

free42 Custom Constants

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1 Metadata

The home for this HTML file is: <https://richmit.github.io/hp42/cons.html>

A PDF version of this file may be found here: <https://richmit.github.io/hp42/cons.pdf>

Files related to this document may be found on github: <https://github.com/richmit/hp42>

Directory contents:

| | | |
|----------------------|---|--|
| <code>src</code> | - | The org-mode file that generated this HTML document |
| <code>src_42s</code> | - | Ready to convert source listings for 42s code in this document |
| <code>docs</code> | - | This html document and associated PDF |
| <code>bin</code> | - | Importable RAW program files |

2 Introduction

Several constants libraries are available for the 42s, and some of them are quite good. Unfortunately nobody is going to make a constants library with just the constants I use. ;)

This Emacs org-file contains a bit of lisp code to write a 42s CONST program with the constants you want.

The constants I use are taken from the NIST 2018 constants DB. As a reference I have included the unused constants from the NIST list.

The flow to create your custom CONST program:

- Evaluate the "Generic menu generator" babel block in `hp42s-meta.org`. This will define the function `MJR-generate-42-menu-code`
- Put the constants you want into the table in the Constants Used section below (see: Customizing the Constants Table)
- Optional: Customize the generator code in the Code section below. (see: Customizing the Gen Code)

- Evaluate the babel block in the Code section below.
- Load the program on your calculator

2.1 Customizing the Constants Table

The "Menu" column describes the menu keys that will be assigned to the constant. Colons are used to define a menu hierarchy. For example "top:mid:con1" means we have a top level menu "top" containing a menu "mid" containing a constant "con1". Another entry like "top:con2" would add a constant named "con2" to the "top" menu – yes menus can contain a mix of constants and menus.

The menu structure can be as deep as you like. The one I use has a top level menu consisting of NIST constant category labels. Each of these menus, except for "atom", directly contain constants – so most constants are two key presses away. The exception is the atom menu which contains deeper menus – thus making atomic constants three key presses away.

Note the code generator uses two digit local labels in the generated code, and thus you can run out of labels if you have too many constants. Each menu page and each constant consumes one label.

The "Desc" column is the source for the description printed by the CONS program. Make sure it is 22 chars or less. Note the description print can be suppressed (see: Customizing the Gen Code)

The "Unit" column is the source for the second line printed by the CONS program. Note I use an odd syntax for the units – everything in front of the "/" is on the top of the fraction and everything after the "/" is on the bottom. While incorrect syntax for an algebraic expression, it is handy and saves some space. Note the units print can be suppressed (see: Customizing the Gen Code)

2.2 Customizing the Gen Code

The generator code can be customized in a few ways:

- `print-desc` can be set to `NIL` to suppress printing the description
- `print-unit` can be set to `NIL` to suppress printing the unit
- The `'exit` argument to `MJR-generate-42-menu-code` can be set to `'stay` if you prefer the menu to remain after a constant is recalled
- The `'up` argument to `MJR-generate-42-menu-code` can be set to `'exit` if you prefer the `[EXIT]` key to entirely exit the application instead of going up one menu level.

3 Constants

3.1 Constant Data (2018 NIST)

3.2 Test Data

| Symbol | Value | Description | units | NIST Category |
|--------|-------|-------------------------|-------|---------------|
| x13 | 1 | 0123456789012 | u | |
| x14 | 1 | 01234567890123 | u | |
| x15 | 1 | 012345678901234 | u | |
| x16 | 1 | 0123456789012345 | u | |
| x17 | 1 | 01234567890123456 | u | |
| x21 | 1 | 012345678901234567890 | u | |
| x22 | 1 | 0123456789012345678901 | u | |
| x23 | 1 | 01234567890123456789012 | u | |

3.3 Constants Used

| Menu | Desc | Quantity | Value | Uncertainty | Unit | Category |
|-----------|------------------------|-----------------------------------|------------------|------------------|-----------------------------------|----------|
| univ:h | Planck Constant | Planck constant | 6.62607015e-34 | 0 | J/Hz | univ |
| univ:hbar | Dirac Constant | reduced Planck constant | 1.054571817e-34 | 0 | J*s | univ |
| univ:c | Speed of Light | speed of light in vacuum | 299792458 | 0 | m/s | univ |
| univ:E0 | Vac Ele Permittivity | vacuum electric permittivity | 8.8541878128e-12 | 0.0000000013e-12 | F/m | univ |
| univ:μ0 | Vac Mag Permeability | vacuum magnetic permeability | 1.25663706212e-6 | 0.00000000019e-6 | N/A ² | univ |
| univ:G | Gravitational Constant | Newtonian constant of gravitation | 6.67430e-11 | 0.00015e-11 | m ³ /kg*s ² | univ |
| univ:tp | Planck Time | Planck time | 5.391247e-44 | 0.000060e-44 | s | univ |

