



EngiLab Units 2026

v6.1.9469

User Manual



www.engilab.com

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EngiLab Units 2026 v6.1.9469 User Manual

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"There are two possible outcomes: if the result confirms the hypothesis, then you've made a measurement. If the result is contrary to the hypothesis, then you've made a discovery."

Enrico Fermi

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Chapter



1

Introduction to EngiLab Units

1 Introduction to EngiLab Units

- [Overview](#)
- [Free Edition](#)

1.1 Overview



EngiLab Units 2026

v6.1.9469

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EngiLab Units 2026 is a powerful software tool for scientific unit conversion. It features a fast, rich, and intuitive user interface and provides direct links to relevant Wikipedia articles for additional information on the definition and use of each unit and unit category. The program includes **728 units** organized into **22 categories**, offering broad coverage for scientific, engineering, and general reference needs.

EngiLab Units 2026 is provided **free of charge** for all users, with no limitations. No registration is required. Simply download the program, install it, and use it. When selecting a unit or category, the software offers convenient access to Wikipedia articles by opening them in the user's default web browser.

The unit categories are the following:

- | | |
|--|--|
| 1. Acceleration (Linear) - 1512 Units | 13. Second Moment of Area (Area Moment of Inertia) - 16 Units |
| 2. Angle - 13 Units | 14. SI Prefixes - 25 Units |
| 3. Angular Velocity - 72 Units | 15. Solid Angle - 11 Units |
| 4. Area - 25 Units | 16. Speed (Velocity) - 20 Units |
| 5. Computer storage (decimal & binary) - 34 Units | 17. Surface Tension & Translational Stiffness - 35 Units |
| 6. Density - 55 Units | 18. Temperature - 8 Units |
| 7. Energy & Work - 65 Units | 19. Time - 18 Units |
| 8. Force - 17 Units | 20. Torque & Moment of force - 35 Units |
| 9. Length & Distance - 2120 Units | 21. Torsional (Rotational) Stiffness - 70 Units |
| 10. Mass - 35 Units | 22. Volume - 36 Units |
| 11. Power - 60 Units | |

Communication

For general inquiries, you may contact us at info@engilab.com

Technical support

EngiLab provides technical support via email at support@engilab.com. Email questions are normally answered within 48 hours. Although our support team operates on a demanding schedule, EngiLab strives to assist all users as quickly and effectively as possible.

Required Information for Support

When sending a support request, please include the following details:

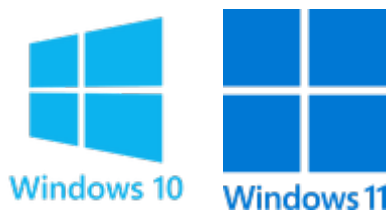
- Operating system (Windows 10, Windows 11)
- The name and exact version of the product.
- A brief description of the issue.
- Clear steps that allow us to reproduce the problem.

You may find additional information, updates, and new releases on our website at www.engilab.com. We take customer satisfaction very seriously and always welcome your feedback.

Compatibility

EngiLab Units is compatible with 64 bit versions of Microsoft Windows, including:

- Windows 10 (64 bit)
- Windows 11 (64 bit)



Limited Warranty - Disclaimer of Damages

See the [End User License Agreement \(EULA\)](#).

1.2 Free Edition

EngiLab Units is distributed as a **completely free software**, offering full functionality without restrictions. The program is ready to use immediately after installation, and no registration or activation is required.

Key Features of the Free Edition:

- Free of charge, available for download at www.engilab.com
- Fully functional, with no missing features
- No advertisements, no banners, and no pop-up messages
- No hidden fees and no usage limitations
- May be used for personal, academic, educational, or commercial purposes
- Ideal for students, hobbyists, professional engineers, researchers, instructors, and professors
- Technical support is provided via email at support@engilab.com

Chapter



2

Program use

2 Program use

- [Definitions, assumptions and values of standard variables](#)
- [User interface and general rules](#)
- [Standard use example](#)
- [Accessing Wikipedia Information About Units](#)
- [Calculation of all outputs](#)

2.1 Definitions, assumptions and values of standard variables

All conversions are based on the definitions, assumptions and the values of standard variables presented below.

GENERAL

Variable	Value	Meaning	Notes
StandardGravity	9.80665	Standard acceleration due to gravity is 9.80665 m/s ²	Exact definition

LENGTH

Variable	Value	Meaning	Notes
OneFootEqualsInches	12	1 ft = 12 in	Exact definition
OneInchEqualsMeters	0.0254	1 in = 0.0254 m	Exact definition
OneYardEqualsMeters	0.9144	1 yard = 91.44 cm	Exact definition
OneLandMileEqualsYards	1760	1 land mile = 1760 yards	Exact definition
OneNauticalMileEqualsMeters	1852	1 nautical mile = 1852 m	Exact definition
OneAngstromEqualsMeters	0.0000000001	1 angstrom = 10 ⁻¹⁰ m	Exact definition
OneLightYearEqualsMeters	9460730472580800	1 light-year = 9,460,730,472,580,800 m	Exact definition
OneAstronomicalUnitEqualsMeters	149597870700	1 AU = 149,597,870,700 m	Exact definition

OneFathomEqualsFeet	6	1 fathom = 6 feet	Exact definition
OneChainEqualsFeet	66	1 chain (ch) = 66 feet	Exact definition
OneParsecEqualsAU	648000 / p	1 parsec = 648000/p Astronomical Units	Exact definition

AREA

Variable	Value	Meaning	Notes
OneSquareMetreEqualsBarns	10^{28}	1 m ² = 10 ²⁸ barn (1 barn = 10 ⁻²⁸ m ²)	Exact definition
OneStremmaEqualsSquareMeters	1000	1 stremma = 1000 m ²	Exact definition
OneSqMileEqualsAcres	640	1 square mile = 640 acres	Exact definition

MASS (and FORCE)

Variable	Value	Meaning	Notes
OneLbmEqualsKg	0.45359237	1 lbm (avoirdupois) = 0.45359237 kg	Exact definition
OneGrainEqualsmg	64.79891	1 grain = 64.79891 milligrams	Exact definition
OneTroyOunceEqualskg	0.0311034768	1 troy ounce (ozt) = 0.0311034768 kg	Exact definition
OneLongTonEqualsGrams	1016046.9088	1 long ton = 1,016,046.9088 grams	Exact definition
OneShortTonEqualsLbm	2000	1 short ton = 2000 lbm	Exact definition
OneOunceEqualsGram	28.349523125	1 ounce (avoirdupois) = 28.349523125 g	Exact definition
OnePennyweightEqualsGrains	24	1 pennyweight = 24 grains	Exact definition

TIME

Variable	Value	Meaning	Notes
OneMinuteEqualsSeconds	60	1 min = 60 s	Exact definition

OneHourEqualsMinutes	60	1 hour = 60 min	Exact definition
OneDayEqualsHours	24	1 day = 24 h	Conventional civil definition
OneWeekEqualsDays	7	1 week = 7 days	Exact definition
OneJulianYearEqualsDays	365.25	1 Julian year = 365.25 days	Exact definition
OneCommonYearEqualsDays	365	1 Common year = 365 days	Calendar definition
OneDecadeEqualsYears	10	1 decade = 10 years	Conventional definition
OneCenturyEqualsYears	100	1 century = 100 years	Conventional definition

VOLUME

Variable	Value	Meaning	Notes
OneImperialGallonEqualsLitres	4.54609	1 imperial gallon = 4.54609 litres	Exact definition, by UK law
OneUSGallonEqualsCubicInches	231	1 US gallon = 231 cubic inches	Exact definition, by US NIST standards
OneImperialPintEqualsImperialFluidOunces	20	1 imperial pint = 20 imperial fluid ounces	Exact definition
OneUSPintEqualsUSFluidOunces	16	1 US pint = 16 US fluid ounces	Exact definition
OneGallonEqualsPints	8	1 gallon = 8 pints *	Exact definition
OneGallonEqualsQuarts	4	1 gallon = 4 quarts *	Exact definition
OneFluidOunceEqualsMinims	480	1 fluid ounce = 480 minims *	Exact definition
OneFluidOunceEqualsFluidDrams	8	1 fluid ounce = 8 fluid drams *	Exact definition
OneTroyPoundEqualsTroyOunces	12	1 troy pound = 12 troy ounces	Exact definition

* Applies to both imperial and US units (gallon, pint, quart, fluid ounce, minim, etc).

SPEED

Variable	Value	Meaning	Notes
SpeedOfLightInMeterPerSecond	299792458	$c = 299,792,458 \text{ m/s}$	Exact definition According to the 1983 definition and the 2019 revision of the SI base units .

PRESSURE

Variable	Value	Meaning	Notes
OneBarEqualsPascal	100000	1 bar = 100000 Pa	Exact definition
OnemmHgEqualsPascal	133.322387415	1 mm of mercury = 133.322387415 Pa	Conventional value
OneStandardAtmosphereEqualsPascal	101325	1 standard atmosphere = 101,325 Pa	Exact definition
OneAtmosphereEqualsTorr	760	1 standard atmosphere = 760 Torr	Exact definition

COMPUTER

Variable	Value	Meaning	Notes
OneByteEqualsBits	8	1 byte = 8 bits	Exact definition

ENERGY

Variable	Value	Meaning	Notes
OneFoeEqualsJoules	10^{44}	1 foe = 10^{44} J	Exact definition
OneThermEqualsBTU	10^5	1 therm = 100,000 BTU	Exact definition for US therm, defined by US standards.
OneCalTHEqualsJoules	4.184	1 thermochemical calorie = 4.1840 J	Exact definition, set in 1956.
OneCalITEqualsJoules	4.1868	1 Int. Steam Table calorie (1956) = 4.1868 J	Exact definition The Fifth International Conference on the Properties of Steam (London, July 1956) defined the

			International Table calorie as 4.1868 J
OneCal15EqualsJoules	4.1855	One 15 °C calorie ~ 4.1855 J	This is not an exact definition but an experimentally determined value. The amount of energy required to warm one gram of air-free water from 14.5 to 15.5 °C at standard atmospheric pressure. Experimental values of this calorie ranged from 4.1852 to 4.1858 J. The CIPM in 1950 (Comité international des poids et mesures (International Committee for Weights and Measures) 1950; PV, 1950, 22, 79–80) published a mean experimental value of 4.1855 J, noting an uncertainty of 0.0005 J.
OneTonOfTNTEqualsCaloriesTH	10^9	1 ton TNT $\approx 10^9$ thermochemical calories	Common approximation used in physics and engineering. Not an exact physical constant.
OneBTUITEqualsJoules	OneLbmEqualsKg * 1000 * 5 / 9 * OneCalITEqualsJoules = 1055.05585262	1 BTU(IT) = 1055.05585262 J	Based on the International Table calorie (1956), defined as 4.1868 J. This is the standard BTU used in engineering.

			The most widespread BTU uses the International Steam Table (IT) calorie, which was defined by the Fifth International Conference on the Properties of Steam (London, July 1956) to be exactly 4.1868 J. Therefore, the exact conversion factor for the International Table Btu is 1055.05585262 J, as shown in the calculation.
OneBTUTHEqualsJoules	$\text{OneLbmEqualsKg} * 1000 * 5 / 9 *$ $\text{OneCalTHEqualsJoules} = 9489.1523804 / 9$ ~ 1054.350264488889	$1 \text{ BTU(TH)} = 9489.1523804 / 9 \text{ J} \sim 1054.350264488889 \text{ J}$	Conventional value, not exact. It is based on the definition of the thermochemical calorie, which is equal to 4.184 J. The calculation is similar to the one for the IT case.
OneBTU59FEqualsJoules	1054.804	$1 \text{ BTU(59)} = 1054.804$	Conventional value, not exact. 59 °F (15 °C) is the most widely used reference temperature for BTU definition in the US. Different values can be found in the literature. This value is the one most commonly used. See: https://en.wikipedia.org/wiki/British_thermal_unit (reporting 1054.80 J)

			https://physics.nist.gov/cuu/pdf/sp811.pdf (reporting 1054.80 J)
ElementaryCharge	$1.602176634 \times 10^{-19}$	1 electronvolt = $1.602176634 \times 10^{-19}$ J	Exact definition (2019) According to the 2019 revision of the SI base units .

Notes:

- A calorie is a unit of energy originally defined as the amount of heat required to raise the temperature of one gram of water by one degree Celsius. The exact amount of heat needed depends on the atmospheric pressure and, most importantly, on the starting temperature of the water, because the heat capacity of water varies with temperature. As a result, several different definitions of the calorie have been used over time, each based on slightly different reference conditions. Due to this variation, the exact conversion between calories and joules has changed historically. In modern thermochemistry and nutrition, the accepted standard is the **thermochemical calorie**, which is defined to be exactly **4.184 J**.
- A British Thermal Unit (BTU) was originally defined as the amount of heat required to raise the temperature of one avoirdupois pound of liquid water by one degree Fahrenheit at a pressure of one atmosphere. As with the calorie, the heat required depends slightly on the initial temperature of the water, which has led to several different BTU definitions. These definitions differ by up to about 0.5 percent. The variations arise from using different reference temperatures for water, such as 39 °F, 59 °F, the mean interval from 32 °F to 212 °F, or other standardized reference points. The most widely used definition today is the International Table BTU (BTU(IT)), which is based on the International Table calorie. Source: https://en.wikipedia.org/wiki/British_thermal_unit

POWER

Variable	Value	Meaning	Notes
OneHorsepowerMechanicalHPEquals_ftlbf_per_min	33000	1 Mechanical horsepower = 33,000 ft·lbf/min	Classical Watt definition
OneHorsepowerMetricPSEquals_kgfm_per_s	75	1 Metric horsepower = 75 kgf·m/s	DIN exact definition
OneHorsepowerElectricalEquals_Watt	746	1 Electrical horsepower = 746 W	Exact value used in electrical engineering

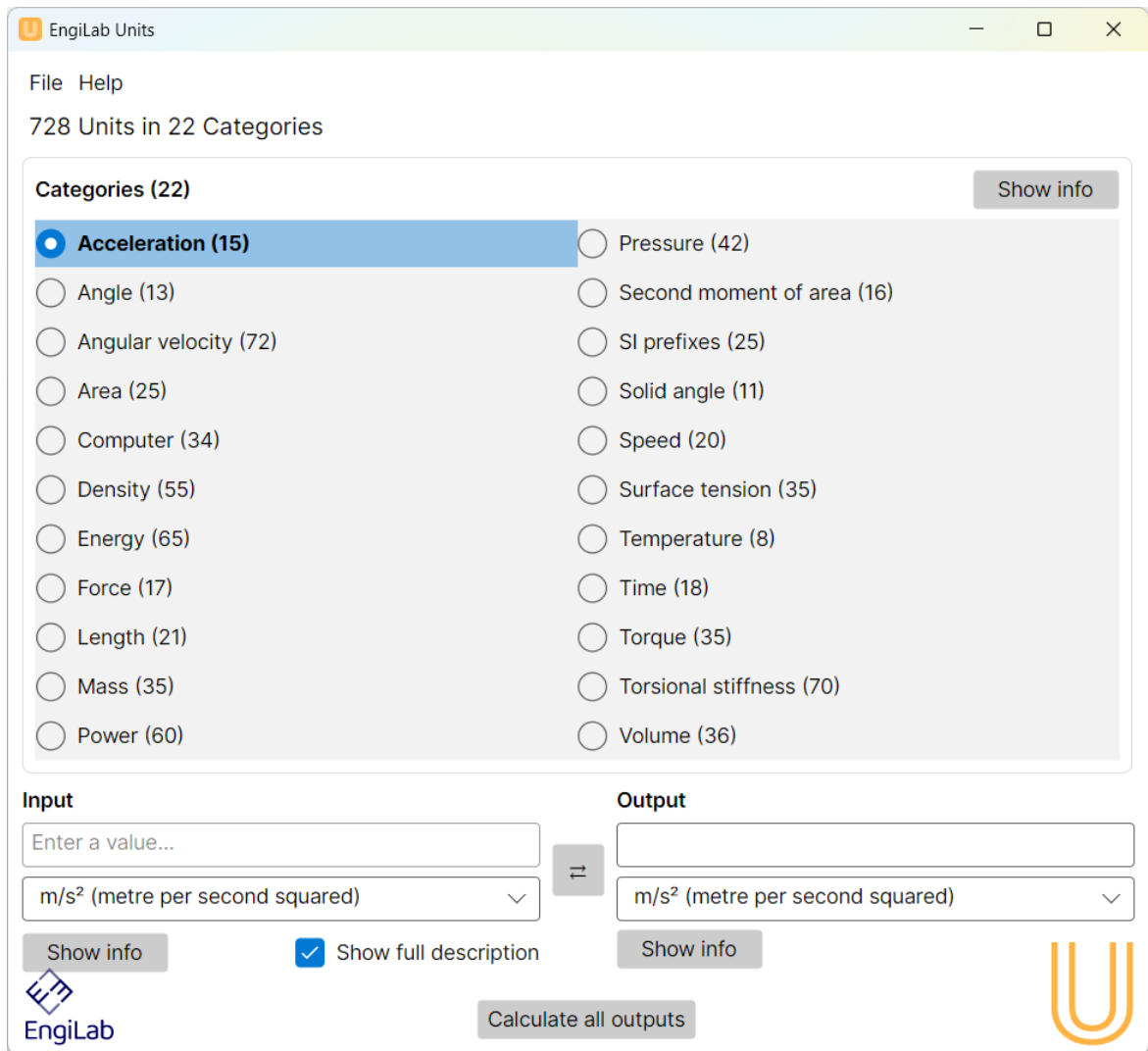
TEMPERATURE

Unit (symbol)	Definition
Celsius (°C)	-
Fahrenheit (°F)	$[^{\circ}\text{F}] = [^{\circ}\text{C}] \times 9/5 + 32$
Kelvin (K)	$[\text{K}] = [^{\circ}\text{C}] + 273.15$
Rankine (°R)	$[^{\circ}\text{R}] = ([^{\circ}\text{C}] + 273.15) \times 9/5$
Delisle (°D)	$[^{\circ}\text{De}] = (100 - [^{\circ}\text{C}]) \times 3/2$
Newton (°N)	$[^{\circ}\text{N}] = [^{\circ}\text{C}] \times 33/100$
Réaumur (°Ré)	$[^{\circ}\text{Ré}] = [^{\circ}\text{C}] \times 4/5$
Rømer (°Rø)	$[^{\circ}\text{Rø}] = [^{\circ}\text{C}] \times 21/40 + 7.5$

2.2 User interface and general rules

The program features a clean, easy-to-use, and powerful user interface designed to make unit conversion fast, intuitive, and reliable.

The main program window is shown below.



