmenite, etc	tonnes (t)
precious metals (gold and silver)	grams (g) kilograms (kg)
diamonds	metric carats (CM) grams (g)
oil	tonnes (t)
Volumes of:	
natural gas	cubic metres (m^3)
oil	cubic metres (m^3)

The following convention is in accordance with the 9th CGPM meeting and also in accordance with the current Commonwealth Style Manual of the Australian Government.

Terms	*Significance*	*Corresponding Decimal Factor*
million	thousand × thousand	10^6
billion	million × million	10^{12}
trillion	million × billion	10^{18}
quadrillion	million × trillion	10^{24}

A different convention is in use in the United States of America and now also in France where:
'billion' signifies a thousand times a million (10^9)
'trillion' signifies a million times a million (10^{12})
'quadrillion' signifies a million times a US billion (10^{15})

In view of the existence of the different conventions, use of the terms billion, trillion and quadrillion should be avoided.

UNITS, PREFIXFS AND THEIR SYMBOLS
UNITS AND PREFIXFS WITHIN SI

Name	*Symbol*
ampere	A
atto (prefix 10^{-18})	a
candela	cd
centi (prefix 10^{-2})*	c
coulomb	C
deci (prefix 10^{-1})*	d
deka (prefix 10^{1})*	da
farad	F
femto (prefix 10^{-15})	f
giga (prefix 10^{9})	G
gram	g
hecto (prefix 10^{2})*	h
henry	H
hertz	Hz
joule	J
kelvin	K
kilo (prefix 10^{3})	k
kilogram	kg
lumen	lm
lux	lx
mega (prefix 10^{6})	M
metre	m
micro (prefix 10^{-6})	μ
milli (prefix 10^{-3})	m
mole	mol
nano (prefix 10^{-9})	n
newton	N
ohm	Ω
pascal	Pa
pico (prefix 10^{-12})	p
radian	rad
second	s
siemens	S
steradian	st
tera (prefix 10^{12})	T
tesla	T
volt	V
watt	W
weber	Wb

* not generally used in technical applications.

OTHER UNITS WHICH MAY BE ENCOUNTERED IN THE INDUSTRY

Name	*Symbol*
ampere hour	A.h
centipoise	cP (†)
centistokes	cSt (†)
day	d
degree (angle)	°
degree Celsius	°C
hectare	ha
hour	h
kilogram per litre	kg/L
kilometre per hour	km/h
kilowatt hour	kW.h
knot	kn
litre ‡	L(*)
metric carat	CM(†)
millibar	mb
minute (angle)	′
minute (time)	min
nautical mile (international)	n mile
revolution per minute	r/min
revolution per second	r/s
second (angle)	″
tonne §	t
tonne per cubic metre	t/m^3
watt hour	W.h

* See note re 'litre'.

† Continued use in Australia deprecated.

‡ Used in conjunction with all prefixes – eg millilitre, microlitre, etc.

§ Used in conjunction with positive power prefixes – eg megatonne.

From Metric Conversion Board; Engineering Industry Advisory Committee, 1974. *Metric Conversion Information Brochure, Mining and Metallurgy Industry*, pp 9-14 (Australian Government Publishing Service: Canberra), by permission, amended to agree with AS 1000-1979.

CONVERSION FACTORS, IMPERIAL AND INTERNATIONAL SYSTEMS

One	(Multiplier for Col. 1)
acre	= 160 square perches
	= 4 roods = 43 560 sq. ft
	= 4840 square yards
	= 0.404 685 6 ha
	= 4046.856 m^2
acre foot	= 1233.482 m^3 = 43 560 cu. ft
	= 271 327 Imp. gallons
Admiralty nautical mile	= 1.853 184 km
atmosphere	= 1013.25 millibars (20°C)
	= 101.325 x 10^3 Pa (20°C)
	= 760 mm head of mercury (20°C)
	= 10.3509 metres head of water (20°C)
	= 14.6960 pounds force/square inch (20°C)
average month	= 30.42 days = 730 hours
	= 4.34 weeks
barrel, US	= 0.158 987 m^3
	= 0.125 to 0.150 t crude oil
	= 158.987 3 L
	= 34.97 Imp. gallons
	= 42 US gallons
British thermal unit (Btu)	= 1055.06 J
Btu/cubic foot	= 37.258 95 kJ/m^3
Btu/gallon	= 0.232 kJ/L
Btu/hour	= 0.2931 W
Btu/pound	= 2.326 J/g*
	= 0.002 326 MJ/kg
bushel	= 1.284 352 cubic feet
	= 0.0364 m^3
bushel, US	= 0.0352 m^3
	= 0.968 940 bushel
calorie, international	= 4.1868 J*
calorie, 15° (water calorie)	= 4.1855 J*
calorie, thermochemical	= 4.184 J*
carat, metric (CM)	= 0.2 g
	= 3.0865 grains
cental	= 100 pounds
cent/cubic yard	= 0.764 555 cents/m^3
cent/long ton	= 1.016 047 cents/t
cent/short ton	= 0.907 185 cents/t
chain	= 100 links
	= 66 feet
	= 22 yards
	= 20.116 8 m*