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| Menu | Desc | Quantity | Value | Uncertainty | Unit | Category |
|----------------|------------------------|----------------------------------|---------------------|--------------------|----------------------------------|----------|
| adpt:gacc | Earth Std Grav Accel | standard acceleration of gravity | 9.80665 | 0 | m/s | derv |
| adpt:atm | Standard Atmosphere | standard atmosphere | 101325 | 0 | Pa | derv |
| elec:mN | Nuclear Magnetron | nuclear magneton | 5.0507837461e-27 | 0.0000000015e-27 | J/*T | elec |
| elec: μ B | Bohr Magnetron | Bohr magneton | 9.2740100783e-24 | 0.0000000028e-24 | J/T | elec |
| elec:e | Elementary Charge | elementary charge | 1.602176634e-19 | 0 | C | elec |
| elec:F0 | Mag flux quantum | magnetic flux quantum | 2.067833848e-15 | 0 | Wb | elec |
| elec:G0 | Conductance Quantum | conductance quantum | 7.748091729e-5 | 0 | S | elec |
| pchm:mu | Atomic Mass Unit | unified atomic mass unit | 1.66053906660e-27 | 0.00000000050e-27 | kg | pchem |
| pchm:F | Faraday | Faraday constant | 96485.33212 | 0 | C/mol | pchem |
| pchm:Na | Avogadro's Number | Avogadro constant | 6.02214076e23 | 0 | 1/mol | pchem |
| pchm:k | Boltzmann Constant | Boltzmann constant | 1.380649e-23 | 0 | J/K | pchem |
| pchm:R | Ideal Gas Constant | molar gas constant | 8.314462618 | 0 | J/mol*K | pchem |
| pchm:s | Stefan Constant | Stefan-Boltzmann constant | 5.670374419e-8 | 0 | W/m ² *K ⁴ | pchem |
| pchm:rc1 | First Radiation Cnst | first radiation constant | 3.741771852e-16 | 0 | W*m ² | pchem |
| pchm:rc2 | Second Radiation Cnst | second radiation constant | 1.438776877e-2 | 0 | m*K | pchem |
| atom:misc:a | Fine Structure | fine-structure constant | 7.2973525693e-3 | 0.0000000011e-3 | | atom |
| atom:misc:Eh | Hartree Energy | Hartree energy | 4.3597447222071e-18 | 0.000000000085e-18 | J | atom |
| atom:misc:Ry | Rydberg Constant | Rydberg constant | 10973731.568160 | 0.000021 | 1/m | atom |
| atom:mass:pro | Proton Mass | proton mass | 1.67262192369e-27 | 0.00000000051e-27 | kg | atom |
| atom:mass:ele | Electron Mass | electron mass | 9.1093837015e-31 | 0.0000000028e-31 | kg | atom |
| atom:mass:neut | Neutron Mass | neutron mass | 1.67492749804e-27 | 0.00000000095e-27 | kg | atom |
| atom:mass:muon | Muon Mass | muon mass | 1.883531627e-28 | 0.000000042e-28 | kg | atom |
| atom:magm:pro | Proton Mag Mom | proton magnetic moment | 1.41060679736e-26 | 0.0000000060e-26 | J/T | atom |
| atom:magm:ele | Electron Mag Mom | electron magnetic moment | -9.2847647043e-24 | 0.0000000028e-24 | J/T | atom |
| atom:magm:neut | Neutron Mag Mom | neutron magnetic moment | -9.6623651e-27 | 0.0000023e-27 | J/T | atom |
| atom:magm:muon | Muon Mag Mom | muon magnetic moment | -4.49044830e-26 | 0.00000010e-26 | J/T | atom |
| atom:rad:bohr | Bohr Radius | Bohr radius | 5.29177210903e-11 | 0.0000000080e-11 | m | atom |
| atom:rad:ele | Electron Radius | classical electron radius | 2.8179403262e-15 | 0.0000000013e-15 | m | atom |
| atom:comp:std | Compton Wavelength | Compton wavelength | 2.42631023867e-12 | 0.0000000073e-12 | m | atom |
| atom:comp:pro | Proton Compton waveln | proton Compton wavelength | 1.32140985539e-15 | 0.0000000040e-15 | m | atom |
| atom:comp:neut | Neutron Compton waveln | neutron Compton wavelength | 1.31959090581e-15 | 0.00000000075e-15 | m | atom |
| atom:comp:muon | Nuon Compton waveln | muon Compton wavelength | 1.173444110e-14 | 0.000000026e-14 | m | atom |
| math:grat | Golden ratio | | 1.618033988749894 | | | |
| math:emc | Eul-Masc | Euler-Mascheroni | 0.577215664901532 | | | |
| math:omga | Omega | Omega constant | 0.567143290409783 | | | |
| math:lapl | Laplace limit | Laplace limit | 0.662743419349181 | | | |