1. Categories Panel

On the left side of the window, the user will find the list of 22 unit categories, such as Acceleration, Force, Energy, Pressure, Torque, and many others. To begin a conversion, the user must first select the appropriate category. For example, to convert newtons to pounds-force, the user selects the Force category.

When a category is selected:

- The Input Unit dropdown (left side) is populated with all units belonging to that category.
- The Output Unit dropdown (right side) is populated with the same units.

This ensures that all conversions are meaningful and internally consistent.

2. Input Section

The Input panel allows the user to define the unit and the quantity to be converted. It includes:

- A text box where the user enters the numerical value of the input quantity. As the user types, the program instantly computes the result in the selected output unit. This real-time calculation makes the workflow fast and efficient.

- A dropdown menu where the user chooses the input unit within the selected category.
- A Show info button that opens the corresponding Wikipedia page (in the system's default browser) for additional information about the selected unit.
- A Show full description checkbox that displays the complete name of each unit in the dropdown menus (for both input and output units).

3. Output Section

The Output panel mirrors the Input panel and includes:

- A **read-only text box** showing the converted value. This value updates automatically as the user types or changes units.
- A dropdown menu for selecting the output unit.
- A Show info button for opening the relevant Wikipedia page for the output unit.

4. Swap Button

Between the Input and Output panels, there is a swap button ($\leftrightarrow$). When pressed, the program immediately exchanges:

- The input and output units
- The numerical values

This allows the user to invert a conversion with a single click, i.e. make the input output and vice versa.

5. Calculate All Outputs Button

The Calculate all outputs button performs a broader calculation and converts the input quantity to all units in the selected category. This feature is explained in detail in [another section of the help file](#), but it is worth noting that this button provides a comprehensive view of the value across the entire category.

Decimal Input Rules

For numerical input, the program accepts only the period "." as a decimal separator.

- The comma "," cannot be used to enter decimals.
- If the user types a comma, then a message "Input values must be numeric" will appear in the output text box.

In this help file, the comma "," is used only as a thousands separator to improve readability.

2.3 Standard use example

Example use of the program:

- We would like to convert **100 feet (ft) to millimetres**.

Below are the instructions for doing that using EngiLab Units:

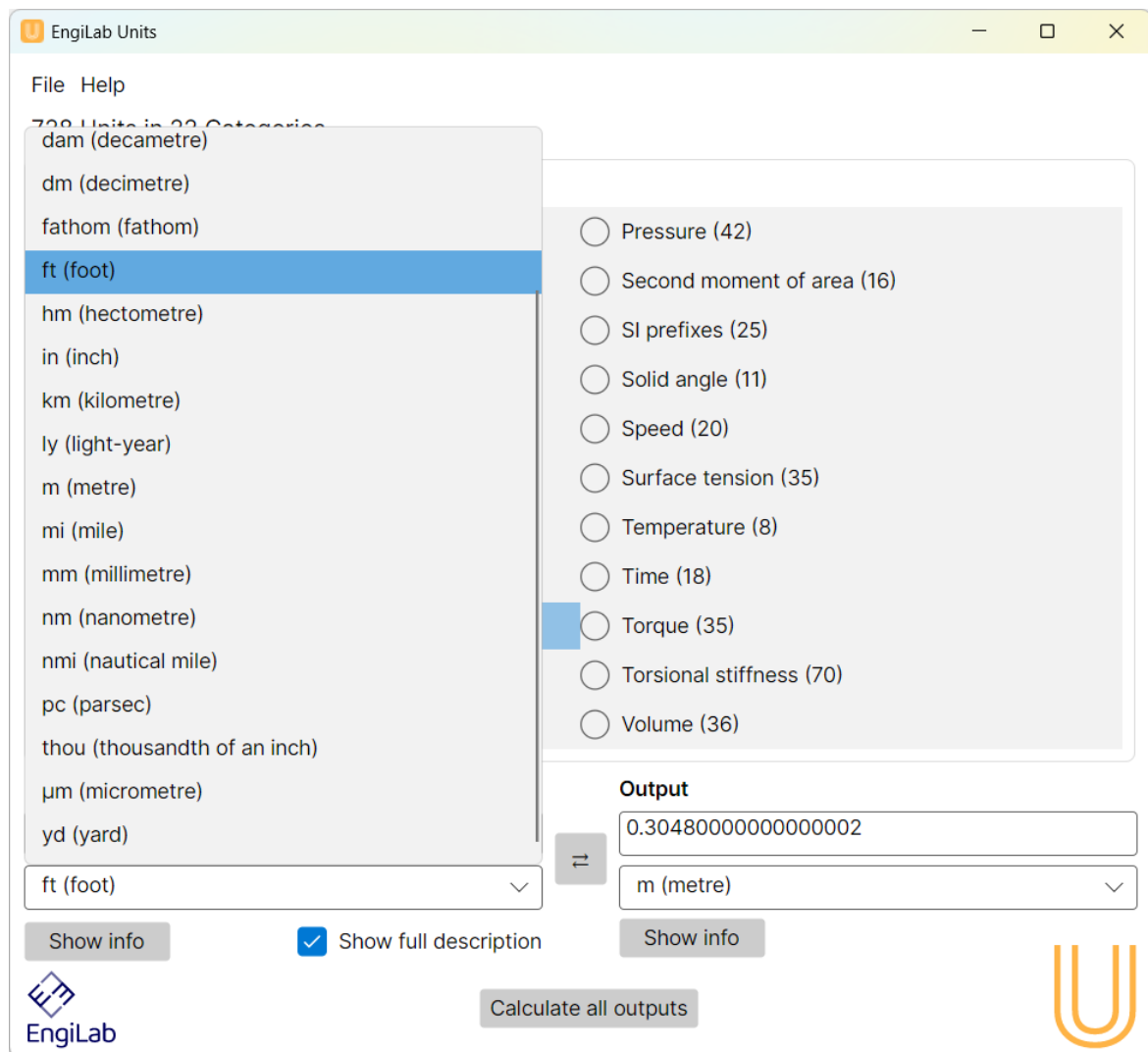
1. First, we select the unit category with the radio buttons on top.

Categories (22)

☐ Acceleration (15)	☐ Pressure (42)
☐ Angle (13)	☐ Second moment of area (16)
☐ Angular velocity (72)	☐ SI prefixes (25)
☐ Area (25)	☐ Solid angle (11)
☐ Computer (34)	☐ Speed (20)
☐ Density (55)	☐ Surface tension (35)
☐ Energy (65)	☐ Temperature (8)
☐ Force (17)	☐ Time (18)
☒ Length (21)	☐ Torque (35)
☐ Mass (35)	☐ Torsional stiffness (70)
☐ Power (60)	☐ Volume (36)

In this case, we select the "**Length - Distance**" category above.

2. We select the input unit from this category, using the input combo menu



In this example, we select the "**foot (ft)**" unit.

3. We type in the value of the length in feet, as shown below.

Input

100

ft (foot)

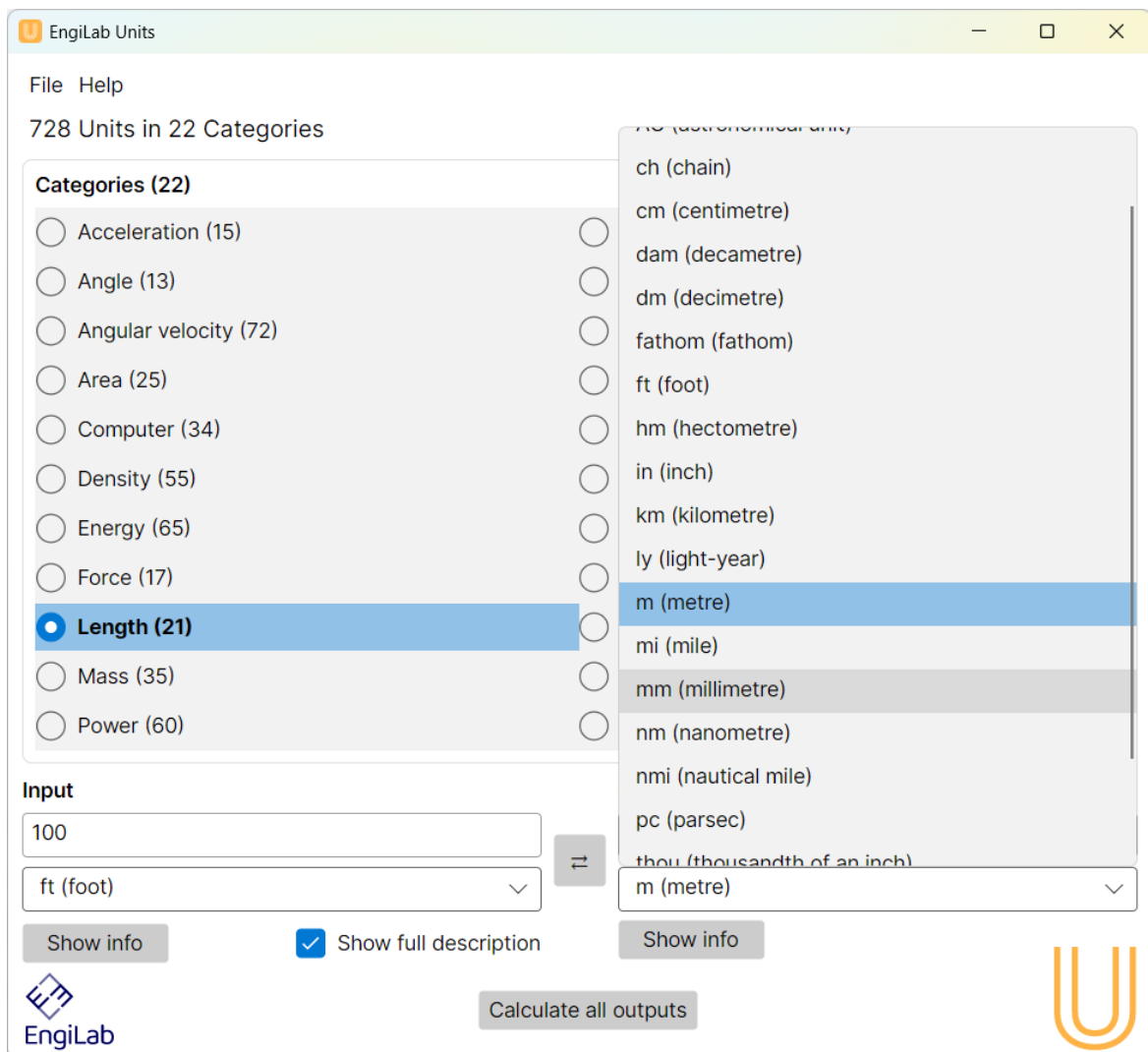
Show info ☒ Show full description

EngiLab

Calcul

After typing the value, you will get the result in the Output text box. You do not need to press the ENTER key as the program does the conversion on the fly.

4. We select the output unit from the category, using the output combo menu



5. The result appears in the Output text box

EngiLab Units

File Help

728 Units in 22 Categories

Categories (22)

- ☐ Acceleration (15)
- ☐ Angle (13)
- ☐ Angular velocity (72)
- ☐ Area (25)
- ☐ Computer (34)
- ☐ Density (55)
- ☐ Energy (65)
- ☐ Force (17)
- ☒ **Length (21)**
- ☐ Mass (35)
- ☐ Power (60)
- ☐ Pressure (42)
- ☐ Second moment of area (16)
- ☐ SI prefixes (25)
- ☐ Solid angle (11)
- ☐ Speed (20)
- ☐ Surface tension (35)
- ☐ Temperature (8)
- ☐ Time (18)
- ☐ Torque (35)
- ☐ Torsional stiffness (70)
- ☐ Volume (36)

Input

100

ft (foot)

Show info

☒ Show full description

Output

30480

mm (millimetre)

Show info

Calculate all outputs

EngiLab

As shown above, in this example, the result is: **100 ft = 30,480 mm**

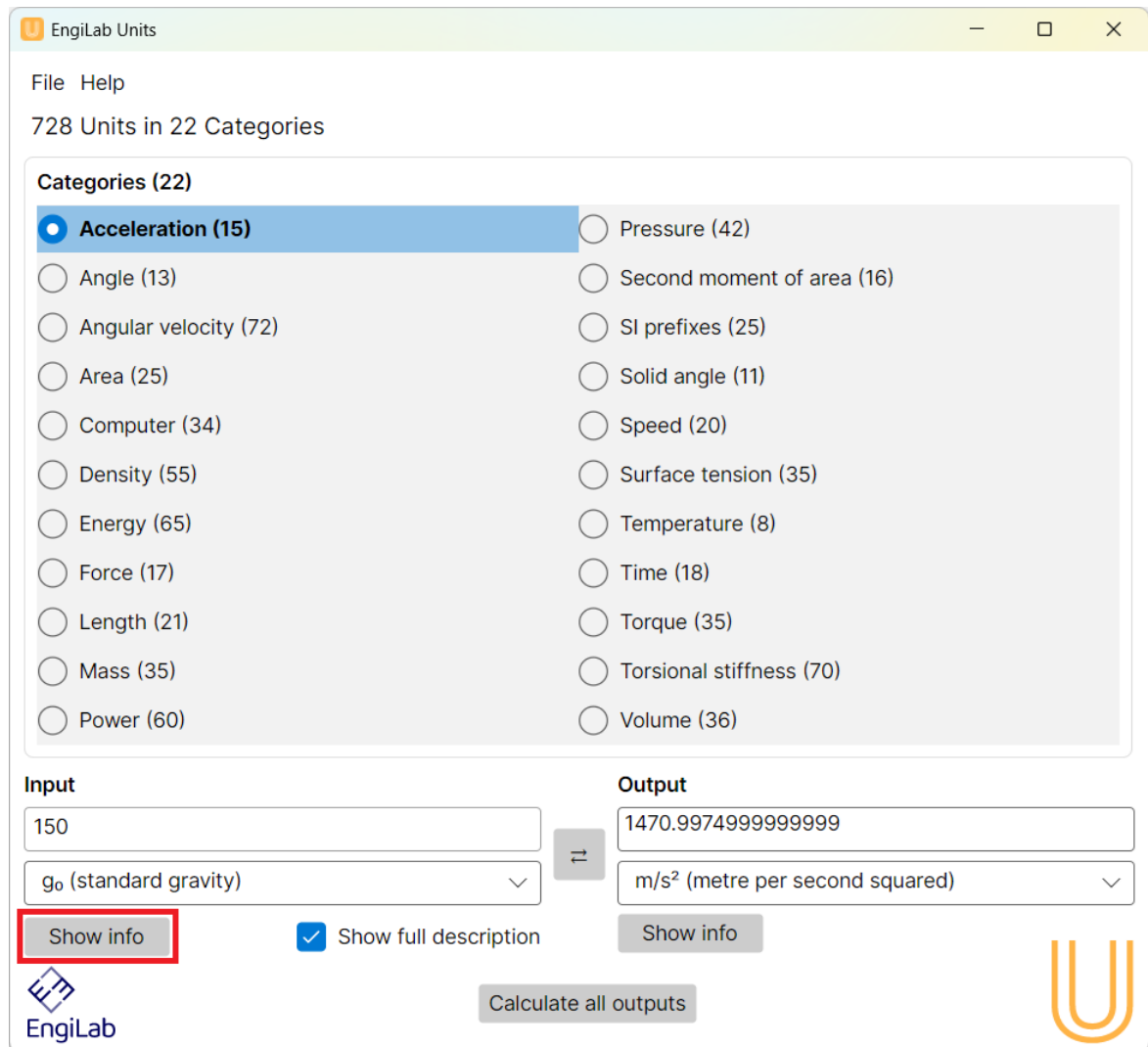
2.4 Accessing Wikipedia Information About Units

Often, it is useful to check the definition of a specific unit or learn more about its background, historical origins, or applications. To make this process easier, EngiLab Units provides direct links to relevant Wikipedia articles for many units. Instead of the older built-in browser, the program now (v6.0.0) uses your system's default web browser.

Whenever you click the "Show info" button (for either the input unit or the output unit), EngiLab Units automatically opens the corresponding Wikipedia page in your regular browser.

Example

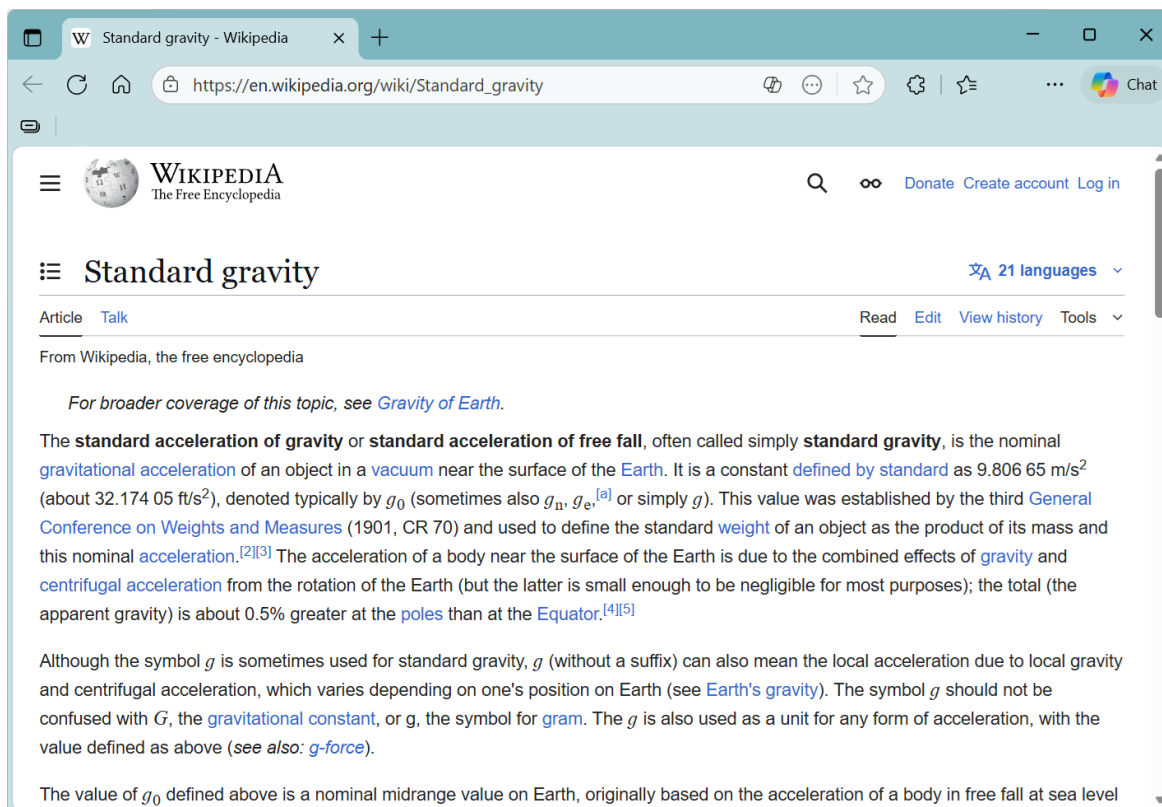
In the example below, we click “**Show info**” for the unit ‘**Standard gravity**’. EngiLab Units immediately opens the corresponding Wikipedia article in the default browser.