One	(Multiplier for Col. 1)
Cheval vapeur (C.V.)	= 735.5 W
circle	= 6.2832 radians
cubic centimetre	= 0.061 024 cubic inches
cubic metre	= 10^3 L
	= 61023.7 cubic inches
	= 35.314 7 cubic feet
	= 1.307 95 cubic yards
	= 27.4962 bushels
	= 219.969 248 Imp. gallons
cubic foot	= 1728 cubic inches = 0.028 317 m^3
	= 6.228 84 gallons
	= 28.316 85 L
cubic foot/second	= 28.3168 L/s
cubic foot/long ton	= $27.87 \times 10^{-6} m^3/kg$
cubic foot/pound	= 64.43 m^3/kg
cubic foot/minute	= $471.947\ 4 \times 10^{-6} m^3/s$
cubic inch	= 16 387.064 mm^{3*}
	= 276.837 minims
cubic yard	= 27 cubic feet
	= 0.764 554 857 m^3
	= 168.178 Imp. gallons
cycle/second	= 1 Hz
degree (angle)	= $17.453\ 293 \times 10^{-3}$ rad
degree Celsius	= 0.555 (°F – 32)
degree Fahrenheit	= 1.8 (°C) + 32
degree Kelvin (TK)	= C + 273.15
drachm	= 3 scruples
	= 60 grains
	= 3.887 934 6 g
drachm, fluid	= 60 minims
	= 3.551 633 mL
	= 0.216 734 cubic inches
dram	= 27.343 75 grains
	= 1.771 845 g
fathom	= 6 feet
	= 1.8288 m*
fluid ounce	= 8 fluid drachms
	= 28.413 062 mL
	= 1.731 375 cubic inches
foot	= 12 inches
	= 0.3048 m*
foot head of water	= 2983.6992 Pa (at 20°C)
foot/minute	= 5.08×10^{-3} m/s*
foot poundal	= 0.042 14 J
foot pound force	= 1.335 818 J

* Exact Australian Standard conversion factor.

One	(Multiplier for Col. 1)
foot pound force/minute	= 80.149 W
foot pound force/second	= 1.335 818 W
foot/second	= 0.3048 m/s*
foot, superficial	= $2.359\,737 \times 10^{-3}$ m^3
furlong	= 10 chains
	= 201.168 m*
gallon	= 160 fluid ounces
	= 8 pints
	= 4 quarts
	= 4.546 09 L*
	= 1.200 95 US gallons
	= 277.42 cubic inches
	= 0.160 544 cubic feet
	= $4.546\,09 \times 10^{-3}$ m^3*
gallon (US)	= 3.785 412 L
	= 0.832 675 Imp. gallons
	= 231 cubic inches*
	= 0.133 681 cubic feet
gallon/hour	= $1.262\,803 \times 10^{-3}$L/s
gallon/minute	= 0.075 768 17 L/s
giga (G)	= 10^9
gill	= 142.065 mL = ¼ pint
grain	= 0.041 667 pennyweight
	= $1.428\,57 \times 10^{-4}$ pounds
	= 0.064 798 918 g*
grain/cubic yard	= 0.084 753 78 g/m^3
grain/gallon (Clark Hardness)	= 14.3 ppm $CaCO_3$ by weight
grain/US gallon (Clark Hardness)	= 17.1 ppm $CaCO_3$ by weight
grain/normal cubic foot (suspended solids)	= 2.2883×10^6 μg/m^3
gram	= 15.432 358 grains
	= 5 Metric carats (CM)
	= $35.273\,962 \times 10^{-3}$ ounces
	= $2.204\,623 \times 10^{-3}$ pounds
gram/cubic centimetre	= 1 g/mL
	= 1 kg/L
	= 1 t/m^3
	= 62.427 961 lbs/ft^3
	= Density
gram/cubic metre	= 11.7993 grains/cubic yard
	= 0.491 64 dwt/cubic yard
	= 1.686×10^{-3} lbs/cubic yard
gram/tonne	= 1 part per million (ppm)
	= 0.0001 per cent
	= 0.583 33 dwt (Troy)/short ton