3.4 Constants Not Used

| Menu | Desc | Quantity | Value | Uncertainty | Unit | Category |
|------|------|---|-------------------|-------------------|--------|----------|
| | | alpha particle mass | 6.6446573357e-27 | 0.0000000020e-27 | kg | atom |
| | | alpha particle mass energy equivalent | 5.9719201914e-10 | 0.0000000018e-10 | J | atom |
| | | alpha particle mass energy equivalent in MeV | 3727.3794066 | 0.0000011 | MeV | atom |
| | | alpha particle mass in u | 4.001506179127 | 0.00000000063 | u | atom |
| | | alpha particle molar mass | 4.0015061777e-3 | 0.0000000012e-3 | kg/mol | atom |
| | | alpha particle relative atomic mass | 4.001506179127 | 0.00000000063 | | atom |
| | | alpha particle-electron mass ratio | 7294.29954142 | 0.00000024 | | atom |
| | | alpha particle-proton mass ratio | 3.97259969009 | 0.00000000022 | | atom |
| | | Angstrom star | 1.00001495e-10 | 0.00000090e-10 | m | |
| | | atomic mass constant | 1.66053906660e-27 | 0.00000000050e-27 | kg | atom |
| | | atomic mass constant energy equivalent | 1.49241808560e-10 | 0.00000000045e-10 | J | atom |
| | | atomic mass constant energy equivalent in MeV | 931.49410242 | 0.00000028 | MeV | atom |
| | | atomic mass unit-electron volt relationship | 9.3149410242e8 | 0.0000000028e8 | eV | atom |