Usually, we need to check the definition of a unit or study more about the specific unit, its origins, use and others. Instead of having to google using a separate browser, EngiLab Units features a built-in web browser with ready-to-use links to Wikipedia articles for certain units. All one has to do is click the “**Show info**” button, either for the input or the output unit.

See for example the screenshot below which shows the Wikipedia article for “**Standard gravity**”.

The system then opens the Wikipedia article:



Notes

- Not all units in EngiLab Units have a corresponding Wikipedia article. The “Show info” button is enabled only for units that either:
 1. have their own dedicated Wikipedia page, or
 2. are best explained through a related/general Wikipedia article.
- The same applies to all 22 categories of units. Clicking the “Show info” button for a category opens the Wikipedia article that corresponds to that category.

2.5 Calculation of all outputs

In addition to converting between a selected pair of units, EngiLab Units can instantly compute the equivalent value in **every unit of the chosen category**. This feature provides a complete overview of how a quantity is expressed across all relevant units.

To use it, simply enter the input value, select the input unit, and click the “**Calculate all outputs**” button. The program will generate a table containing the converted value for every unit in the category.

Below is an example using a value of **150 miles per hour** in the **Speed / Velocity** category. With a single click, all 22 speed units are computed and displayed.

EngiLab Units

File Help

728 Units in 22 Categories

Categories (22) Show info

- Acceleration (15)
- Angle (13)
- Angular velocity (72)
- Area (25)
- Computer (34)
- Density (55)
- Energy (65)
- Force (17)
- Length (21)
- Mass (35)
- Power (60)
- Pressure (42)
- Second moment of area (16)
- SI prefixes (25)
- Solid angle (11)
- Speed (20)**
- Surface tension (35)
- Temperature (8)
- Time (18)
- Torque (35)
- Torsional stiffness (70)
- Volume (36)

Input: 150 m/s (metre per second) Show info

Output: 150 m/s (metre per second) Show info

☒ Show full description

Calculate all outputs

Copy table Save as CSV Save as Excel (.xlsx) Close

Value	Symbol	Unit
5.003461427	c	speed of light
54000000	cm/h	centimetre per hour
900000	cm/min	centimetre per minute
15000	cm/s	centimetre per second
1771653.543	ft/h	foot per hour
29527.55905	ft/min	foot per minute
492.1259842	ft/s	foot per second
540	km/h	kilometre per hour
9	km/min	kilometre per minute
0.15	km/s	kilometre per second
291.5766738	knot	nautical mile per hour
540000	m/h	metre per hour
9000	m/min	metre per minute
150	m/s	metre per second
5.592340731	mi/min	mile per minute
0.093205671	mi/s	mile per second
540000000	mm/h	millimetre per hour
9000000	mm/min	millimetre per minute
150000	mm/s	millimetre per second
335.540443	mph	mile per hour

Working with the Results Table

When the table is displayed, four additional buttons appear at the top of the window. These allow the user to export or work with the results:

1. Copy table

Copies all rows of the results table to the clipboard. The user can then paste the data directly into applications such as Excel, Word, or text editors.

2. Save as CSV

Saves the entire table in CSV (comma-separated values) format. This is ideal for importing into spreadsheet software, databases, or data analysis tools.

3. Save as Excel (.xlsx)

Exports the results directly into a Microsoft Excel file. This is useful when the user wants to store results, create plots, or perform further processing in Excel.

4. Close

Closes the results (right) window and returns to the main interface.

Chapter



3

Units categories

3 Units categories

1. [Acceleration \(Linear\)](#)
2. [Angle](#)
3. [Angular Velocity](#)
4. [Area](#)
5. [Computer storage \(decimal & binary\)](#)
6. [Density](#)
7. [Energy and Work](#)
8. [Force](#)
9. [Length and Distance](#)
10. [Mass](#)
11. [Power](#)
12. [Pressure and Stress](#)
13. [Second Moment of Area](#)
14. [SI Prefixes](#)
15. [Solid Angle](#)
16. [Speed \(Velocity\)](#)
17. [Surface Tension and Translational Stiffness](#)
18. [Temperature](#)
19. [Time](#)
20. [Torque \(Moment of force\)](#)
21. [Torsional Stiffness](#)
22. [Volume](#)

3.1 Acceleration (Linear)

The following **15 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	centimetre/second squared (cm/s ²)	10 ⁻² m/s ²	https://en.wikipedia.org/wiki/Gal_(unit) The same as galileo (Gal)
2	foot/second squared (ft/s ²)	0.3048 m/s ²	https://en.wikipedia.org/wiki/Foot_per_second_squared

3	standard gravity (g ₀)	9.80665 m/s ²	https://en.wikipedia.org/wiki/Standard_gravity
4	galileo (Gal)	10 ⁻² m/s ²	https://en.wikipedia.org/wiki/Gal_(unit) The same as centimetre/second squared (cm/s ²)
5	inch/second squared (in/s ²)	0.0254 m/s ²	
6	kilometre/ (hour·minute) (km/ (h·min))	(1/216) m/s ²	
7	kilometre/ (hour·second) (km/ (h·s))	(1/3.6) m/s ²	
8	kilometre/hour squared (km/h ²)	(1/12,960) m/s ²	
9	kilometre/second squared (km/s ²)	10 ³ m/s ²	
10	metre/second squared (m/s²)	-	https://en.wikipedia.org/wiki/Metre_per_second_squared
11	mile/ (hour·minute) (mi/ (h·min))	(37/4966) m/s ²	
12	mile/ (hour·second) (mi/ (h·s))	0.44704 m/s ²	
13	mile/hour squared (mi/h ²)	(34/273,801) m/s ²	
14	mile/second squared (mi/s ²)	1609.344 m/s ²	
15	millimetre/second	10 ⁻³ m/s ²	

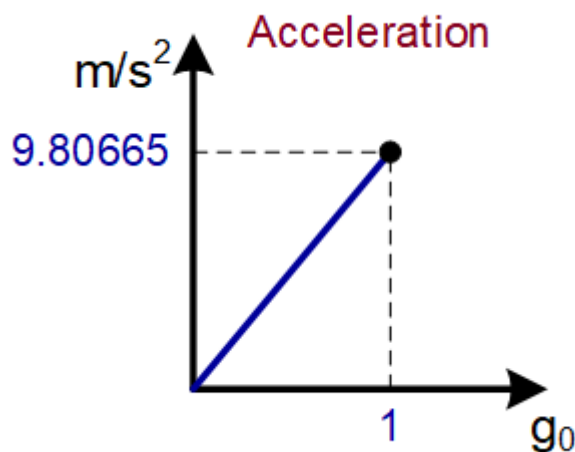
	squared (mm/s ²)		
--	---------------------------------	--	--

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.2 Angle

The following **13 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	minute of arc ('')	(1/60) deg	https://en.wikipedia.org/wiki/Minute_and_second_of_arc Page refers to Minute and second of arc
2	second of arc ('')	(1/3600) deg	https://en.wikipedia.org/wiki/Minute_and_second_of_arc Page refers to Minute and second of arc
3	circle (circle)	(2 π) rad	https://en.wikipedia.org/wiki/Turn_(angle)
4	degree (deg)	(π /180) rad	https://en.wikipedia.org/wiki/Degree_(angle)
5	gon (gon)	(π /200) rad	https://en.wikipedia.org/wiki/Gradian
6	gradian (grad)	(π /200) rad	https://en.wikipedia.org/wiki/Gradian
7	milliradian (mrad)	10 ⁻³ rad	https://en.wikipedia.org/wiki/Radian#Prefixes_and_variants

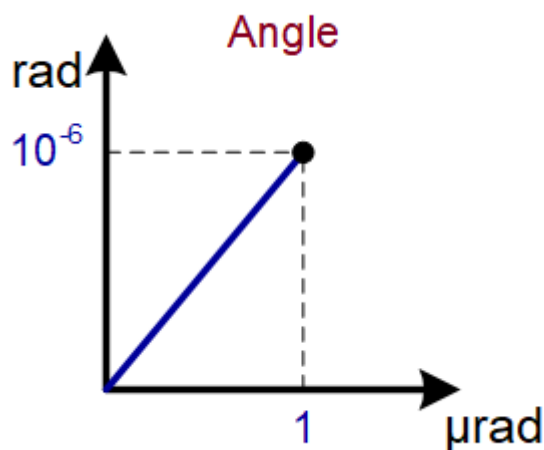
			Page refers to Multiples of radian units
8	quadrant (quad)	$(\pi/2)$ rad	https://en.wikipedia.org/wiki/Right_angle
9	radian (rad)	-	https://en.wikipedia.org/wiki/Radian
10	revolution (rev)	(2π) rad	https://en.wikipedia.org/wiki/Turn_(angle)
11	right angle (rt_angle)	$(\pi/2)$ rad	https://en.wikipedia.org/wiki/Right_angle
12	turn (turn)	(2π) rad	https://en.wikipedia.org/wiki/Turn_(angle)
13	microradian (μrad)	10^{-6} rad	https://en.wikipedia.org/wiki/Radian#Prefixes_and_variants Page refers to Multiples of radian units

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.3 Angular Velocity

The following **72 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
----	---------------	------------	--------------------------------

1	second of arc per day ("/d)	(1/311,040,000) degree/s	
2	second of arc per hour ("/h)	(1/12,960,000) degree/s	
3	second of arc per minute ("/min)	(1/216,000) degree/s	
4	second of arc per millisecond ("/ms)	(5/18) degree/s	
5	second of arc per second ("/s)	(1/3600) degree/s	
6	second of arc per microsecond ("/μs)	(5000/18) degree/s	
7	minute of arc per day ('d)	(1/5,184,000) degree/s	
8	minute of arc per hour ('/h)	(1/216,000) degree/s	
9	minute of arc per minute ('/min)	(1/3600) degree/s	
10	minute of arc per millisecond ('/ms)	(50/3) degree/s	
11	minute of arc per second ('/s)	(1/60) degree/s	
12	minute of arc per microsecond ('/μs)	(50,000/3) degree/s	

13	circle per day (circle/d)	$(\pi/43,200)$ rad/s	
14	circle per hour (circle/h)	$(\pi/1800)$ rad/s	
15	circle per minute (circle/min)	$(2\pi/60)$ rad/s	https://en.wikipedia.org/wiki/Revolutions_per_minute
16	circle per millisecond (circle/ms)	(2000π) rad/s	
17	circle per second (circle/s)	(2π) rad/s	https://en.wikipedia.org/wiki/Cycle_per_second
18	circle per microsecond (circle/ μ s)	$2 \times 10^6 \pi$ rad/s	
19	degree per day (deg/d)	$(\pi/15,552,000)$ rad/s	
20	degree per hour (deg/h)	$(\pi/648,000)$ rad/s	
21	degree per minute (deg/min)	$(\pi/10,800)$ rad/s	
22	degree per millisecond (deg/ms)	$(50\pi/9)$ rad/s	
23	degree per second (deg/s)	$(\pi/180)$ rad/s	
24	degree per microsecond (deg/ μ s)	$1000 \cdot (50\pi/9)$ rad/s	
25	gon per day (gon/d)	$(\pi/17,280,000)$ rad/s	
26	gon per hour (gon/h)	$(\pi/720,000)$ rad/s	
27	gon per minute (gon/min)	$(\pi/12,000)$ rad/s	

28	gon per millisecond (gon/ms)	(5π) rad/s	
29	gon per second (gon/s)	$(\pi/200)$ rad/s	
30	gon per microsecond (gon/ μ s)	(5000π) rad/s	
31	gradian per day (grad/d)	$(\pi/17,280,000)$ rad/s	
32	gradian per hour (grad/h)	$(\pi/720,000)$ rad/s	
33	gradian per minute (grad/min)	$(\pi/12,000)$ rad/s	
34	gradian per millisecond (grad/ms)	(5π) rad/s	
35	gradian per second (grad/s)	$(\pi/200)$ rad/s	
36	gradian per microsecond (grad/ μ s)	(5000π) rad/s	
37	milliradian per day (mrad/d)	$10^{-5}/864$ rad/s	
38	milliradian per hour (mrad/h)	$10^{-5}/36$ rad/s	
39	milliradian per minute (mrad/min)	$10^{-3}/60$ rad/s	
40	milliradian per millisecond (mrad/ms)	1 rad/s	

41	milliradian per second (mrad/s)	10^{-3} rad/s	
42	milliradian per microsecond (mrad/ μ s)	1000 rad/s	
43	quadrant per day (quad/d)	$(\pi/172,800)$ rad/s	
44	quadrant per hour (quad/h)	$(\pi/7200)$ rad/s	
45	quadrant per minute (quad/min)	$(\pi/120)$ rad/s	
46	quadrant per millisecond (quad/ms)	(500π) rad/s	
47	quadrant per second (quad/s)	$(\pi/2)$ rad/s	
48	quadrant per microsecond (quad/ μ s)	$5 \times 10^5 \pi$ rad/s	
49	radian per day (rad/d)	1/86,400 rad/s	
50	radian per hour (rad/h)	1/3600 rad/s	
51	radian per minute (rad/min)	1/60 rad/s	
52	radian per millisecond (rad/ms)	1000 rad/s	
53	radian per second (rad/s)	-	https://en.wikipedia.org/wiki/Radian_per_second
54	radian per microsecond (rad/ μ s)	10^6 rad/s	

55	revolution per day (rev/d)	$(\pi/43,200)$ rad/s	
56	revolution per hour (rev/h)	$(\pi/1800)$ rad/s	
57	revolution per minute (revolution/min)	$(2\pi/60)$ rad/s	https://en.wikipedia.org/wiki/Revolutions_per_minute
58	revolution per millisecond (rev/ms)	(2000π) rad/s	
59	revolution per second (rev/s)	(2π) rad/s	https://en.wikipedia.org/wiki/Cycle_per_second
60	revolution per microsecond (rev/ μ s)	$2 \times 10^6 \pi$ rad/s	
61	right angle per day (rt_angle/d)	$(\pi/172,800)$ rad/s	
62	right angle per hour (rt_angle/h)	$(\pi/7200)$ rad/s	
63	right angle per minute (rt_angle/min)	$(\pi/120)$ rad/s	
64	right angle per millisecond (rt_angle/ms)	(500π) rad/s	
65	right angle per second (rt_angle/s)	$(\pi/2)$ rad/s	
66	right angle per	$5 \times 10^5 \pi$ rad/s	

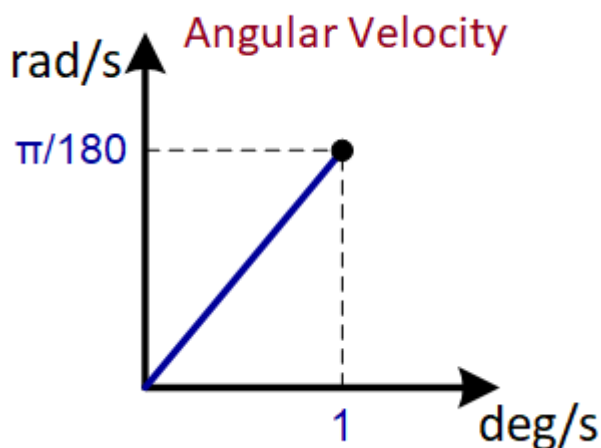
	microsecond (rt_angle/ μ s)		
67	microradian per day (μ rad/d)	$10^{-8}/864$ rad/s	
68	microradian per hour (μ rad/h)	$10^{-8}/36$ rad/s	
69	microradian per minute (μ rad/min)	$10^{-6}/60$ rad/s	
70	microradian per millisecond (μ rad/ms)	10^{-3} rad/s	
71	microradian per second (μ rad/s)	10^{-6} rad/s	
72	microradian per microsecond (μ rad/ μ s)	1 rad/s	

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.4 Area

The following **25 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	are (a)	100 m ²	https://en.wikipedia.org/wiki/Hectare#Are
2	sq. angstrom (Å ²)	10 ⁻²⁰ m ²	https://en.wikipedia.org/wiki/Angstrom Page refers to angstrom (distance unit)
3	acre (ac)	(1/640) mi ²	https://en.wikipedia.org/wiki/Acre
4	sq. astronomical unit (AU ²)	22,379,522,917,973,918,490,000 m ²	https://en.wikipedia.org/wiki/Astronomical_unit Page refers to astronomical unit (distance unit)
5	barn (b)	10 ⁻²⁸ m ²	https://en.wikipedia.org/wiki/Barn_(unit) Page refers to barn (distance unit)
6	sq. centimetre (cm ²)	10 ⁻⁴ m ²	https://en.wikipedia.org/wiki/Square_metre#SI_prefixes_applied
7	decare (daa)	1000 m ²	https://en.wikipedia.org/wiki/Hectare#Decare
8	sq. decametre (dam ²)	100 m ²	https://en.wikipedia.org/wiki/Square_metre#SI_prefixes_applied
9	sq. decimetre (dm ²)	10 ⁻² m ²	https://en.wikipedia.org/wiki/Square_metre#SI_prefixes_applied
10	sq. foot (ft ²)	1 ft ² = 0.09290304 m ²	https://en.wikipedia.org/wiki/Square_foot
11	hectare (ha)	10,000 m ²	https://en.wikipedia.org/wiki/Hectare