One	(Multiplier for Col. 1)
	= 0.653 33 dwt (Troy)/long ton
	= 0.029 17 oz (Troy)/short ton
	= 0.032 666 oz (Troy)/long ton
	= 0.002 24 lbs (avoir)/long ton
gravity, standard	= 9.806 65 m/s^{2*}
	= 32.174 05 ft/s^2
hand = 0.1016 m = 4 inches	
hectare	= 10 000 m^2
	= 11959.9 square yards
	= 2.471 053 8 acres
horsepower	= 745.699 87 W
	= 550 foot pounds force/second
horsepower hour	= 2.684 519 MJ
hundredweight	= 112 pounds
	= 50.802 345 kg
inch	= 25.4 mm*
inch head of water	= 248.6416 Pa at 20°C
joule	= 0.737 562 foot pound force
kilo (k)	= 10^3
kilogram (kg)	= 2.204 622 6 pounds
	= 32.150 745 oz Troy
kilogram force	= 9.806 65 N
kilogram force/square centimetre = 98.0665 kPa	
kilogram force/square metre = 9.806 65 Pa	
kilogram force metres per second per second = 1 N	
kilogram/cubic metre	= 0.062 428 lbs/cubic foot
kilogram/litre	= Density
kilogram/metre	= 0.671 97 lb/ft
kilolitre	= 219.969 gallons
kilometre	= 0.621 371 miles
kilometre/litre	= 2.824 8 m.p.g.
kilonewton	= 224.809 pounds force
kilopascal	= 0.145 lbs/sq. inch
kilowatt	= 737.562 foot lbs force/second
	= 1.34102 horsepower
kilowatt hour	= 3.6 MJ
	= 3412.14 British thermal units
knot, international	= 1.852 km/hour
link	= 7.92 inches
	= 0.66 feet
	= 0.201 168 m
litre = 0.219 969 gallons = 0.264 17 US galls.	
	= 1.759 75 pints = 50.812 839 cu. ins.
	= 35.195 fluid ounces
	= 0.001 m^3
litre per 100 km = $\frac{282.481}{\text{litres /100 km}}$ m.p.g.	
litre/second = 13.2 gallons/minute	

* Exact Australian Standard conversion factor.

One	(Multiplier for Col. 1)
long ton (see ton, long)	
mega (M)	= 10^6
metre	= 3.280 84 feet
	= 1.093 613 2 yards
metre/second	= 196.850 39 feet/minute
metric carat	= 0.2 grams
metric horsepower	= 735.5 W
micro (μ)	= 10^{-6}
mile	= 5280 feet
	= 1760 yards
	= 80 chains
	= 8 furlongs
	= 1.609 344 km*
mile/gallon	= 0.354 km/L
	= $\frac{282.481}{\text{m.p.g.}}$ L/100 km
mile/hour	= 0.447 04 m/s
milli (m)	= 10^{-3}
millibar	= 100 Pa
millilitre	= 0.035 195 fluid ounces
	= 0.281 561 fluid drachms
	= 16.893 6 minims
millilitre/second	= 0.792 gallons/hour
millimetre	= 0.039 4 inches
millimetre/second	= 0.196 85 ft/minute
minute (angle)	= $0.290\ 89 \times 10^{-3}$ radians
minim	= 0.059 194 mL
	= $3.612\ 24 \times 10^{-3}$ cubic inches
nano (n)	= 10^{-9}
nautical mile, Admiralty	= 1.853 184 km
nautical mile, international	= 1.852 km
newton	= 0.224 8 lbs force
ounce (Apothecaries)	= 8 drachms
	= 1 ounce (Troy)
ounce (Avoirdupois)	= 437.5 grains
	= 16 drams
	= 28.349 523 g
ounce (fluid) see fluid ounce	
ounce/cubic yard	= 37.07978 g/m^3
ounce (Troy)	= 20 pennyweights
	= 480 grains
	= 31.103 477 g
ounce (T)/long ton	= 30.612 24 g/t
ounce (T)/short ton	= 34.285 71 g/t
part per million (ppm)—see gram/tonne	
pascal	= 0.020 885 lbs force/sq. ft