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| Menu | Desc | Quantity | Value | Uncertainty | Unit | Category |
|------|------|--|---------------------|--------------------|---|----------|
| | | atomic mass unit-hartree relationship | 3.4231776874e7 | 0.0000000010e7 | E_h | atom |
| | | atomic mass unit-hertz relationship | 2.25234271871e23 | 0.00000000068e23 | Hz | atom |
| | | atomic mass unit-inverse meter relationship | 7.5130066104e14 | 0.0000000023e14 | 1/m | atom |
| | | atomic mass unit-joule relationship | 1.49241808560e-10 | 0.00000000045e-10 | J | atom |
| | | atomic mass unit-kelvin relationship | 1.08095401916e13 | 0.00000000033e13 | K | atom |
| | | atomic mass unit-kilogram relationship | 1.66053906660e-27 | 0.00000000050e-27 | kg | atom |
| | | atomic unit of 1st hyperpolarizability | 3.2063613061e-53 | 0.0000000015e-53 | C ³ m ³ J ⁻² | atom |
| | | atomic unit of 2nd hyperpolarizability | 6.2353799905e-65 | 0.0000000038e-65 | C ⁴ m ⁴ J ⁻³ | atom |
| | | atomic unit of action | 1.054571817e-34 | 0 | J*s | atom |
| | | atomic unit of charge | 1.602176634e-19 | 0 | C | atom |
| | | atomic unit of charge density | 1.08120238457e12 | 0.00000000049e12 | C*m ⁻³ | atom |
| | | atomic unit of current | 6.623618237510e-3 | 0.00000000013e-3 | A | atom |
| | | atomic unit of electric dipole moment | 8.4783536255e-30 | 0.000000013e-30 | C*m | atom |
| | | atomic unit of electric field | 5.14220674763e11 | 0.00000000078e11 | V/m | atom |
| | | atomic unit of electric field gradient | 9.7173624292e21 | 0.0000000029e21 | V/m ² | atom |
| | | atomic unit of electric polarizability | 1.64877727436e-41 | 0.00000000050e-41 | C ² m ² /J | atom |
| | | atomic unit of electric potential | 27.211386245988 | 0.00000000053 | V | atom |
| | | atomic unit of electric quadrupole moment | 4.4865515246e-40 | 0.0000000014e-40 | C*m ² | atom |
| | | atomic unit of energy | 4.3597447222071e-18 | 0.000000000085e-18 | J | atom |
| | | atomic unit of force | 8.2387234983e-8 | 0.0000000012e-8 | N | atom |
| | | atomic unit of length | 5.29177210903e-11 | 0.00000000080e-11 | m | atom |
| | | atomic unit of magnetic dipole moment | 1.85480201566e-23 | 0.00000000056e-23 | J/T | atom |
| | | atomic unit of magnetic flux density | 2.35051756758e5 | 0.00000000071e5 | T | atom |
| | | atomic unit of magnetizability | 7.8910366008e-29 | 0.0000000048e-29 | J/T ² | atom |
| | | atomic unit of mass | 9.1093837015e-31 | 0.0000000028e-31 | kg | atom |
| | | atomic unit of momentum | 1.99285191410e-24 | 0.00000000030e-24 | kg*m/s | atom |
| | | atomic unit of permittivity | 1.11265005545e-10 | 0.00000000017e-10 | F/m | atom |
| | | atomic unit of time | 2.4188843265857e-17 | 0.000000000047e-17 | s | atom |
| | | atomic unit of velocity | 2.18769126364e6 | 0.00000000033e6 | m/s | atom |
| | | Bohr magneton in eV/T | 5.7883818060e-5 | 0.0000000017e-5 | eV/T | atom |
| | | Bohr magneton in Hz/T | 1.39962449361e10 | 0.00000000042e10 | Hz/T | atom |
| | | Bohr magneton in inverse meter per tesla | 46.686447783 | 0.000000014 | 1/m*T | atom |
| | | Bohr magneton in K/T | 0.67171381563 | 0.00000000020 | K/T | atom |
| | | Boltzmann constant in eV/K | 8.617333262e-5 | 0 | eV/K | pchem |
| | | Boltzmann constant in Hz/K | 2.083661912e10 | 0 | Hz/K | pchem |
| | | Boltzmann constant in inverse meter per kelvin | 69.50348004 | 0 | 1/m*K | pchem |
| | | characteristic impedance of vacuum | 376.730313668 | 0.000000057 | ohm | |
| | | conventional value of ampere-90 | 1.00000008887 | 0 | A | |
| | | conventional value of coulomb-90 | 1.00000008887 | 0 | C | |
| | | conventional value of farad-90 | 0.99999998220 | 0 | F | |
| | | conventional value of henry-90 | 1.00000001779 | 0 | H | |
| | | conventional value of Josephson constant | 483597.9e9 | 0 | Hz/V | |
| | | conventional value of ohm-90 | 1.00000001779 | 0 | ohm | |
| | | conventional value of volt-90 | 1.00000010666 | 0 | V | |
| | | conventional value of von Klitzing constant | 25812.807 | 0 | ohm | |
| | | conventional value of watt-90 | 1.00000019553 | 0 | W | |
| | | Copper x unit | 1.00207697e-13 | 0.00000028e-13 | m | |
| | | deuteron g factor | 0.8574382338 | 0.0000000022 | | atom |
| | | deuteron magnetic moment | 4.330735094e-27 | 0.000000011e-27 | J/T | atom |
| | | deuteron magnetic moment to Bohr magneton ratio | 4.669754570e-4 | 0.000000012e-4 | | atom |
| | | deuteron magnetic moment to nuclear magneton ratio | 0.8574382338 | 0.0000000022 | | atom |
| | | deuteron mass | 3.3435837724e-27 | 0.0000000010e-27 | kg | atom |
| | | deuteron mass energy equivalent | 3.00506323102e-10 | 0.00000000091e-10 | J | atom |
| | | deuteron mass energy equivalent in MeV | 1875.61294257 | 0.000000057 | MeV | atom |