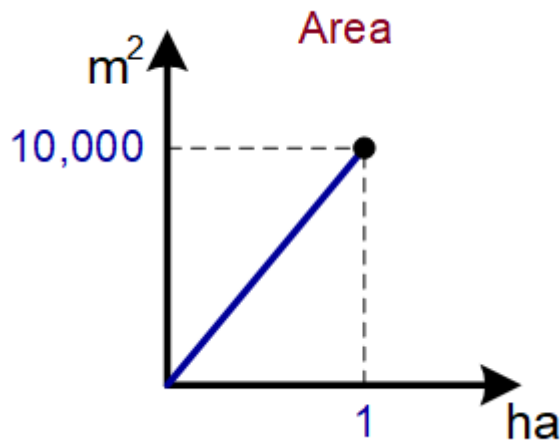
12	sq. hectometre (hm ²)	10,000 m ²	https://en.wikipedia.org/wiki/Square_metre#SI_prefixes_applied
13	sq. inch (in ²)	1 in ² = 6.4516·10 ⁻⁴ m ²	https://en.wikipedia.org/wiki/Square_inch
14	sq. kilometre (km ²)	10 ⁶ m ²	https://en.wikipedia.org/wiki/Square_kilometre
15	sq. light-year (ly ²)	89,505,421,074,818,927,300,612,528,640,000 m ²	https://en.wikipedia.org/wiki/Light-year Page refers to light-year (distance unit)
16	sq. metre (m²)	-	https://en.wikipedia.org/wiki/Square_metre
17	sq. mile (mi ²)	1 mi ² = 2,589,988.110336 m ²	https://en.wikipedia.org/wiki/Square_mile
18	sq. millimetre (mm ²)	10 ⁻⁶ m ²	https://en.wikipedia.org/wiki/Square_metre#SI_prefixes_applied
19	sq. nanometre (nm ²)	10 ⁻¹⁸ m ²	https://en.wikipedia.org/wiki/Square_metre#SI_prefixes_applied
20	sq. nautical mile (nmi ²)	3,429,904 m ²	https://en.wikipedia.org/wiki/Nautical_mile Page refers to nautical mile (distance unit)
21	sq. parsec (pc ²)	(419,904,000,000/p ²) AU ²	https://en.wikipedia.org/wiki/Parsec Page refers to parsec (distance unit)
22	stremma [royal]	1000 m ²	https://en.wikipedia.org/wiki/Stremma
23	sq. thousandth of an inch (thou ² , mil ²)	10 ⁻⁶ in ²	https://en.wikipedia.org/wiki/Thousandth_of_an_inch Page refers to thousandth of an inch (distance unit)
24	sq. micrometre (µm ²)	10 ⁻¹² m ²	https://en.wikipedia.org/wiki/Square_metre#SI_prefixes_applied
25	sq. yard (yd ²)	1 yd ² = 0.83612736 m ²	https://en.wikipedia.org/wiki/Square_yard

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.5 Computer storage (decimal & binary)

The following **34 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	bit	-	https://en.wikipedia.org/wiki/Bit
2	kilobit (kbit)	10^3 bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits
3	kibibit (Kibit)	$2^{10} = 1024^1$ bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits
4	megabit (Mbit)	10^6 bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits
5	mebibit (Mibit)	$2^{20} = 1024^2$ bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits
6	gigabit (Gbit)	10^9 bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits
7	gibibit (Gibit)	$2^{30} = 1024^3$ bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits
8	terabit (Tbit)	10^{12} bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits
9	tebibit (Tibit)	$2^{40} = 1024^4$ bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits

10	petabit (Pbit)	10^{15} bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits
11	pebibit (Pibit)	$2^{50} = 1024^5$ bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits
12	exabit (Ebit)	10^{18} bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits
13	exbibit (Eibit)	$2^{60} = 1024^6$ bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits
14	zettabit (Zbit)	10^{21} bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits
15	zebibit (Zibit)	$2^{70} = 1024^7$ bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits
16	yottabit (Ybit)	10^{24} bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits
17	yobibit (Yibit)	$2^{80} = 1024^8$ bits	https://en.wikipedia.org/wiki/Bit#Multiple_bits
18	byte	8 bits	https://en.wikipedia.org/wiki/Byte
19	kilobyte (kB)	10^3 bytes	https://en.wikipedia.org/wiki/Byte#Multiple-byte_units
20	kibibyte (KiB)	$2^{10} = 1024^1$ bytes	https://en.wikipedia.org/wiki/Byte#Multiple-byte_units
21	megabyte (MB)	10^6 bytes	https://en.wikipedia.org/wiki/Megabyte
22	mebibyte (MiB)	$2^{20} = 1024^2$ bytes	https://en.wikipedia.org/wiki/Byte#Multiple-byte_units
23	gigabyte (GB)	10^9 bytes	https://en.wikipedia.org/wiki/Gigabyte
24	gibibyte (GiB)	$2^{30} = 1024^3$ bytes	https://en.wikipedia.org/wiki/Byte#Multiple-byte_units
25	terabyte (TB)	10^{12} bytes	https://en.wikipedia.org/wiki/Byte#Multiple-byte_units
26	tebibyte (TiB)	$2^{40} = 1024^4$ bytes	https://en.wikipedia.org/wiki/Byte#Multiple-byte_units
27	petabyte (PB)	10^{15} bytes	https://en.wikipedia.org/wiki/Byte#Multiple-byte_units
28	pebibyte (PiB)	$2^{50} = 1024^5$ bytes	https://en.wikipedia.org/wiki/Byte#Multiple-byte_units

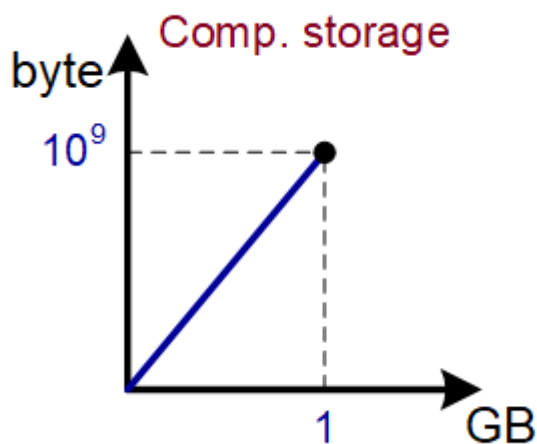
29	exabyte (EB)	10^{18} bytes	https://en.wikipedia.org/wiki/Byte#Multiple-byte_units
30	exbibyte (EiB)	$2^{60} = 1024^6$ bytes	https://en.wikipedia.org/wiki/Byte#Multiple-byte_units
31	zettabyte (ZB)	10^{21} bytes	https://en.wikipedia.org/wiki/Byte#Multiple-byte_units
32	zebibyte (ZiB)	$2^{70} = 1024^7$ bytes	https://en.wikipedia.org/wiki/Byte#Multiple-byte_units
33	yottabyte (YB)	10^{24} bytes	https://en.wikipedia.org/wiki/Byte#Multiple-byte_units
34	yobibyte (YiB)	$2^{80} = 1024^8$ bytes	https://en.wikipedia.org/wiki/Byte#Multiple-byte_units

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.6 Density

The following **55 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
----	---------------	------------	--------------------------------

1	blob per cubic foot (blob/ft ³)	$(1/12)^3 \text{ blob/in}^3$	
2	blob per cubic inch (blob/in ³)	$(444,822,161.52605 / (6.4516)^2) \text{ kg/m}^3$	
3	blob per cubic yard (blob/yd ³)	$(1/36)^3 \text{ blob/in}^3$	
4	gram per cubic centimetre (g/cm ³)	10^3 kg/m^3	https://en.wikipedia.org/wiki/Gram_per_cubic_centimetre
5	gram per litre (g/l)	1 kg/m^3	https://en.wikipedia.org/wiki/Gram_per_litre
6	gram per cubic metre (g/m ³)	10^{-3} kg/m^3	
7	gram per cubic millimetre (g/mm ³)	10^6 kg/m^3	
8	grain per cubic foot (grain/ft ³)	$(1/1728) \text{ grain/in}^3$	
9	grain per gallon [imperial] (grain/gallon_imp)	$64.79891 \times 10^{-3} / 4.54609 \text{ kg/m}^3$	
10	grain per gallon [US liquid] (grain/gallon_US)	$(1/231) \text{ grain/in}^3$	
11	grain per cubic inch (grain/in ³)	$(64.79891 \times 10^{-6} / (0.0254)^3) \text{ kg/m}^3$	
12	grain per cubic yard	$(1/46,656) \text{ grain/in}^3$	

	(grain/yd ³)		
13	kilogram per cubic centimetre (kg/cm ³)	10 ⁶ kg/m ³	
14	kilogram per litre (kg/l)	10 ³ kg/m ³	
15	kilogram per cubic metre (kg/m³)	-	https://en.wikipedia.org/wiki/Kilogram_per_cubic_metre
16	kilogram per cubic millimetre (kg/mm ³)	10 ⁹ kg/m ³	
17	pound [avoirdupois] per cubic foot (lbm/ft ³)	(1/1728) lbm/in ³	
18	pound [avoirdupois] per gallon [imperial] (lbm/gallon_imp)	(453.59237/4.54609) kg/m ³	
19	pound [avoirdupois] per gallon [US liquid] (lbm/gallon_US)	(1/231) lbm/in ³	
20	pound [avoirdupois] per cubic inch (lbm/in ³)	(0.45359237/(0.0254) ³) kg/m ³	
21	pound [avoirdupois] per cubic yard (lbm/yd ³)	(1/46,656) lbm/in ³	

22	milligram per cubic centimetre (mg/cm ³)	1 kg/m ³	
23	megagram per cubic centimetre (Mg/cm ³)	10 ⁹ kg/m ³	
24	milligram per litre (mg/l)	10 ⁻³ kg/m ³	
25	megagram per litre (Mg/l)	10 ⁶ kg/m ³	The same as “tonne [metric] per litre”
26	milligram per cubic metre (mg/m ³)	10 ⁻⁶ kg/m ³	
27	megagram per cubic metre (Mg/m ³)	10 ³ kg/m ³	The same as “tonne [metric] per cubic metre”
28	milligram per cubic millimetre (mg/mm ³)	10 ³ kg/m ³	
29	megagram per cubic millimetre (Mg/mm ³)	10 ¹² kg/m ³	The same as “tonne [metric] per cubic millimetre”
30	ounce [avoirdupois] per cubic foot (oz/ft ³)	(1/1728) oz/in ³	
31	ounce [avoirdupois] per gallon [imperial] (oz/gallon_i mp)	(28.349523125/4.54 609) kg/m ³	
32	ounce [avoirdupois	(1/231) oz/in ³	

	] per gallon [US liquid] (oz/gallon_US)		
33	ounce [avoirdupois]] per cubic inch (oz/in ³)	$(28.349523125 \times 10^{-3} / (0.0254)^3) \text{ kg/m}^3$	
34	ounce [avoirdupois]] per cubic yard (oz/yd ³)	$(1/46,656) \text{ oz/in}^3$	
35	slug per cubic foot (slug/ft ³)	$(1/12)^3 \text{ slug/in}^3$	
36	slug per cubic inch (slug/in ³)	$(444,822,161.52605 / 12 / (6.4516)^2) \text{ kg/m}^3$	
37	slug per cubic yard (slug/yd ³)	$(1/36)^3 \text{ slug/in}^3$	
38	tonne [metric] per cubic centimetre (t/cm ³)	10^9 kg/m^3	The same as “megagram per cubic centimetre”
39	tonne [metric] per litre (t/l)	10^6 kg/m^3	The same as “megagram per litre”
40	tonne [metric] per cubic metre (t/m ³)	10^3 kg/m^3	The same as “megagram per cubic metre”
41	tonne [metric] per cubic millimetre (t/mm ³)	10^{12} kg/m^3	
42	long ton per cubic foot	$(1/1728) \text{ long ton per in}^3$	

	(ton_long/ft ³)		
43	long ton per gallon [imperial] (ton_long/gallon_imp)	1016046.9088/4.54609 kg/m ³	
44	long ton per gallon [US liquid] (ton_long/gallon_US)	(1/231) long ton per in ³	
45	long ton per cubic inch (ton_long/in ³)	(1016.0469088/(0.0254) ³) kg/m ³	
46	long ton per cubic yard (ton_long/yd ³)	(1/46,656) long ton per in ³	
47	short ton per cubic foot (ton_short/ft ³)	(1/1728) short ton per in ³	
48	short ton per gallon [imperial] (ton_short/gallon_imp)	(907,184.74/4.54609) kg/m ³	
49	short ton per gallon [US liquid] (ton_short/gallon_US)	(1/231) short ton per in ³	
50	short ton per cubic inch (ton_short/in ³)	907.18474/(0.0254) ³ kg/m ³	
51	short ton per cubic	(1/46,656) short ton per in ³	

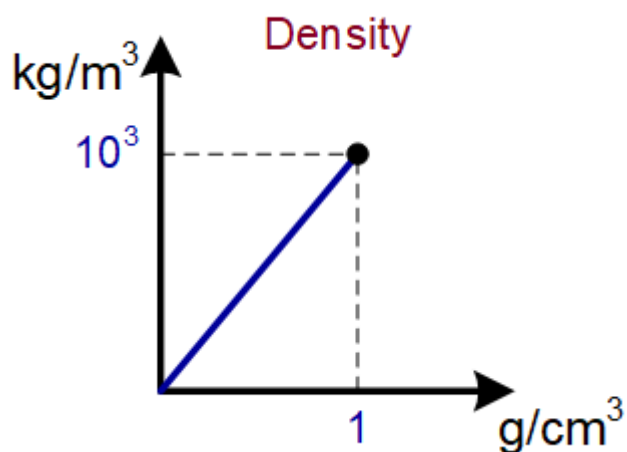
	yard (ton_short/y d ³)		
52	microgram per cubic centimetre ($\mu\text{g}/\text{cm}^3$)	$10^{-3} \text{ kg}/\text{m}^3$	
53	microgram per litre ($\mu\text{g}/\text{l}$)	$10^{-6} \text{ kg}/\text{m}^3$	
54	microgram per cubic metre ($\mu\text{g}/\text{m}^3$)	$10^{-9} \text{ kg}/\text{m}^3$	
55	microgram per cubic millimetre ($\mu\text{g}/\text{mm}^3$)	$1 \text{ kg}/\text{m}^3$	

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.7 Energy and Work

The following **65 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	BTU [IT] (BTU_IT)	1055.05585262 J	https://en.wikipedia.org/wiki/British_thermal_unit#Definitions Can be considered an approximate definition The most widespread BTU uses the International Steam Table (IT) calorie, which was defined by the Fifth International Conference on the Properties of Steam (London, July 1956) to be exactly 4.1868 J. Therefore, the exact conversion factor for the International Table Btu is 1055.05585262 J, as shown in the calculation: $\text{OneLbmEqualsKg} * 1000 * 5 / 9 * \text{OneCalITEqualsJoules} = 0.45359237 * 1000 * 5 / 9 * 4.1868 = 1055.05585262$
2	BTU [Thermochemical TH] (BTU_TH)	9489.1523804 / 9 J	https://en.wikipedia.org/wiki/British_thermal_unit#Definitions Can be considered an approximate definition It is based on the definition of the thermochemical calorie, which is equal to 4.184 J. The calculation is similar to the one for the IT case: $\text{OneLbmEqualsKg} * 1000 * 5 / 9 * \text{OneCalTHEqualsJoules} = 0.45359237 * 1000 * 5 / 9 * 4.184 = 9,489.1523804 / 9 \sim 1054.35026448889$
3	BTU [US, 59 °F (15 °C)] (BTU_US_59 F)	1,054.804 J	https://en.wikipedia.org/wiki/British_thermal_unit#Definitions Can be considered an approximate definition 59 °F (15 °C) is the most widely used reference temperature for BTU definition in the US. Different values can be found in the literature. This value is the one most commonly used. See:

			https://en.wikipedia.org/wiki/British_thermal_unit (reporting 1054.80 J) https://physics.nist.gov/cuu/pdf/sp811.pdf (reporting 1054.80 J)
4	calorie [IT] (cal_IT)	4.1868 J	https://en.wikipedia.org/wiki/Calorie#Definitions The Fifth International Conference on the Properties of Steam (London, July 1956) defined the International Table calorie as exactly 4.1868 J
5	calorie [Thermochemical TH] (cal_TH)	4.184 J	https://en.wikipedia.org/wiki/Calorie#Definitions It is defined as 4.184 J exactly
6	calorie [15 °C] (cal15)	4.1855 J	https://en.wikipedia.org/wiki/Calorie#Definitions Can be considered an approximate definition It is the amount of energy required to warm one gram of air-free water from 14.5 to 15.5 °C at standard atmospheric pressure. Experimental values of this calorie ranged from 4.1852 to 4.1858 J. The CIPM in 1950 (Comité international des poids et mesures (International Committee for Weights and Measures) 1950; PV, 1950, 22, 79–80) published a mean experimental value of 4.1855 J , noting an uncertainty of 0.0005 J.
7	dyne centimetre (dyn·cm)	10 ⁻⁷ J	
8	dyne metre (dyn·m)	10 ⁻⁵ J	
9	dyne millimetre (dyn·mm)	10 ⁻⁸ J	
10	erg (erg)	10 ⁻⁷ J	https://en.wikipedia.org/wiki/Erg
11	electronvolt (eV)	1.602176634×10 ⁻¹⁹ J	https://en.wikipedia.org/wiki/Electronvolt
12	femtojoule (fJ)	10 ⁻¹⁵ J	

13	foe (foe)	10^{44} J	https://en.wikipedia.org/wiki/Foe_(unit)
14	gigaelectron volt (GeV)	10^9 eV	https://en.wikipedia.org/wiki/Electronvolt Page refers to electronvolt
15	gram-force centimetre (gf·cm)	9.80665×10^{-5} J	
16	gram-force metre (gf·m)	9.80665×10^{-3} J	
17	gram-force millimetre (gf·mm)	9.80665×10^{-6} J	
18	gigajoule (GJ)	10^9 J	https://en.wikipedia.org/wiki/Joule#Multiples
19	gigawatt hour (GW·h)	3.6×10^{12} J	https://en.wikipedia.org/wiki/Kilowatt-hour#Watt-hour_multiples
20	joule (J)	-	https://en.wikipedia.org/wiki/Joule Equivalent to watt second, and newton metre
21	kilocalorie [IT] (kcal_IT)	4,186.8 J	https://en.wikipedia.org/wiki/Calorie#Definitions Page refers to Calorie
22	kilocalorie [Thermochemical TH] (kcal_TH)	4,184 J	https://en.wikipedia.org/wiki/Calorie#Definitions Page refers to Calorie
23	kilocalorie [15 °C] (kcal15)	4,185.5 J	https://en.wikipedia.org/wiki/Calorie#Definitions Page refers to Calorie Can be considered an approximate definition, see cal15 above
24	kiloelectronvolt (keV)	10^3 eV	https://en.wikipedia.org/wiki/Electronvolt Page refers to electronvolt
25	kilogram-force centimetre (kgf·cm)	9.80665×10^{-2} J	The same as "kilopond centimetre"
26	kilogram-force metre (kgf·m)	9.80665 J	The same as "kilopond metre"

