

26. Units Module

Traditionally, several types of energy, temperature, mass, and volume units have been used in thermochemical calculations. Therefore, some inconvenient conversions are needed to compare the results from different sources. The new Units Conversion module is an easy tool for fast unit conversions in thermochemistry as well as in other engineering fields. The specifications of this module can be summarized as follows.

1. Some 90 different quantities and 444 units are available. Users can easily add their own units and coefficients to the conversion calculator database.
2. The Units Module also offers data sheets for chemical constants, particle mesh sizes, air humidity, and water pressure tables. These tables can be modified by the user according to personal requirements.

Unit Conversions (Convert Sheet)

The screenshot shows the 'Measure Units' software window. At the top, there is a menu bar (File, Edit, Help) and a 'Unit Conversion' section with dropdown menus for quantity ('Energy, work'), prefix ('Kilo (k) 10^3'), unit ('J'), and target unit ('cal(th)'). A 'Clear Sheet' button is also present. To the right, there is a 'Sampler and Graphs' section with buttons for 'Sampler' and 'Water in air'. Below this is a spreadsheet interface with columns labeled 'Data 1', 'Units 1', 'Data 2', and 'Units 2'. The spreadsheet contains the following data:

	A	B	C	D	E
	Data 1	Units 1	Data 2	Units 2	
1					
2	1	cal(th)	4.184000633	J	
3	0.2390057	cal(th)	1	J	
4	25	°C	77	°F	
5	-17.77777778	°C	0	°F	
6	3.785411818	l	1	gal(US)	
7	22	kJ	5258.1254	cal(th)	
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

Fig. 1. Unit Conversion module.

The user interface of the Units module is shown in Fig. 1. All the data is given in the workbook, which consists of six sheets. The first Convert sheet works as a simple unit conversion calculator, which is used in the following manner:

1. Select the quantity you are interested in, for example, **Energy**.
2. Select the unit and prefix to be used in columns 1 and 2.
3. Select the unit and prefix to be used in columns 3 and 4.

4. Type the values into column 1 or 3. This will automatically show the converted value using the selected units. You can change the quantities, units, and prefixes whenever you want, as seen in **Fig. 1**.

Units Database (Units Sheet)

The screenshot shows the 'Measure Units' application window. The 'Unit Conversion' section is active, showing 'Energy, work' selected. Below it, there are dropdown menus for units and a 'Clear Sheet' button. To the right, there is a 'Sampler and Graphs' section with 'Sampler' and 'Water in air' buttons. The main part of the window is a spreadsheet with columns A, B, C, and D. The spreadsheet contains a list of physical quantities and their units and conversion coefficients.

	A	B	C	D
71	Energy, work	joule	British thermal unit(IT)	British thermal unit(IST.)
72	E	J	Btu(IT)	Btu(IST)
73	m ² kg s ⁻²	1.0000	9.4781E-04	0.000947831
74	Energy density	joule per cubic meter	British thermal unit per cubic foot	British thermal unit per gallon(B.)
75		J m ⁻³	Btu ft ⁻³	Btu gal(B.) ⁻¹
76	J m ⁻³	1.0000	2.68E-05	4.31E-06
77	Entropy	joule per Kelvin	calories (IT) per degree centigrade	ish thermal unit per degree fahrenheit
78	S	J K ⁻¹	cal (IT) deg C ⁻¹	btu deg F ⁻¹
79	J K ⁻¹	1.0000	2.39E-01	5.27E-04
80	Force	newton	dyne	grain force
81	F	N	dyn	grf
82	kg m s ⁻²	1.0000	1.00E+05	1573.6632
83	Frequency	hertz	degree/hour	degree/minute
84	f	Hz	degree h ⁻¹	degree min ⁻¹
85	s ⁻¹	1.0000	1.30E+06	2.16E+04
86	Heat capacity	joule per Kelvin	BTU/°C	BTU/°F
87	C	J K ⁻¹	BTU/°C	BTU/°F
88	J K ⁻¹	1.0000	9.48E-04	5.27E-04
89	Heat flux density, irradiance	watt per square meter	British thermal unit per hour square foot	ish thermal unit per second square foot

Fig. 2. Database sheet for unit coefficients.

The unit calculator on the Convert sheet reads all the quantities and unit coefficients from the Units sheet, see **Fig. 2**. Three rows are reserved for one quantity, and up to 255 units in the columns can be used for one quantity. The name of the quantity is given in the first column, the quantity first row gives the name of the unit, the second one the abbreviation and the third one the conversion coefficient.

Users can easily add their own quantities and units to this sheet. However, remember to save the worksheet if you want to use this new data later on.

Other Sheets

The Units workbook also contains other sheets:

1. **Constants sheet:** Chemical and physical constants.
2. **Mesh sheet:** Particle sizes in mesh and mm units.
3. **Air sheet:** Air composition and humidity tables.
4. **H2O sheet:** Water vapor pressure tables.

The user may also modify these sheets as well as add new sheets. The workbook must be saved with the **File Save** selection in order to use the new data later on.

Nearly all the same format, edit, and printing properties, as well as resizing of the form, are available in the Units module.