One	(Multiplier for Col. 1)
peck	= $9.092\ 18 \times 10^{-3}$ m^3 = 2 gallons
pennyweight (Troy)	= 24 grains
	= 1.555 173 8 g
pennyweight (T) / cu. yd.	= 2.034 906 g/m^3
pennyweight (T) / l. ton	= 1.530 612 g/t
pennyweight (T) / sh. ton	= 1.714 286 g/t
perch (area)	= 25.292 85 m^2
perch (length)	= 5.0292 m*
pico (p)	= 10^{-12}
pferdestarke (PS)	= 735.5 W
pi (π)	= 3.141 592 654
pint	= 20 fluid ounces
	= 0.568 261 L
	= 34.667 4 cubic inches
point (rainfall)	= 0.254 mm*
pole	= 5.0292 m*
pound (Avoir)	= 7000 grains
	= 16 ounces
	= 453.592 37 g*
pound (Troy)	= 12 ounces (Troy) = 5760 grains
pound force/square inch	= 6.894 757 kPa
pound/cubic foot (Density)	= 16.018 46 kg/m^3
	= 0.016 018 t/m^3
pound/cubic inch (Density)	= 27.68 t/m^3
pound/cubic yard (Assay)	= 593.2763 g/m^3
pound/long ton (Assay)	= 0.446 428 6 kg/t
pound/minute	= 7.559 873 g/s
pound force	= 4.448 N
pound force/square foot	= 47.880 259 Pa
pound/short ton (Assay)	= 398.597 g/t
quart	= 40 fluid ounces
	= 2 pints
	= 1.136 522 L
quarter (mass)	= 12.700 586 kg
quintal	= 100 kg
radian	= 57.295 78°
rod	= 5.0292 m*
rood	= 1210 square yards
	= 1011.714 m^2
scruple	= 20 grains
	= 1.296 g
short ton see ton, short	
square (of flooring)	= 100 sq.ft
	= 9.29 m^2
square centimetre	= 0.155 000 square inches
square foot	= 144 square inches
	= 0.092 903 04 m^2
square inch	= 645.16 mm^2

* Exact Australian Standard conversion factor.

One	(Multiplier for Col. 1)
square kilometre	= 0.386 102 square miles
square metre	= 10.763 91 square feet
	= 1550.003 square inches
square mile	= 640 acres
	= 2.589 988 km^2
square millimetre	= 1.55×10^{-8} square inch
square yard	= 9 square feet
	= 0.836 127 4 m^{2*}
	= $0.836\ 127\ 4 \times 10^{-4}$ ha
stone	= 6.350 293 2 kg
super foot — see foot, superficial	
tera (T)	= 10^{12}
tex (mass/unit length of textiles)	= 1 g/km
therm	= 105.506 MJ*
thermie	= 10^6 water calories
	= 4.1855 MJ*
ton, assay	= 32.6667 g (in which 1 mg = 1 ounce (T) per long ton

One	(Multiplier for Col. 1)
ton, long	= 2240 pounds
	= 20 hundredweights
	= 1.016 047 t
ton, short (US)	= 2000 pounds
	= 0.907 185 t
ton, refrigeration	= 3.516 853 kW
ton (long)/vertical foot	= 3.3335 t/m
tonne (t)	= 0.984 2 long tons
	= 1.102 3 short tons
	= 10^6 g = 2204.62 lbs
	= 1000 kg
tonne/square mile/month	= 13.1 $mg/m^2/d$
tonne/cubic metre	= 62.4238 lbs/cubic foot
tonne/vertical metre	= 0.3 long tons/vertical foot
US survey foot	= 1.000 002 0 feet
	= 1200 ÷ 3937 m
velocity of sound (0°C)	= 332 m/s
water Btu	= 1 Btu (60°F)
	= 1054.54 J
watt	= 0.737 56 foot lbs force/second
yard	= 3 feet
	= 0.9144 m*

* Exact Australian Standard conversion factor.