27	kilogram-force millimetre (kgf·mm)	$9.80665 \times 10^{-3} \text{ J}$	The same as “kilopond millimetre”
28	kilojoule (kJ)	10^3 J	https://en.wikipedia.org/wiki/Joule#Multiples Equivalent to kilowatt second
29	kilopond centimetre (kp·cm)	$9.80665 \times 10^{-2} \text{ J}$	The same as “kilogram-force centimetre”
30	kilopond metre (kp·m)	9.80665 J	The same as “kilogram-force metre”
31	kilopond millimetre (kp·mm)	$9.80665 \times 10^{-3} \text{ J}$	The same as “kilogram-force millimetre”
32	kiloton of TNT (kt_TNT)	10^{12} cal_TH	https://en.wikipedia.org/wiki/Ton#Units_of_energy_and_power Based on that: 1 ton TNT $\approx 10^9$ thermochemical calories Can be considered an approximate definition
33	kilowatt hour (kW·h)	$3.6 \times 10^6 \text{ J}$	https://en.wikipedia.org/wiki/Kilowatt_hour
34	kilowatt second (kW·s)	10^3 J	https://en.wikipedia.org/wiki/Watt_second Page refers to watt second Equivalent to kilojoule
35	pound-force foot (lbf·ft)	$12 \text{ lbf}\cdot\text{in}$	https://en.wikipedia.org/wiki/Foot-pound_(energy)
36	pound-force inch (lbf·in)	$0.11298482902761 \text{ J}$	
37	millielectron volt (meV)	10^{-3} eV	https://en.wikipedia.org/wiki/Electronvolt Page refers to electronvolt
38	megaelectron volt (MeV)	10^6 eV	https://en.wikipedia.org/wiki/Electronvolt Page refers to electronvolt
39	millijoule (mJ)	10^{-3} J	https://en.wikipedia.org/wiki/Joule#Multiples
40	megajoule (MJ)	10^6 J	https://en.wikipedia.org/wiki/Joule#Multiples
41	megaton of TNT (Mt_TNT)	10^{15} cal_TH	https://en.wikipedia.org/wiki/Ton#Units_of_energy_and_power

			Based on that: 1 ton TNT $\approx 10^9$ thermochemical calories Can be considered an approximate definition
42	milliwatt hour (mW·h)	3.6 J	https://en.wikipedia.org/wiki/Kilowatt-hour#Watt-hour_multiples
43	megawatt hour (MW·h)	3.6×10^9 J	https://en.wikipedia.org/wiki/Kilowatt-hour#Watt-hour_multiples
44	newton centimetre (N·cm)	10^{-2} J	
45	newton metre (N·m)	1 J	https://en.wikipedia.org/wiki/Newton_metre Equivalent to Joule and watt second
46	newton millimetre (N·mm)	10^{-3} J	
47	nanojoule (nJ)	10^{-9} J	https://en.wikipedia.org/wiki/Joule#Multiples
48	ounce-force foot (ozf·ft)	12 ozf·in	
49	ounce-force inch (ozf·in)	0.00706155181422 604375 J	
50	poundal foot (pdl·ft)	12 pdl·in	https://en.wikipedia.org/wiki/Foot-poundal
51	poundal inch (pdl·in)	0.00351167584115 04 J	
52	picojoule (pJ)	10^{-12} J	
53	petajoule (PJ)	10^{15} J	https://en.wikipedia.org/wiki/Joule#Multiples
54	petawatt hour (PW·h)	3.6×10^{18} J	https://en.wikipedia.org/wiki/Kilowatt-hour#Watt-hour_multiples
55	ton of TNT (t _{TNT})	10^9 cal _{TH}	https://en.wikipedia.org/wiki/Ton#Units_of_energy_and_power Based on that: 1 ton TNT $\approx 10^9$ thermochemical calories Can be considered an approximate definition

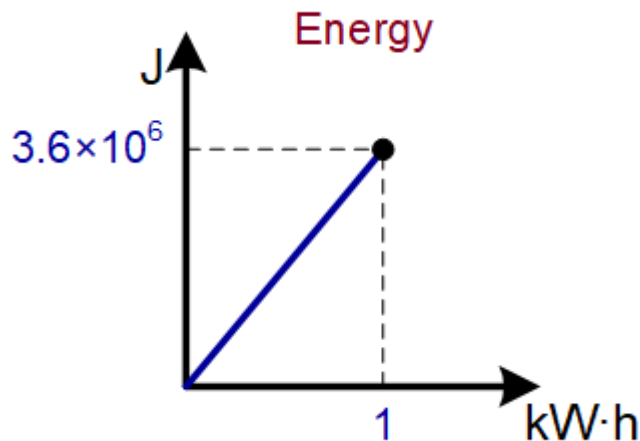
56	teraelectron volt (TeV)	10^{12} eV	https://en.wikipedia.org/wiki/Electronvolt Page refers to electronvolt
57	therm [IT] (thm_IT)	10^5 BTU [IT]	https://en.wikipedia.org/wiki/Therm#Definitions
58	therm [TH] (thm_TH)	10^5 BTU [Thermochemical TH]	https://en.wikipedia.org/wiki/Therm#Definitions
59	therm [US, 59 °F (15.0 °C)] (thm_US_59 F)	10^5 BTU [US, 59 °F (15 °C)]	https://en.wikipedia.org/wiki/Therm#Definitions
60	terajoule (TJ)	10^{12} J	https://en.wikipedia.org/wiki/Joule#Multiples
61	terawatt hour (TW·h)	3.6×10^{15} J	https://en.wikipedia.org/wiki/Kilowatt-hour#Watt-hour_multiples
62	microjoule (μJ)	10^{-6} J	https://en.wikipedia.org/wiki/Joule#Multiples
63	microwatt hour (μW·h)	3.6×10^{-3} J	https://en.wikipedia.org/wiki/Kilowatt-hour#Watt-hour_multiples
64	watt hour (W·h)	3600 J	https://en.wikipedia.org/wiki/Kilowatt-hour#Watt-hour_multiples
65	watt second (W·s)	1 J	https://en.wikipedia.org/wiki/Watt_second Equivalent to Joule and newton metre

Most of the above definitions of the various units are **EXACT** with the **exception of the cases that are highlighted in red color**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.8 Force

The following **17 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	dyne (dyn)	10^{-5} N	https://en.wikipedia.org/wiki/Dyne
2	gram-force (gf)	9.80665×10^{-3} N	https://en.wikipedia.org/wiki/Kilogram-force Page refers to kilogram-force
3	kilogram-force (kgf)	9.80665 N	https://en.wikipedia.org/wiki/Kilogram-force The same as kilopond (kp)
4	kip	10^3 pound-force	https://en.wikipedia.org/wiki/Kip_(unit)
5	kilonewton (kN)	10^3 N	https://en.wikipedia.org/wiki/Newton_(unit)#Kilonewtons
6	kilopond (kp)	9.80665 N	https://en.wikipedia.org/wiki/Kilogram-force The same as kilogram-force (kgf)
7	pound-force (lbf)	4.4482216152605 N	https://en.wikipedia.org/wiki/Pound_(force) Not to be confused with avoirdupois pound (symbol: lbm), often simply called pounds, which is a unit of mass
8	milligram-force (mgf)	9.80665×10^{-6} N	https://en.wikipedia.org/wiki/Kilogram-force Page refers to kilogram-force
9	millinewton (mN)	10^{-3} N	https://en.wikipedia.org/wiki/Newton_(unit)#Conversion_factors

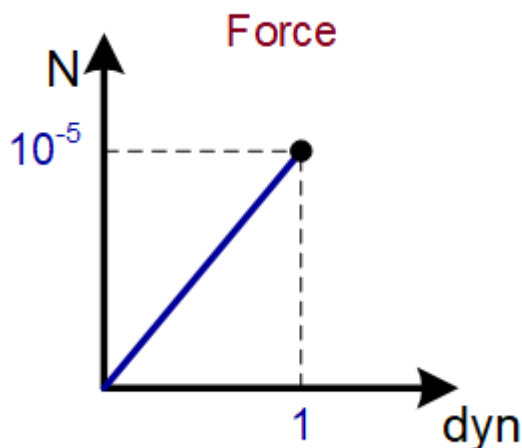
10	meganewton (MN)	10^6 N	https://en.wikipedia.org/wiki/Newton_(unit)#Conversion_factors
11	newton (N)	-	https://en.wikipedia.org/wiki/Newton_(unit) $N = \text{kg} \cdot \text{m/s}^2$
12	ounce-force (ozf)	0.2780138509537 8125 N	https://en.wikipedia.org/wiki/Ounce#Ounce-force Not to be confused with the ounce (abbreviated oz) which is a unit of mass used in most British derived customary systems of measurement.
13	poundal (pdl)	0.138254954376 N	https://en.wikipedia.org/wiki/Poundal
14	tonne-force (tf)	9806.65 N	https://en.wikipedia.org/wiki/Ton-force
15	long ton-force (tf_long)	2240 pound-force (lbf)	https://en.wikipedia.org/wiki/Ton-force#Long_ton-force
16	short ton-force (tf_short)	2000 pound-force (lbf)	https://en.wikipedia.org/wiki/Ton-force#Short_ton-force
17	micronewton (μN)	10^{-6} N	https://en.wikipedia.org/wiki/Newton_(unit)#Conversion_factors

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.9 Length and Distance

The following **21 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	ångström (Å)	10^{-10} m	https://en.wikipedia.org/wiki/Angstrom
2	astronomical unit (AU)	149,597,870,700 m	https://en.wikipedia.org/wiki/Astronomical_unit
3	chain (ch)	66 ft	https://en.wikipedia.org/wiki/Chain_(unit)
4	centimetre (cm)	10^{-2} m	https://en.wikipedia.org/wiki/Centimetre
5	decametre (dam)	10 m	https://en.wikipedia.org/wiki/Decametre
6	decimetre (dm)	10^{-1} m	https://en.wikipedia.org/wiki/Decimetre
7	fathom	6 ft	https://en.wikipedia.org/wiki/Fathom
8	foot (ft)	12 in = 0.3048 m	https://en.wikipedia.org/wiki/Foot_(unit)
9	hectometre (hm)	100 m	https://en.wikipedia.org/wiki/Hectometre
10	inch (in)	0.0254 m	https://en.wikipedia.org/wiki/Inch
11	kilometre (km)	1000 m	https://en.wikipedia.org/wiki/Kilometre
12	light-year (ly)	9,460,730,472,580,800 m	https://en.wikipedia.org/wiki/Light-year
13	metre (m)	-	https://en.wikipedia.org/wiki/Metre
14	mile (mi)	5280 ft = 1,760 yd = 1,609.344 m	https://en.wikipedia.org/wiki/Mile Sometimes distinguished as the "land mile", "statute mile", or "international mile". Not to be confused with other types of miles
15	millimetre (mm)	10^{-3} m	https://en.wikipedia.org/wiki/Millimetre
16	nanometre (nm)	10^{-9} m	https://en.wikipedia.org/wiki/Nanometre
17	nautical mile (nmi)	1852 m	https://en.wikipedia.org/wiki/Nautical_mile Not to be confused with other types of miles
18	parsec (pc)	(648,000/ π) AU	https://en.wikipedia.org/wiki/Parsec

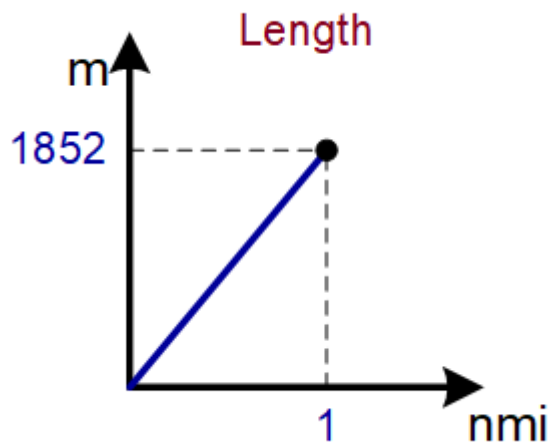
19	thousandth of an inch (thou, mil)	10^{-3} inches	https://en.wikipedia.org/wiki/Thousandth_of_an_inch
20	micrometre (μm)	10^{-6} m	https://en.wikipedia.org/wiki/Micrometre
21	yard (yd)	3 ft = 0.9144 m	https://en.wikipedia.org/wiki/Yard

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.10 Mass

The following **35 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	blob (blob)	12 slugs	https://en.wikipedia.org/wiki/Slug_(unit)#Related_units The blob is the inch version of the slug (1 blob = 1 lbf·s ² /in = 12 slugs) The same as "lbf·s ² /in"
2	centigram (cg)	10^{-5} kg	https://en.wikipedia.org/wiki/Orders_of_magnitude_(mass) Page refers to "Orders of magnitude (mass)"

3	carat (ct)	2×10^{-4} kg	https://en.wikipedia.org/wiki/Carat_(mass)
4	decigram (dg)	10^{-4} kg	https://en.wikipedia.org/wiki/Orders_of_magnitude_(mass) Page refers to "Orders of magnitude (mass)"
5	pennyweight (dwt)	24 grains	https://en.wikipedia.org/wiki/Pennyweight
6	gram (g)	10^{-3} kg	https://en.wikipedia.org/wiki/Gram
7	grain (grain)	64.79891 mg	https://en.wikipedia.org/wiki/Grain_(unit)
8	hyl (hyl)	9.80665 kg	https://en.wikipedia.org/wiki/Gravitational_metric_system#Mass Page refers to "Gravitational metric system" The same as " $\text{kp} \cdot \text{s}^2/\text{m}$ "
9	kilogram (kg)	-	https://en.wikipedia.org/wiki/Kilogram
10	$\text{kip} \cdot \text{s}^2/\text{cm}$ ($\text{kip} \cdot \text{s}^2/\text{cm}$)	444822.16152605 kg	
11	$\text{kip} \cdot \text{s}^2/\text{ft}$ ($\text{kip} \cdot \text{s}^2/\text{ft}$)	1000 slugs	
12	$\text{kip} \cdot \text{s}^2/\text{in}$ ($\text{kip} \cdot \text{s}^2/\text{in}$)	12000 slugs	
13	$\text{kip} \cdot \text{s}^2/\text{m}$ ($\text{kip} \cdot \text{s}^2/\text{m}$)	4448.2216152605 kg	
14	$\text{kip} \cdot \text{s}^2/\text{mm}$ ($\text{kip} \cdot \text{s}^2/\text{mm}$)	4448221.6152605 kg	
15	$\text{kp} \cdot \text{s}^2/\text{cm}$ ($\text{kp} \cdot \text{s}^2/\text{cm}$)	980.665 kg	https://en.wikipedia.org/wiki/Gravitational_metric_system#Mass Page refers to "Gravitational metric system"
16	$\text{kp} \cdot \text{s}^2/\text{m}$ ($\text{kp} \cdot \text{s}^2/\text{m}$)	9.80665 kg	https://en.wikipedia.org/wiki/Gravitational_metric_system#Mass Page refers to "Gravitational metric system" The same as "hyl"
17	$\text{kp} \cdot \text{s}^2/\text{mm}$ ($\text{kp} \cdot \text{s}^2/\text{mm}$)	9806.65 kg	https://en.wikipedia.org/wiki/Gravitational_metric_system#Mass Page refers to "Gravitational metric system"
18	$\text{lbf} \cdot \text{s}^2/\text{cm}$ ($\text{lbf} \cdot \text{s}^2/\text{cm}$)	444.82216152605 kg	
19	$\text{lbf} \cdot \text{s}^2/\text{ft}$ ($\text{lbf} \cdot \text{s}^2/\text{ft}$)	(4.4482216152605/0.3048) kg	https://en.wikipedia.org/wiki/Slug_(mass) The same as "slug"

20	lbf·s ² /in (lbf·s ² /in)	12 slugs	https://en.wikipedia.org/wiki/Slug_(unit) #Related_units The same as “blob”
21	lbf·s ² /m (lbf·s ² /m)	4.4482216152605 kg	
22	lbf·s ² /mm (lbf·s ² /mm)	4448.2216152605 kg	
23	pound [avoirdupois] (lbm)	0.45359237 kg	https://en.wikipedia.org/wiki/Pound_(mass)
24	milligram (mg)	10 ⁻⁶ kg	https://en.wikipedia.org/wiki/Orders_of_magnitude_(mass) Page refers to “Orders of magnitude (mass)”
25	megagram (Mg)	10 ³ kg	https://en.wikipedia.org/wiki/Tonne The same as “tonne [metric ton]”
26	ounce [avoirdupois] (oz)	437.5 grains	https://en.wikipedia.org/wiki/Ounce#Intern ational_avoirdupois_ounce
27	ounce [troy] (oz_t)	31.1034768 g	https://en.wikipedia.org/wiki/Troy_ounce
28	pound [troy] (pound_troy)	5760 grains	https://en.wikipedia.org/wiki/Pound_(mass) #Troy_pound
29	slinch (slinch)	12 slugs	https://en.wikipedia.org/wiki/Slug_(unit) #Related_units The same as “blob”
30	slug (slug)	(4.4482216152605/0.3048) kg	https://en.wikipedia.org/wiki/Slug_(mass) A slug is defined as the mass that is accelerated by 1 ft/s ² when a force of one pound (lbf) is exerted on it The same as “lbf·s ² /ft”
31	stone (st)	14 pounds (lbm)	https://en.wikipedia.org/wiki/Stone_(unit)
32	tonne [metric ton] (t)	10 ³ kg	https://en.wikipedia.org/wiki/Tonne The same as “tonne [metric ton]”
33	long ton, imperial ton (ton_long)	2240 lbm	https://en.wikipedia.org/wiki/Long_ton
34	short ton (ton_short)	2000 lbm	https://en.wikipedia.org/wiki/Short_ton

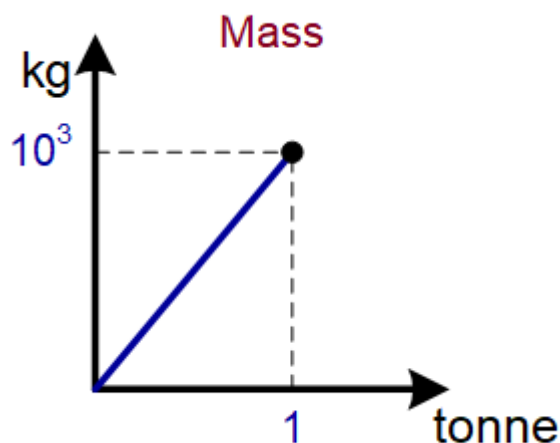
35	microgram (μg)	10^{-9} kg	https://en.wikipedia.org/wiki/Microgram
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All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.11 Power

The following **60 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	Attowatt (aW)	10^{-18} W	https://en.wikipedia.org/wiki/Watt#Attowatt
2	BTU [IT] per hour (BTU_IT/h)	$1055.05585262/3600$ W	
3	BTU [IT] per minute (BTU_IT/min)	$1055.05585262/60$ W	

4	BTU [IT] per second (BTU_IT/s)	1055.05585262 W	
5	BTU [TH] per hour (BTU_TH/h)	1054.35026444/3600 W	
6	BTU [TH] per minute (BTU_TH/min)	1054.35026444/60 W	
7	BTU [TH] per second (BTU_TH/s)	1054.35026444 W	
8	calorie [IT] per hour (cal_IT/h)	0.001163 W	
9	calorie [IT] per minute (cal_IT/min)	0.06978 W	
10	calorie [IT] per second (cal_IT/s)	4.1868 W	
11	calorie [TH] per hour (cal_TH/h)	0.01046/9 W	
12	calorie [TH] per minute (cal_TH/min)	0.2092/3 W	
13	calorie [TH] per second (cal_TH/s)	4.184 W	
14	exajoule per second (EJ/s)	10^{18} W	
15	erg per hour (erg/h)	$10^{-9}/36$ W	
16	erg per minute (erg/min)	$10^{-8}/6$ W	

17	erg per second (erg/s)	10^{-7} W	
18	exawatt (EW)	10^{18} W	
19	femtowatt (fW)	10^{-15} W	https://en.wikipedia.org/wiki/Watt#Femtowatt
20	gigajoule per hour (GJ/h)	$10^6/3.6$ W	
21	gigajoule per minute (GJ/min)	$10^8/6$ W	
22	gigajoule / second (GJ/s)	10^9 W	https://en.wikipedia.org/wiki/Watt#Gigawatt
23	gigawatt (GW)	10^9 W	https://en.wikipedia.org/wiki/Watt#Gigawatt
24	horsepower [Mechanical HP] (HP)	$44741.992294936213/2/60$ W	https://en.wikipedia.org/wiki/Horsepower
25	horsepower [Electrical] (hpE)	746 W	https://en.wikipedia.org/wiki/Horsepower#Electrical_horsepower
26	joule per hour (J/h)	$1/3600$ W	
27	joule per minute (J/min)	$1/60$ W	
28	joule / second (J/s)	1 W	https://en.wikipedia.org/wiki/Watt The same as W
29	kilocalorie [IT] per hour (kcal_IT/h)	1.163 W	
30	kilocalorie [IT] per minute (kcal_IT/min)	69.78 W	
31	kilocalorie [IT] per second (kcal_IT/s)	4186.8 W	

32	kilocalorie [TH] per hour (kcal_TH/h)	10.46/9 W	
33	kilocalorie [TH] per minute (kcal_TH/min)	209.2/3 W	
34	kilocalorie [TH] per second (kcal_TH/s)	4184 W	
35	kilogram- force metre per hour (kgf·m/h)	(9.80665/3600) W	
36	kilogram- force metre per minute (kgf·m/min)	(9.80665/60) W	
37	kilogram- force metre per second (kgf·m/s)	9.80665 W	
38	kilojoule per hour (kJ/h)	1/3.6 W	
39	kilojoule per minute (kJ/min)	50/3 W	
40	kilojoule per second (kJ/s)	10 ³ W	https://en.wikipedia.org/wiki/Watt#Kilowatt
41	kilovolt ampere (kV·A)	1000 W	
42	kilowatt (kW)	10 ³ W	https://en.wikipedia.org/wiki/Watt#Kilowatt
43	pound-force foot per hour (lbf·ft/h)	1.3558179483314/3600 W	

44	pound-force foot per minute (lbf·ft/min)	$1.3558179483314/60$ W	
45	pound-force foot per second (lbf·ft/s)	1.3558179483314 W	
46	megajoule per hour (MJ/h)	$(1000/3.6)$ W	
47	megajoule per minute (MJ/min)	$(10^5/6)$ W	
48	megajoule per second (MJ/s)	10^6 W	https://en.wikipedia.org/wiki/Watt#Megawatt
49	milliwatt (mW)	10^{-3} W	https://en.wikipedia.org/wiki/Watt#Milliwatt
50	megawatt (MW)	10^6 W	https://en.wikipedia.org/wiki/Watt#Megawatt
51	nanowatt (nW)	10^{-9} W	https://en.wikipedia.org/wiki/Watt#Nanowatt
52	petajoule per second (PJ/s)	10^{15} W	https://en.wikipedia.org/wiki/Watt#Petawatt
53	horsepower [Metric PS] (PS)	735.49875 W	https://en.wikipedia.org/wiki/Horsepower#Metric_horsepower_(PS,_cv,_hk,_pk,_ks,_ch)
54	petawatt (PW)	10^{15} W	https://en.wikipedia.org/wiki/Watt#Petawatt
55	picowatt (pW)	10^{-12} W	https://en.wikipedia.org/wiki/Watt#Picowatt
56	microwatt (μ W)	10^{-6} W	https://en.wikipedia.org/wiki/Watt#Microwatt
57	terajoule per second (TJ/s)	10^{12} W	https://en.wikipedia.org/wiki/Watt#Terawatt
58	terawatt (TW)	10^{12} W	https://en.wikipedia.org/wiki/Watt#Terawatt

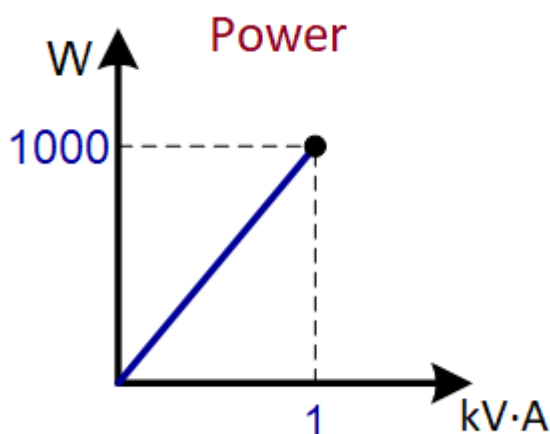
59	volt ampere (V·A)	1 W	https://en.wikipedia.org/wiki/Volt-ampere
60	watt (W)	-	https://en.wikipedia.org/wiki/Watt The same as J/s

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.12 Pressure and Stress

The following **42 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	atmosphere [technical] (at)	98,066.5 Pa	https://en.wikipedia.org/wiki/Technical_atmosphere The same as "kilogram-f per sq. cm"
2	atmosphere [standard] (atm)	101,325 Pa	https://en.wikipedia.org/wiki/Atmosphere_(unit)
3	barye (Ba)	10^{-1} Pa	https://en.wikipedia.org/wiki/Barye

			The same as “dyne per sq. centimetre”
4	bar (bar)	10^5 Pa	https://en.wikipedia.org/wiki/Bar_(unit)
5	centimetre of water [conv.] (cmAq)	98.0665 Pa	https://en.wikipedia.org/wiki/Centimetre_of_water
6	centimetre of mercury [conv.] (cmHg)	1333.22387415 Pa	
7	dyne per sq. centimetre (dyn/cm ²)	10^{-1} Pa	https://en.wikipedia.org/wiki/Barye The same as “barye”
8	dyne per sq. metre (dyn/m ²)	10^{-5} Pa	
9	foot of water [conv.] (ftAq)	2989.06692 Pa	
10	foot of mercury [conv.] (ftHg)	40,636.663684092 Pa	
11	gigabar (Gbar)	10^{14} Pa	https://en.wikipedia.org/wiki/Bar_(unit) Page refers to bar
12	giganewton per sq. metre (GN/m ²)	10^9 Pa	https://en.wikipedia.org/wiki/Pascal_(unit) #Multiples_and_submultiples
13	gigapascal (GPa)	10^9 Pa	https://en.wikipedia.org/wiki/Pascal_(unit) #Multiples_and_submultiples

14	hectopascal (hPa)	10^2 Pa	https://en.wikipedia.org/wiki/Pascal_(unit)#Multiples_and_submultiples
15	inch of water [conv.] (inAq)	249.08891 Pa	https://en.wikipedia.org/wiki/Inch_of_water
16	inch of mercury [conv.] (inHg)	3386.388640341 Pa	https://en.wikipedia.org/wiki/Inch_of_mercury
17	kilobar (kbar)	10^8 Pa	https://en.wikipedia.org/wiki/Bar_(unit) Page refers to bar
18	kilogram-f per sq. cm (kgf/cm ²)	98,066.5 Pa	https://en.wikipedia.org/wiki/Kilogram-force_per_square_centimetre The same as "Technical atmosphere"
19	kilogram-f per sq. metre (kgf/m ²)	9.80665 Pa	
20	kilonewton per sq. centimetre (kN/cm ²)	10^7 Pa	
21	kilonewton per sq. metre (kN/m ²)	10^3 Pa	https://en.wikipedia.org/wiki/Pascal_(unit)#Multiples_and_submultiples
22	kilonewton per sq. millimetre (kN/mm ²)	10^9 Pa	
23	kilopascal (kPa)	10^3 Pa	https://en.wikipedia.org/wiki/Pascal_(unit)#Multiples_and_submultiples
24	kilopound- force per sq.	$(10^3/144)$ psi	

	foot (ksf)		
25	kilopound-force per sq. inch (ksi)	10^3 psi	https://en.wikipedia.org/wiki/Pounds_per_square_inch#Multiples
26	millibar (mbar)	10^2 Pa	https://en.wikipedia.org/wiki/Bar_(unit) Page refers to bar
27	megabar (Mbar)	10^{11} Pa	https://en.wikipedia.org/wiki/Bar_(unit) Page refers to bar
28	millimetre of water [conv.] (mmAq)	9.80665 Pa	https://en.wikipedia.org/wiki/Centimetre_of_millimetre_of_water Conventionally, the density $1,000 \text{ kg/m}^3$ is used for water for this definition, which is the approximate density of water at 4°C (39.2°F), and 9.80665 m/s^2 is standard gravity: $1000 * 9.80665 = 9806.65$ for 1 metre of water Note: The maximum density of water is 999.972 kg/m^3 at a temperature of 3.98°C (39.164°F) but conventionally we use a value of 1000 kg/m^3 for water for the definition of this unit
29	millimetre of mercury [conv.] (mmHg)	133.322387415 Pa	https://en.wikipedia.org/wiki/Millimeter_of_mercury Conventionally, the density $13,595.1 \text{ kg/m}^3$ is used for mercury for this definition, which is the approximate density of mercury at 0°C (32°F), and 9.80665 m/s^2 is standard gravity: $13595.1 * 9.80665 = 133,322.387415$ for 1 metre of mercury
30	meganewton per sq. metre (MN/m^2)	10^6 Pa	https://en.wikipedia.org/wiki/Pascal_(unit)#Multiples_and_submultiples
31	megapascal (MPa)	10^6 Pa	https://en.wikipedia.org/wiki/Pascal_(unit)#Multiples_and_submultiples

32	megapound-force per sq. foot (Mpsf)	$(10^6/144)$ psi	
33	megapound-force per sq. inch (Mpsi)	10^6 psi	https://en.wikipedia.org/wiki/Pounds_per_square_inch#Multiples
34	newton per sq. centimetre (N/cm ²)	10^4 Pa	
35	newton per sq. metre (N/m ²)	1 Pa	https://en.wikipedia.org/wiki/Pascal_(unit) The same as pascal
36	newton per sq. millimetre (N/mm ²)	10^6 Pa	
37	pascal (Pa)	-	https://en.wikipedia.org/wiki/Pascal_(unit) The same as newton per sq. metre
38	pound-force per sq. foot (psf)	$(1/144)$ psi	
39	pound-force per sq. inch (psi)	$(444,822,161.52605/64,516)$ Pa	https://en.wikipedia.org/wiki/Pounds_per_square_inch The same as lbf/in ²
40	pièze (pz)	10^3 Pa	https://en.wikipedia.org/wiki/Pi%C3%A8ze
41	torr (Torr)	$(1/760)$ atm	https://en.wikipedia.org/wiki/Torr
42	microbar (μbar)	10^{-1} Pa	https://en.wikipedia.org/wiki/Bar_(unit) Page refers to bar

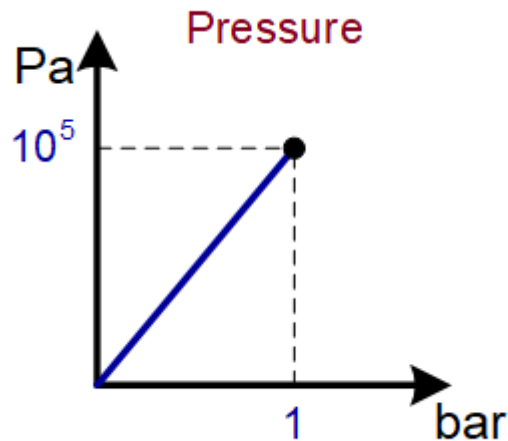
All the above definitions of the various units are **EXACT**.

Note that for the units **based on mercury** (millimetre of mercury [conv.] (mmHg), centimetre of mercury [conv.] (cmHg), inch of mercury [conv.] (inHg), foot of mercury [conv.] (ftHg)) and the units **based on water** (millimetre of water [conv.] (mmAq), centimetre of water [conv.] (cmAq), inch of water [conv.] (inAq), foot of water [conv.] (ftAq)), other similar definitions can be found in the literature, referring to different base temperatures, as the density of the material depends on its temperature. In the above we have used the conventional values that can be found in the literature.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.13 Second Moment of Area

The following **16 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	bisquare angstrom (Å ⁴)	10^{-40} m^4	https://en.wikipedia.org/wiki/Angstrom Page refers to angstrom, not bisquare angstrom
2	bisquare centimetre (cm ⁴)	10^{-8} m^4	https://en.wikipedia.org/wiki/Centimetre Page refers to centimetre, not bisquare centimetre
3	bisquare decametre (dam ⁴)	10^4 m^4	https://en.wikipedia.org/wiki/Decametre Page refers to decametre, not bisquare decametre
4	bisquare decimetre (dm ⁴)	10^{-4} m^4	https://en.wikipedia.org/wiki/Decimetre Page refers to decimetre, not bisquare decimetre
5	bisquare foot (ft ⁴)	$(0.30480^4) \text{ m}^4$	https://en.wikipedia.org/wiki/Foot_(unit) Page refers to foot, not bisquare foot
6	bisquare hectometre (hm ⁴)	10^8 m^4	https://en.wikipedia.org/wiki/Hectometre Page refers to hectometre, not bisquare hectometre

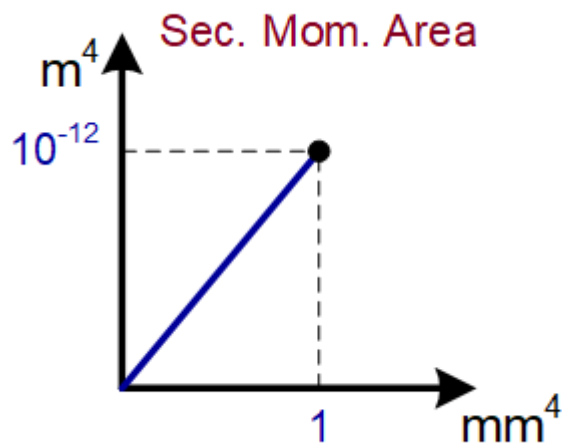
7	bisquare inch (in ⁴)	(1/2,402,510) m ⁴	https://en.wikipedia.org/wiki/Inch Page refers to inch, not bisquare inch
8	bisquare kilometre (km ⁴)	10 ¹² m ⁴	https://en.wikipedia.org/wiki/Kilometre Page refers to kilometre, not bisquare kilometre
9	bisquare metre (m⁴)	-	https://en.wikipedia.org/wiki/Metre Page refers to metre, not bisquare metre
10	bisquare mile (mi ⁴)	(1609.344 ⁴) m ⁴	https://en.wikipedia.org/wiki/Mile Page refers to mile, not bisquare mile
11	bisquare millimetre (mm⁴)	10⁻¹² m⁴	https://en.wikipedia.org/wiki/Millimetre Page refers to millimetre, not bisquare millimetre
12	bisquare nanometre (nm ⁴)	10 ⁻³⁶ m ⁴	https://en.wikipedia.org/wiki/Nanometre Page refers to nanometre, not bisquare nanometre
13	bisquare nautical mile (nmi ⁴)	(1852 ⁴) m ⁴	https://en.wikipedia.org/wiki/Nautical_mile Page refers to nautical mile, not bisquare nautical mile
14	bisquare thousandth of an inch (thou ⁴ , mil ⁴)	2.54 ⁴ ×10 ⁻²⁰ m ⁴	https://en.wikipedia.org/wiki/Thousandth_of_an_inch Page refers to thousandth of an inch, not bisquare thousandth of an inch
15	bisquare micrometre (μm ⁴)	10 ⁻²⁴ m ⁴	https://en.wikipedia.org/wiki/Micrometre Page refers to micrometre, not bisquare micrometre
16	bisquare yard (yd ⁴)	(0.9144 ⁴) m ⁴	https://en.wikipedia.org/wiki/Yard Page refers to yard, not bisquare yard

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL (y=a·x)**

Example conversion diagram (see unit in red above):



3.14 SI Prefixes

The following **25 Units** are included in this category:

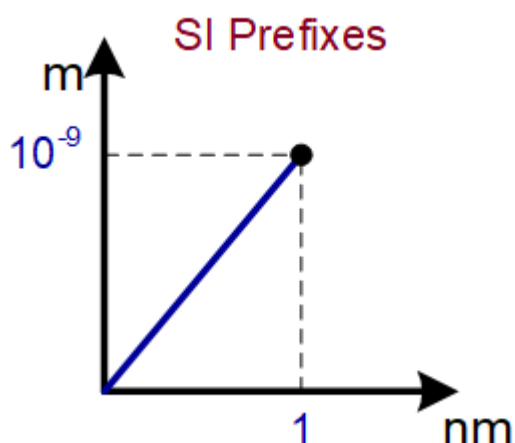
ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	quecto (q)	10^{-30}	https://en.wikipedia.org/wiki/Metric_prefix#List_of_SI_prefixes
2	ronto (r)	10^{-27}	https://en.wikipedia.org/wiki/Metric_prefix#List_of_SI_prefixes
3	yocto (y)	10^{-24}	https://en.wikipedia.org/wiki/Metric_prefix#List_of_SI_prefixes
4	zepto (z)	10^{-21}	https://en.wikipedia.org/wiki/Metric_prefix#List_of_SI_prefixes
5	atto (a)	10^{-18}	https://en.wikipedia.org/wiki/Metric_prefix#List_of_SI_prefixes
6	femto (f)	10^{-15}	https://en.wikipedia.org/wiki/Metric_prefix#List_of_SI_prefixes
7	pico (p)	10^{-12}	https://en.wikipedia.org/wiki/Metric_prefix#List_of_SI_prefixes
8	nano (n)	10^{-9}	https://en.wikipedia.org/wiki/Nano-
9	micro (μ)	10^{-6}	https://en.wikipedia.org/wiki/Micro-
10	milli (m)	10^{-3}	https://en.wikipedia.org/wiki/Milli-
11	centi (c)	10^{-2}	https://en.wikipedia.org/wiki/Centi-
12	deci (d)	10^{-1}	https://en.wikipedia.org/wiki/Deci-