From Australian Standard 1376, *Conversion Factors*, with permission from the Standards Association of Australia.

CONVERSION FACTORS FOR FOREIGN, RARE AND OBSOLETE WEIGHTS AND MEASURES

are (metric)	= 100 m^2
arpent (ancient French)	= (1) area of about 0.85 acre = 0.34 ha (2) length of 192 to 192.5 ft. = 58.5 to 58.7 m
bushel (English)	= 8 gallons = 36.4 L = 4 pecks
cable (nautical)	= 1/600th of a degree of latitude, often taken as 608 ft = 185.37 m
cape foot (Sth. Africa)	= 1.033 Imperial ft. = 0.3149 m
cape rood (Sth. Africa)	= 12 cape feet = 12.4 Imperial ft. = 3.7879 m
chaldron (dry measure, Eng.)	= 36 bushels
cord (of wood, obs. Eng.)	= 128 cu. ft. = 3.6 m^3
cubit (ancient Egypt)	= 18 to 22 inches = 0.457 to 0.559 m (21.8 inches in the Bible)
cup, breakfast	= ½ pint = 284.13 mL
cup, metric	= 250 mL
cup, tea	= ¼ pint = 142.06 mL
ell (obs. English)	= 45 inches = 1.143 m
firkin (obs. English)	= wine volume, 8 to 9 gall. = 36.4 to 40.9 L
flask of mercury	= 34.5 kg
gross (obs.)	= 144
hogshead (obs. English)	= wine volume, 52 ½ gall. = 238.7 L
hand (English)	= 4 inches (height of horses) = 0.1016 m
hundred (Sth. Aust, NT)	= (land) subdivision of a county or shire, of area tens to hundreds of km^2
kati (Malaysia)	= 1 $\frac{1}{3}$ lb = 0.60 kg
kilderkin (obs. English)	= wine volume, 16 to 18 gallons (72.7-81.8 L)
load (obs. English)	= 1 cu. yd of alluvium
league (obs. English)	= 3 miles = 4.83 km
miner's inch (USA)	= rate of discharge of water, varying from 0.02 cu. ft/sec. to 0.026 cu. ft/sec. = 0.57 to 0.74 L/sec.
military pace	= 2.5 feet
morgen (Sth. Africa)	= 2.1165 acres = 0.86 ha
nail (obs. English)	= 2 ¼ inches
peck (obs. English)	= 2 gallons = 9.1 L
perch (obs. masonry meas.)	= a length of dimension stone of 12 inch by 12 inch section; 16 ½ ft long
picul (Malaysia)	= 100 katis = 133$\frac{1}{3}$ lbs = 60.48 kg
pipe (obs. English)	= wine volume, 105 gall. = 477.34 L
prospecting dish	= volume of the large sized dish (about 16 inches or 38 cm dia.) is usually taken as 2 gallons (or 9 L), with 112 level dishes accepted as equivalent to 1 cu. yd (146 dishes/m^3)
puncheon (obs. English)	= wine volume, 70 gall. = 318.2 L
quintal (metric)	= 100 kg
quintal (obs. USA)	= 100 lb = 45.36 kg
sea mile (nautical)	= 1/60th degree of latitude
score	= 20
Scruple (Apothecaries)	= 20 grains
shekel (ancient Palestine)	= 252 grains = 16.33 g
shipping ton	= 40 cu. ft
span (obs. Eng.)	= 6 inches = 0.1524 m
tablespoon	= 1 fl. oz. = 28.413 mL
tael	= Chinese weight, 1.23 Troy oz
talent (ancient Palestine)	= 3000 shekels
teaspoon	= ⅓ fl. oz. = 9.47 mL
tola	= Indian weight, 0.375 Troy oz
vara (obs. Spanish)	= 2.6816 ft = 0.8359 m; South American usage ranges from 0.8 to 1.1 m.
verst (Russian)	= 3500 ft = 1067.07 m