13	one (1)	1	https://en.wikipedia.org/wiki/Metric_prefix#List_of_SI_prefixes
14	deca (da)	10	https://en.wikipedia.org/wiki/Deca-
15	hecto (h)	10 ²	https://en.wikipedia.org/wiki/Hecto-
16	kilo (k)	10 ³	https://en.wikipedia.org/wiki/Kilo-
17	mega (M)	10 ⁶	https://en.wikipedia.org/wiki/Mega-
18	giga (G)	10 ⁹	https://en.wikipedia.org/wiki/Giga-
19	tera (T)	10 ¹²	https://en.wikipedia.org/wiki/Tera-
20	peta (P)	10 ¹⁵	https://en.wikipedia.org/wiki/Metric_prefix#List_of_SI_prefixes
21	exa (E)	10 ¹⁸	https://en.wikipedia.org/wiki/Metric_prefix#List_of_SI_prefixes
22	zetta (Z)	10 ²¹	https://en.wikipedia.org/wiki/Metric_prefix#List_of_SI_prefixes
23	yotta (Y)	10 ²⁴	https://en.wikipedia.org/wiki/Metric_prefix#List_of_SI_prefixes
24	ronna (R)	10 ²⁷	https://en.wikipedia.org/wiki/Metric_prefix#List_of_SI_prefixes
25	quetta (Q)	10 ³⁰	https://en.wikipedia.org/wiki/Metric_prefix#List_of_SI_prefixes

All the above definitions of the various units are **EXACT**.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above - the example is in meters with m and nm, but anything else can be used):



3.15 Solid Angle

The following **11 Units** are included in this category:

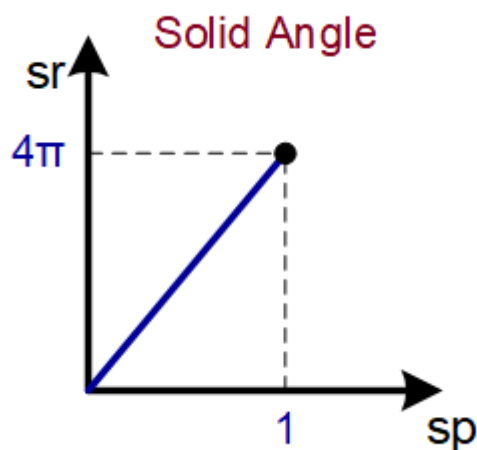
ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	sq. degree (deg ²)	$(\pi/180)^2 \text{ sr}$	https://en.wikipedia.org/wiki/Square_degree
2	sq. gon (gon ²)	$(\pi/200)^2 \text{ sr}$	https://en.wikipedia.org/wiki/Gradian Page refers to gradian, not square gon (square gradian)
3	sq. gradian (grad ²)	$(\pi/200)^2 \text{ sr}$	https://en.wikipedia.org/wiki/Gradian Page refers to gradian, not square gradian
4	hemisphere (hemisphere)	$2\pi \text{ sr}$	https://en.wikipedia.org/wiki/Sphere#Basic_terminology
5	sq. milliradian (mrad ²)	10^{-6} sr	
6	millisteradian (msr)	10^{-3} sr	https://en.wikipedia.org/wiki/Steradian#SI_multiples
7	spat, sphere (sp)	$4\pi \text{ sr}$	https://en.wikipedia.org/wiki/Spat_(unit)
8	spher. right angle (sph_right_angle)	$(\pi/2) \text{ sr}$	
9	sq. arcmin (sq')	$(\pi/10,800)^2 \text{ sr}$	https://en.wikipedia.org/wiki/Solid_angle#Square_minute
10	sq. arcsec (sq'')	$(\pi/648,000)^2 \text{ sr}$	https://en.wikipedia.org/wiki/Solid_angle#Square_second
11	steradian (sr)	-	https://en.wikipedia.org/wiki/Steradian

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.16 Speed (Velocity)

The following **20 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	speed of light (c)	299,792,458 m/s	https://en.wikipedia.org/wiki/Speed_of_light
2	centimetre per hour (cm/h)	(1/360,000) m/s	
3	centimetre per minute (cm/min)	(1/6000) m/s	
4	centimetre per second (cm/s)	10^{-2} m/s	
5	foot per hour (ft/h)	(127×10 ⁻⁴ /150) m/s	
6	foot per minute (ft/min)	0.00508 m/s	
7	foot per second (ft/s)	0.3048 m/s	https://en.wikipedia.org/wiki/Foot_per_second
8	kilometre per hour (km/h)	(1/3.6) m/s	https://en.wikipedia.org/wiki/Kilometres_per_hour

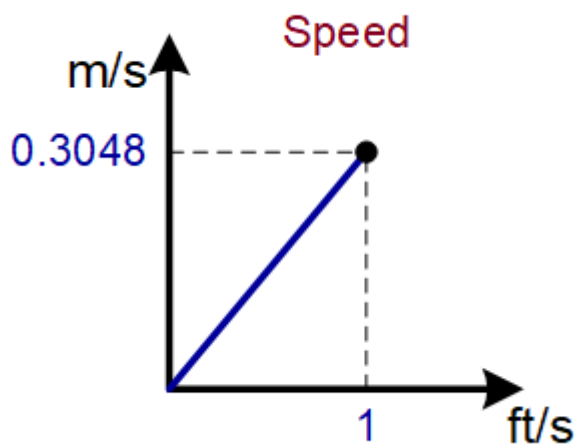
9	kilometre per minute (km/min)	$(50/3) \text{ m/s}$	
10	kilometre per second (km/s)	10^3 m/s	
11	naut. mile per hour (knot)	$(463/900) \text{ m/s}$	https://en.wikipedia.org/wiki/Knot_(unit) Not to be confused with other types of miles
12	metre per hour (m/h)	$(1/3600) \text{ m/s}$	https://en.wikipedia.org/wiki/Metre_per_hour
13	metre per minute (m/min)	$(1/60) \text{ m/s}$	
14	metre per second (m/s)	-	https://en.wikipedia.org/wiki/Metre_per_second
15	mile per minute (mi/min)	$(1/60) \text{ mi/s}$ $= 26.8224 \text{ m/s}$	Not to be confused with other types of miles
16	mile per second (mi/s)	1609.344 m/s	Not to be confused with other types of miles
17	millimetre per hour (mm/h)	$(1/3,600,000) \text{ m/s}$	
18	millimetre per minute (mm/min)	$(1/60,000) \text{ m/s}$	
19	millimetre per second (mm/s)	$(1/1000) \text{ m/s}$	
20	mile per hour (mi/h, mph)	$(1/3,600) \text{ mi/s}$ $= 0.44704 \text{ m/s}$	https://en.wikipedia.org/wiki/Miles_per_hour Not to be confused with other types of miles

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.17 Surface Tension and Translational Stiffness

The following **35 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	dyne per centimetre (dyn/cm)	10^{-3} N/m	
2	dyne per metre (dyn/m)	10^{-5} N/m	
3	dyne per millimetre (dyn/mm)	10^{-2} N/m	
4	gram-force per centimetre (gf/cm)	0.980665 N/m	
5	gram-force per metre (gf/m)	$9.80665 \cdot 10^{-3}$ N/m	
6	gram-force per millimetre (gf/mm)	9.80665 N/m	

7	giganewton per centimetre (GN/cm)	10^{11} N/m	
8	giganewton per metre (GN/m)	10^9 N/m	
9	giganewton per millimetre (GN/mm)	10^{12} N/m	
10	kilogram-force per centimetre (kgf/cm)	980.665 N/m	
11	kilogram-force per metre (kgf/m)	9.80665 N/m	
12	kilogram-force per millimetre (kgf/mm)	9806.65 N/m	
13	kilopound-force per foot (kip/ft)	1000/12 lbf/in	
14	kilopound-force per inch (kip/in)	1000 lbf/in	
15	kilonewton per centimetre (kN/cm)	10^5 N/m	
16	kilonewton per metre (kN/m)	1000 N/m	
17	kilonewton per millimetre (kN/mm)	10^6 N/m	

18	kilopond per centimetre (kp/cm)	980.665 N/m	
19	kilopond per metre (kp/m)	9.80665 N/m	
20	kilopond per millimetre (kp/mm)	9806.65 N/m	
21	pound-force per foot (lbf/ft)	1/12 lbf/in	
22	pound-force per inch (lbf/in) 'pound-force / inch	0.45359237 * 9.80665 / 0.0254 N/m	
23	millinewton per centimetre (mN/cm)	1 / 10 N/m	
24	meganewton per centimetre (MN/cm)	10^8 N/m	
25	millinewton per metre (mN/m)	1 / 1000 N/m	
26	meganewton per metre (MN/m)	10^6 N/m	
27	millinewton per millimetre (mN/mm)	1 N/m	
28	meganewton per millimetre (MN/mm)	10^9 N/m	
29	newton per centimetre (N/cm)	100 N/m	

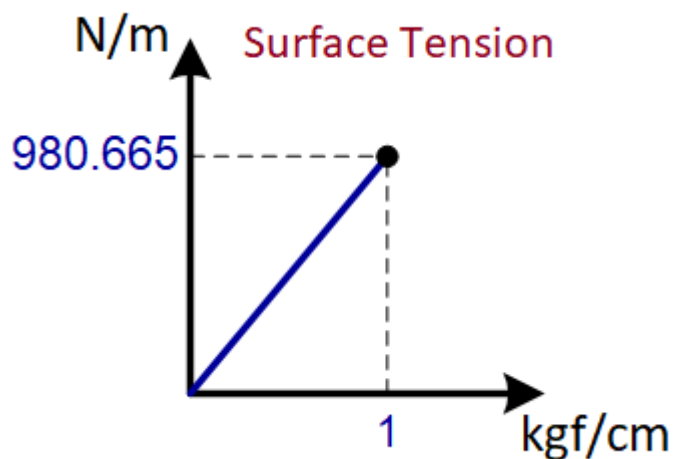
30	newton per metre (N/m)	-	
31	newton per millimetre (N/mm)	1000 N/m	
32	ounce-force per foot (ozf/ft) [avoirdupois]	1/192 lbf/in	
33	ounce-force per inch (ozf/in)	1/16 lbf/in	
34	poundal per foot (pdl/ft)	0.45359237 N/m	
35	poundal per inch (pdl/in)	5.44310844 N/m	

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.18 Temperature

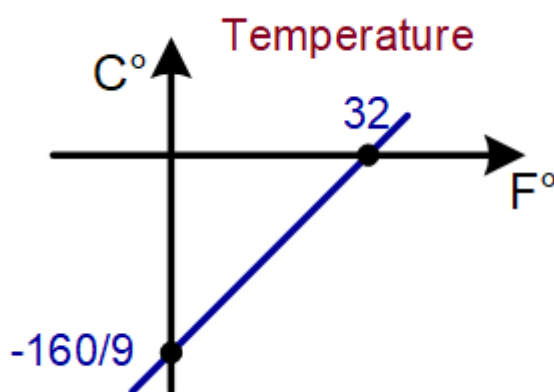
The following **8 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	Celsius (°C)	-	https://en.wikipedia.org/wiki/Celsius
2	Delisle (°D)	$[\text{°De}] = (100 - [\text{°C}]) \times 3/2$	https://en.wikipedia.org/wiki/Delisle_scale
3	Fahrenheit (°F)	$[\text{°F}] = [\text{°C}] \times 9/5 + 32$	https://en.wikipedia.org/wiki/Fahrenheit
4	Newton (°N)	$[\text{°N}] = [\text{°C}] \times 33/100$	https://en.wikipedia.org/wiki/Newton_scale
5	Rankine (°R)	$[\text{°R}] = ([\text{°C}] + 273.15) \times 9/5$	https://en.wikipedia.org/wiki/Rankine_scale
6	Réaumur (°Ré)	$[\text{°Ré}] = [\text{°C}] \times 4/5$	https://en.wikipedia.org/wiki/R%C3%A9aumur_scale
7	Rømer (°Rø)	$[\text{°Rø}] = [\text{°C}] \times 21/40 + 7.5$	https://en.wikipedia.org/wiki/R%C3%B8mer_scale
8	Kelvin (K)	$[\text{K}] = [\text{°C}] + 273.15$	https://en.wikipedia.org/wiki/Kelvin

All the above definitions of the various units are **EXACT**.

Type of conversion relationship: **LINEAR** ($y=a \cdot x+b$)

Example conversion diagram (see unit in red above):



To find where the line crosses the y-axis (where $[\text{°F}]=0$):

$$0 = [\text{°C}] \times 9/5 + 32 \Rightarrow [\text{°C}] = -32 \times 5/9 \Rightarrow [\text{°C}] = -160/9$$

Other examples for various temperatures are given below:

Celsius (°C)	Fahrenheit (°F)	Kelvin (K)	Rankine (°R)	Delisle (°D)	Newton (°N)	Réaumur (°Ré)	Rømer (°Rø)
480	896	753.15	1355.67	-570	158.4	384	259.5
400	752	673.15	1211.67	-450	132	320	217.5
300	572	573.15	1031.67	-300	99	240	165
200	392	473.15	851.67	-150	66	160	112.5
100	212	373.15	671.67	0	33	80	60
0	32	273.15	491.67	150	0	0	7.5
-100.00	-148.00	173.15	311.67	300	-33.00	-80.00	-45.00
-200.00	-328.00	73.15	131.67	450	-66.00	-160.00	-97.50
-273.15	-459.67	0	0	559.725	-90.1395	-218.52	-135.90375

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

3.19 Time

The following **18 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	century [common] (century_common)	100 common years	https://en.wikipedia.org/wiki/Century Not to be confused with the Julian century
2	century [Julian] (century_Julian)	100 Julian years	https://en.wikipedia.org/wiki/Century Not to be confused with the common century
3	day (d)	24 h = 86,400 s	https://en.wikipedia.org/wiki/Day Not to be confused with the stellar day
4	decade [common] (decade_common)	10 common years = 315,360,000 s	https://en.wikipedia.org/wiki/Decade Not to be confused with the Julian decade

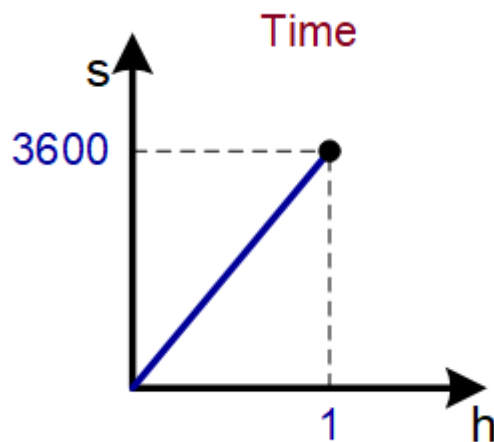
5	decade [Julian] (decade_Julian)	10 Julian years = 315,576,000 s	https://en.wikipedia.org/wiki/Decade Not to be confused with the common decade
6	fortnight (fortnight)	14 days = 1,209,600 s	https://en.wikipedia.org/wiki/Fortnight
7	hour (h)	60 min = 3600 s	https://en.wikipedia.org/wiki/Hour
8	millennium [common] (millennium_common)	1000 common years	https://en.wikipedia.org/wiki/Millennium Not to be confused with the Julian millennium
9	millennium [Julian] (millennium_Julian)	1000 Julian years	https://en.wikipedia.org/wiki/Millennium Not to be confused with the common millennium
10	minute (min)	60 s	https://en.wikipedia.org/wiki/Minute
11	millisecond (ms)	10^{-3} s	https://en.wikipedia.org/wiki/Millisecond
12	nanosecond (ns)	10^{-9} s	https://en.wikipedia.org/wiki/Nanosecond
13	picosecond (ps)	10^{-12} s	https://en.wikipedia.org/wiki/Picosecond
14	second (s)	-	https://en.wikipedia.org/wiki/Second
15	microsecond (μ s)	10^{-6} s	https://en.wikipedia.org/wiki/Microsecond
16	week (week)	7 days = 604,800 s	https://en.wikipedia.org/wiki/Week
17	year [common = 365 days] (year_common)	365 days = 31,536,000 s	https://en.wikipedia.org/wiki/Common_year Not to be confused with the Julian year
18	year [Julian = 365.25 days] (year_Julian)	365.25 days = 31,557,600 s	https://en.wikipedia.org/wiki/Julian_year_(astronomy) Not to be confused with the common year

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.20 Torque (Moment of force)

The following **35 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	dyne centimetre (dyn·cm)	$10^{-7} \text{ N}\cdot\text{m}$	
2	dyne metre (dyn·m)	$10^{-5} \text{ N}\cdot\text{m}$	
3	dyne millimetre (dyn·mm)	$10^{-8} \text{ N}\cdot\text{m}$	
4	gram-force centimetre (gf·cm)	$9.80665 \times 10^{-5} \text{ N}\cdot\text{m}$	
5	gram-force metre (gf·m)	$9.80665 \times 10^{-3} \text{ N}\cdot\text{m}$	
6	gram-force millimetre (gf·mm)	$9.80665 \times 10^{-6} \text{ N}\cdot\text{m}$	
7	giganewton centimetre (GN·cm)	$10^7 \text{ N}\cdot\text{m}$	

8	giganewton metre (GN·m)	10^9 N·m	
9	giganewton millimetre (GN·mm)	10^6 N·m	
10	kilogram-force centimetre (kgf·cm)	$9.80665 \times 10^{-2} \text{ N·m}$	The same as “kilopond centimetre”
11	kilogram-force metre (kgf·m)	9.80665 N·m	The same as “kilopond metre”
12	kilogram-force millimetre (kgf·mm)	$9.80665 \times 10^{-3} \text{ N·m}$	The same as “kilopond millimetre”
13	kilopound-force foot (kip·ft)	1355.8179483314 004 N·m	
14	kilopound-force inch (kip·in)	112.98482902761 7 N·m	
15	kilonewton centimetre (kN·cm)	10 N·m	
16	kilonewton metre (kN·m)	10^3 N·m	
17	kilonewton millimetre (kN·mm)	1 N·m	The same as “newton metre”
18	kilopond centimetre (kp·cm)	$9.80665 \times 10^{-2} \text{ N·m}$	The same as “kilogram-force centimetre”
19	kilopond metre (kp·m)	9.80665 N·m	The same as “kilogram-force metre”
20	kilopond millimetre (kp·mm)	$9.80665 \times 10^{-3} \text{ N·m}$	The same as “kilogram-force millimetre”

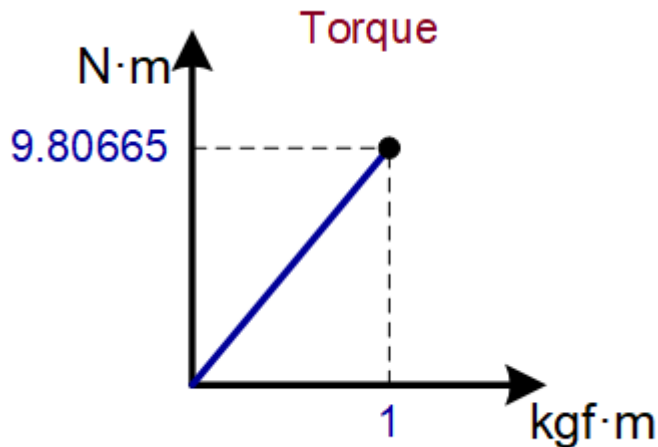
21	pound-force foot (lbf·ft)	12 lbf·in	https://en.wikipedia.org/wiki/Pound-foot_(torque)
22	pound-force inch (lbf·in)	0.1129848290276 167 N·m	
23	millinewton centimetre (mN·cm)	10^{-5} N·m	
24	meganewton centimetre (MN·cm)	10^4 N·m	
25	millinewton metre (mN·m)	10^{-3} N·m	The same as “millinewton metre”
26	meganewton metre (MN·m)	10^6 N·m	
27	millinewton millimetre (mN·mm)	10^{-6} N·m	
28	meganewton millimetre (MN·mm)	10^3 N·m	
29	newton centimetre (N·cm)	10^{-2} N·m	
30	newton metre (N·m)	-	https://en.wikipedia.org/wiki/Newton_metre The same as “kilonewton millimetre”
31	newton millimetre (N·mm)	10^{-3} N·m	The same as “millinewton metre”
32	ounce-force foot (ozf·ft)	12 ozf·in	
33	ounce-force inch (ozf·in)	0.0625 lbf·in	
34	poundal foot (pdl·ft)	12 pdl·in	
35	poundal inch (pdl·in)	0.0035116758411 504 N·m	

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.21 Torsional Stiffness

The following **70 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	dyne metre per degree (dyn·m/deg)	$(180 \cdot 10^{-5} / \pi) \text{ N} \cdot \text{m} / \text{rad}$	
2	dyne metre per gradian (dyn·m/grad)	$(200 \cdot 10^{-5} / \pi) \text{ N} \cdot \text{m} / \text{rad}$	
3	dyne metre per milliradian (dyn·m/mrad)	0.01 N·m/rad	
4	dyne metre per radian (dyn·m/rad)	$10^{-5} \text{ N} \cdot \text{m} / \text{rad}$	
5	dyne metre per microradian (dyn·m/ μrad)	10 N·m/rad	
6	gram-force metre per degree (gf·m/deg)	$(1.765197 / \pi) \text{ N} \cdot \text{m} / \text{rad}$	

7	gram-force metre per gradian (gf·m/grad)	$(1.96133/\pi)$ N·m/rad	
8	gram-force metre per milliradian (gf·m/mrad)	9.80665 N·m/rad	
9	gram-force metre per radian (gf·m/rad)	0.00980665 N·m/rad	
10	gram-force metre per microradian (gf·m/ μ rad)	9806.65 N·m/rad	
11	kilogram-force metre per degree (kgf·m/deg)	$(1765.197/\pi)$ N·m/rad	
12	kilogram-force metre per gradian (kgf·m/grad)	$(1961.33/\pi)$ N·m/rad	
13	kilogram-force metre per milliradian (kgf·m/mrad)	9806.65 N·m/rad	
14	kilogram-force metre per radian (kgf·m/rad)	9.80665 N·m/rad	
15	kilogram-force metre per microradian (kgf·m/ μ rad)	9806650 N·m/rad	
16	kilopound-force foot per degree (kip·ft/deg)	$(244,047.230699652072/\pi)$ N·m/rad	
17	kilopound-force foot per gradian (kip·ft/grad)	$(271,163.58966628008/p)$ N·m/rad	
18	kilopound-force foot per milliradian (kip·ft/mrad)	1,355,817.9483314004 N·m/rad	
19	kilopound-force foot per radian (kip·ft/rad)	1355.8179483314004 N·m/rad	
20	kilopound-force foot per microradian (kip·ft/ μ rad)	1,355,817,948.3314004 N·m/rad	
21	kilopound-force inch per degree (kip·in/deg)	$(20337.269224971006/p)$ N·m/rad	
22	kilopound-force inch per gradian	$(22596.96580552334/p)$ N·m/rad	

	(kip·in/grad)		
23	kilopound-force inch per milliradian (kip·in/mrad)	112,984.8290276167 N·m/rad	
24	kilopound-force inch per radian (kip·in/rad)	112.9848290276167 N·m/rad	
25	kilopound-force inch per microradian (kip·in/μrad)	112,984,829.0276167 N·m/rad	
26	kilonewton metre per degree (kN·m/deg)	$(180,000/\pi)$ N·m/rad	
27	kilonewton metre per gradian (kN·m/grad)	$(200,000/\pi)$ N·m/rad	
28	kilonewton metre per milliradian (kN·m/mrad)	10^6 N·m/rad	
29	kilonewton metre per radian (kN·m/rad)	10^3 N·m/rad	
30	kilonewton metre per microradian (kN·m/μrad)	10^9 N·m/rad	
31	kilopond metre per degree (kp·m/deg)	$(1765.197/\pi)$ N·m/rad	
32	kilopond metre per gradian (kp·m/grad)	$(1961.33/\pi)$ N·m/rad	
33	kilopond metre per milliradian (kp·m/mrad)	9806.65 N·m/rad	
34	kilopond metre per radian (kp·m/rad)	9.80665 N·m/rad	
35	kilopond metre per microradian (kp·m/μrad)	9806650 N·m/rad	
36	pound-force foot per degree (lbf·ft/deg)	$(244.047230699652072/\pi)$ N·m/rad	
37	pound-force foot per gradian (lbf·ft/grad)	$(271.16358966628008/p)$ N·m/rad	
38	pound-force foot per milliradian	1,355.8179483314004 N·m/rad	

	(lbf·ft/mrad)		
39	pound-force foot per radian (lbf·ft/rad)	1.3558179483314004 N·m/rad	
40	pound-force foot per microradian (lbf·ft/μrad)	1,355,817.9483314004 N·m/rad	
41	pound-force inch per degree (lbf·in/deg)	(20.337269224971006/p) N·m/rad	
42	pound-force inch per gradian (lbf·in/grad)	(22.59696580552334/p) N·m/rad	
43	pound-force inch per milliradian (lbf·in/mrad)	112.9848290276167 N·m/rad	
44	pound-force inch per radian (lbf·in/rad)	0.1129848290276167 N·m/rad	
45	pound-force inch per microradian (lbf·in/μrad)	112,984.8290276167 N·m/rad	
46	newton metre per degree (N·m/deg)	(180/π) N·m/rad	
47	newton metre per gradian (N·m/grad)	(200/π) N·m/rad	
48	newton metre per milliradian (N·m/mrad)	10 ³ N·m/rad	
49	newton metre per radian (N·m/rad)	-	
50	newton metre per microradian (N·m/μrad)	10 ⁶ N·m/rad	
51	ounce-force foot per degree (ozf·ft/deg)	(15.2529519187282545/π) N·m/rad	
52	ounce-force foot per gradian (ozf·ft/grad)	(16.947724354142505/p) N·m/rad	
53	ounce-force foot per milliradian	84.7386217707125 N·m/rad	

	(ozf·ft/mrad)		
54	ounce-force foot per radian (ozf·ft/rad)	0.084738621770712525 N·m/rad	
55	ounce-force foot per microradian (ozf·ft/μrad)	84,738.6217707125 N·m/rad	
56	ounce-force inch per degree (ozf·in/deg)	(1.271079326560687875 /π) N·m/rad	
57	ounce-force inch per gradian (ozf·in/grad)	(1.41231036284520875/ π) N·m/rad	
58	ounce-force inch per milliradian (ozf·in/mrad)	7.06155181422604375 N·m/rad	
59	ounce-force inch per radian (ozf·in/rad)	0.0070615518142260437 5 N·m/rad	
60	ounce-force inch per microradian (ozf·in/μrad)	7061.55181422604375 N·m/rad	
61	poundal foot per degree (pdl·ft/deg)	(7.585219816884864/p) N·m/rad	
62	poundal foot per gradian (pdl·ft/grad)	(8.42802201876096/p) N·m/rad	
63	poundal foot per milliradian (pdl·ft/mrad)	42.1401100938048 N·m/rad	
64	poundal foot per radian (pdl·ft/rad)	0.0421401100938048 N·m/rad	
65	poundal foot per microradian (pdl·ft/μrad)	42,140.1100938048 N·m/rad	
66	poundal inch per degree (pdl·in/deg)	(0.632101651407072/p) N·m/rad	
67	poundal inch per gradian (pdl·in/grad)	(0.70233516823008/p) N·m/rad	
68	poundal inch per milliradian (pdl·in/mrad)	3.5116758411504 N·m/rad	
69	poundal inch per radian (pdl·in/rad)	0.0035116758411504 N·m/rad	

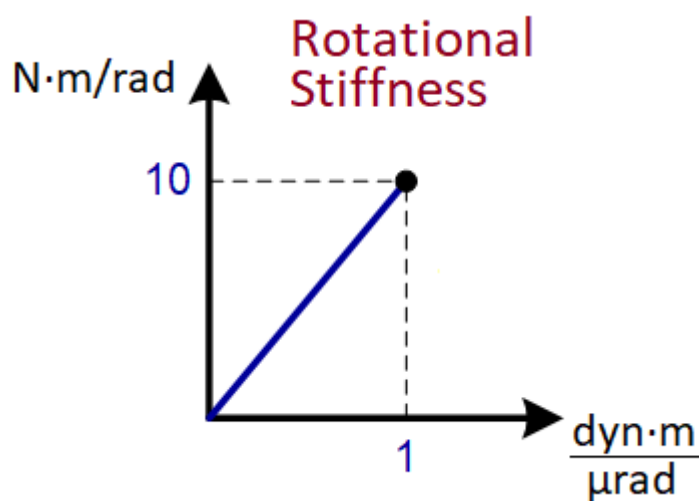
70	poundal inch per microradian (pdl·in/μrad)	3511.6758411504 N·m/rad	
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All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



3.22 Volume

The following **36 Units** are included in this category:

ID	Unit (symbol)	Definition	Wikipedia page and other notes
1	cubic angstrom (Å ³)	10 ⁻³⁰ m ³	https://en.wikipedia.org/wiki/Angstrom Page refers to angstrom, not cubic angstrom
2	cubic astronomical unit (AU ³)	(149,597,870,700) ³ m ³	https://en.wikipedia.org/wiki/Astronomical_unit Page refers to astronomical unit, not cubic astronomical unit
3	centilitre (cl)	10 cm ³	https://en.wikipedia.org/wiki/Litre#SI_prefixes_applied_to_the_litre

			Page refers to SI prefixes applied to the litre
4	cubic centimetre (cm ³)	10 ⁻⁶ m ³	https://en.wikipedia.org/wiki/Cubic_centimetre
5	decalitre (dal)	10 l = 10 ⁻² m ³	https://en.wikipedia.org/wiki/Litre#SI_prefixes_applied_to_the_litre Page refers to SI prefixes applied to the litre
6	cubic decametre (dam ³)	10 ³ m ³	https://en.wikipedia.org/wiki/Decametre Page refers to decametre, not cubic decametre
7	decilitre (dl)	10 ² cm ³	https://en.wikipedia.org/wiki/Litre#SI_prefixes_applied_to_the_litre Page refers to SI prefixes applied to the litre
8	cubic decimetre (dm ³)	10 ⁻³ m ³	https://en.wikipedia.org/wiki/Litre Page refers to litre, which is the same unit
9	fluid dram [imperial] (fl_dr_imp)	(1/8) imperial fluid ounce	https://en.wikipedia.org/wiki/Dram_(unit)#Unit_of_volume
10	fluid dram [US] (fl_dr_US)	(1/8) US fluid ounce	https://en.wikipedia.org/wiki/Dram_(unit)#Unit_of_volume
11	fluid ounce [imperial] (fl_oz_imp)	(1/160) imperial gallon	https://en.wikipedia.org/wiki/Fluid_ounce#Definitions_and_equivalences
12	fluid ounce [US] (fl_oz_US)	(1/128) US liquid gallon	https://en.wikipedia.org/wiki/Fluid_ounce#Definitions_and_equivalences
13	cubic foot (ft ³)	0.028316846592 m ³	https://en.wikipedia.org/wiki/Cubic_foot
14	gallon [imperial] (gallon_imp)	4.54609 l	https://en.wikipedia.org/wiki/Gallon#Imperial_gallon
15	gallon [US liquid] (gallon_US)	231 in ³	https://en.wikipedia.org/wiki/Gallon#US_gallon_2
16	cubic hectometre (hm ³)	10 ⁶ m ³	https://en.wikipedia.org/wiki/Hectometre Page refers to hectometre, not cubic hectometre

17	cubic inch (in ³)	$1.6387064 \times 10^{-5} \text{ m}^3$	https://en.wikipedia.org/wiki/Cubic_inch
18	cubic kilometre (km ³)	10^9 m^3	https://en.wikipedia.org/wiki/Kilometre Page refers to kilometre, not cubic kilometre
19	litre (l)	10^{-3} m^3	https://en.wikipedia.org/wiki/Litre
20	cubic light-year (ly ³)	$(9,460,730,472,580,800)^3 \text{ m}^3$	https://en.wikipedia.org/wiki/Light-year Page refers to light-year, not cubic light-year
21	cubic metre (m ³)	-	https://en.wikipedia.org/wiki/Cubic_metre
22	cubic mile (mi ³)	$(1,609.344)^3 \text{ m}^3$	https://en.wikipedia.org/wiki/Cubic_mile Not to be confused with other types of miles
23	minim [imperial] (minim_imp)	(1/480) imperial fluid ounce	https://en.wikipedia.org/wiki/Minim_(unit)#Definitions
24	minim [US] (minim_US)	(1/480) US fluid ounce	https://en.wikipedia.org/wiki/Minim_(unit)#Definitions
25	millilitre (ml)	10^{-6} m^3	https://en.wikipedia.org/wiki/Litre#SI_prefixes_applied_to_the_litre
26	cubic millimetre (mm ³)	10^{-9} m^3	https://en.wikipedia.org/wiki/Millimetre Page refers to millimetre, not cubic millimetre
27	cubic nanometre (nm ³)	10^{-27} m^3	https://en.wikipedia.org/wiki/Nanometre Page refers to nanometre, not cubic nanometre
28	cubic nautical mile (nmi ³)	$6,352,182,208 \text{ m}^3$	https://en.wikipedia.org/wiki/Nautical_mile Page refers to nautical mile, not cubic nautical mile. Not to be confused with other types of miles
29	cubic parsec (pc ³)	$(648,000/p)^3 \text{ AU}^3$	https://en.wikipedia.org/wiki/Parsec Page refers to parsec, not cubic parsec
30	pint [imperial] (pt_imp)	(1/8) imperial gallon	https://en.wikipedia.org/wiki/Pint#Imperial_pint
31	pint [US liquid] (pt_US)	(1/8) US liquid gallon	https://en.wikipedia.org/wiki/Pint#US_liquid_pint
32	quart [imperial]	(1/4) imperial gallon	https://en.wikipedia.org/wiki/Quart#Imperial_quart

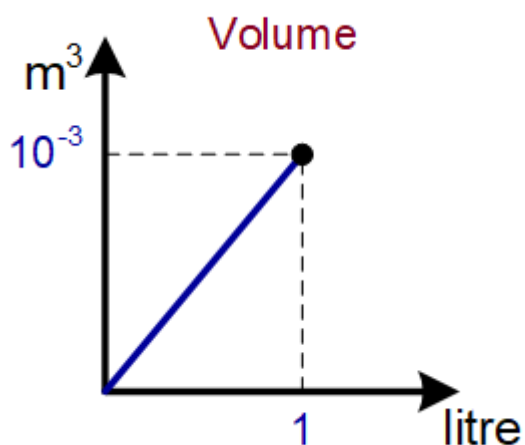
	(qt_imp)		
33	quart [US liquid] (qt_US)	(1/4) US liquid gallon	https://en.wikipedia.org/wiki/Quart#US_liquid_id_quart
34	cubic thousandth of an inch (thou ³ , mil ³)	10 ⁻⁹ in ³	https://en.wikipedia.org/wiki/Thousandth_of_an_inch Page refers to thousandth of an inch, not cubic thousandth of an inch
35	cubic micrometre (μm ³)	10 ⁻¹⁸ m ³	https://en.wikipedia.org/wiki/Micrometre Page refers to micrometre, not cubic micrometre
36	cubic yard (yd ³)	0.764554857984 m ³	https://en.wikipedia.org/wiki/Cubic_yard

All the above definitions of the various units are **EXACT**.

Note: In the above, a period (.) is used to indicate the decimal place and a comma (,) is used to separate groups of thousands.

Type of conversion relationship: **DIRECTLY PROPORTIONAL** ($y=a \cdot x$)

Example conversion diagram (see unit in red above):



Chapter



4

License Agreement

4 License Agreement

- [End User License Agreement \(EULA\)](#)

4.1 End User License Agreement (EULA)

EngiLab Units End User License Agreement (EULA)

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- fitness for a specific purpose, or
- compliance with any engineering standards or regulations.

Engineering results must always be reviewed, verified, and validated independently by qualified professionals. The Software Product is an **aid**, not a substitute for professional judgment. All risk relating to the **use of results, design decisions, or safety** lies entirely with the user.

6. LIMITATION OF LIABILITY

To the maximum extent permitted by the applicable law, EngiLab PC shall **not** be liable for any direct, indirect, incidental, special, consequential, or punitive damages arising out of the use or inability to use the Software Product, including but not limited to:

- loss of data,
- loss of profits,
- structural failures,
- design errors,
- business interruption,
- personal or property damage.

The user bears **full responsibility** for checking, verifying, and validating all engineering calculations and results.

7. TERMINATION

This EULA is effective as long as you use the Software Product. It may be terminated automatically if you violate its terms. Upon termination, you must stop using the Software Product and delete all installed copies. Distribution of the installer file remains allowed as long as it is unmodified.

8. ACCEPTANCE

By installing, copying, or using the Software Product, you acknowledge that:

- you have read this EULA,
- you understand it, and
- you agree to be bound by its terms.



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