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| Menu | Desc | Quantity | Value | Uncertainty | Unit | Category |
|------|------|--|---------------------|--------------------|----------------------|----------|
| | | deuteron mass in u | 2.013553212745 | 0.000000000040 | u | atom |
| | | deuteron molar mass | 2.01355321205e-3 | 0.00000000061e-3 | kg/mol | atom |
| | | deuteron relative atomic mass | 2.013553212745 | 0.000000000040 | | atom |
| | | deuteron rms charge radius | 2.12799e-15 | 0.00074e-15 | m | atom |
| | | deuteron-electron magnetic moment ratio | -4.664345551e-4 | 0.000000012e-4 | | atom |
| | | deuteron-electron mass ratio | 3670.48296788 | 0.00000013 | | atom |
| | | deuteron-neutron magnetic moment ratio | -0.44820653 | 0.00000011 | | atom |
| | | deuteron-proton magnetic moment ratio | 0.30701220939 | 0.00000000079 | | atom |
| | | deuteron-proton mass ratio | 1.99900750139 | 0.00000000011 | | atom |
| | | electron charge to mass quotient | -1.75882001076e11 | 0.0000000053e11 | C/kg | atom |
| | | electron g factor | -2.00231930436256 | 0.0000000000035 | | atom |
| | | electron gyromagnetic ratio | 1.76085963023e11 | 0.0000000053e11 | 1/s*T | atom |
| | | electron gyromagnetic ratio in MHz/T | 28024.9514242 | 0.0000085 | MHz/T | atom |
| | | electron magnetic moment anomaly | 1.15965218128e-3 | 0.00000000018e-3 | | atom |
| | | electron magnetic moment to Bohr magneton ratio | -1.00115965218128 | 0.0000000000018 | | atom |
| | | electron magnetic moment to nuclear magneton ratio | -1838.28197188 | 0.00000011 | | atom |
| | | electron mass energy equivalent | 8.1871057769e-14 | 0.000000025e-14 | J | atom |
| | | electron mass energy equivalent in MeV | 0.51099895000 | 0.00000000015 | MeV | atom |
| | | electron mass in u | 5.48579909065e-4 | 0.00000000016e-4 | u | atom |
| | | electron molar mass | 5.4857990888e-7 | 0.0000000017e-7 | kg/mol | atom |
| | | electron relative atomic mass | 5.48579909065e-4 | 0.00000000016e-4 | | atom |
| | | electron to alpha particle mass ratio | 1.370933554787e-4 | 0.00000000045e-4 | | atom |
| | | electron to shielded helion magnetic moment ratio | 864.058257 | 0.000010 | | atom |
| | | electron to shielded proton magnetic moment ratio | -658.2275971 | 0.0000072 | | atom |
| | | electron volt | 1.602176634e-19 | 0 | J | atom |
| | | electron volt-atomic mass unit relationship | 1.07354410233e-9 | 0.00000000032e-9 | u | atom |
| | | electron volt-hartree relationship | 3.6749322175655e-2 | 0.000000000071e-2 | E _h | atom |
| | | electron volt-hertz relationship | 2.417989242e14 | 0 | Hz | atom |
| | | electron volt-inverse meter relationship | 8.065543937e5 | 0 | 1/m | atom |
| | | electron volt-joule relationship | 1.602176634e-19 | 0 | J | atom |
| | | electron volt-kelvin relationship | 1.160451812e4 | 0 | K | atom |
| | | electron volt-kilogram relationship | 1.782661921e-36 | 0 | kg | atom |
| | | electron-deuteron magnetic moment ratio | -2143.9234915 | 0.0000056 | | atom |
| | | electron-deuteron mass ratio | 2.724437107462e-4 | 0.00000000096e-4 | | atom |
| | | electron-helion mass ratio | 1.819543074573e-4 | 0.000000000079e-4 | | atom |
| | | electron-muon magnetic moment ratio | 206.7669883 | 0.0000046 | | atom |
| | | electron-muon mass ratio | 4.83633169e-3 | 0.00000011e-3 | | atom |
| | | electron-neutron magnetic moment ratio | 960.92050 | 0.00023 | | atom |
| | | electron-neutron mass ratio | 5.4386734424e-4 | 0.000000026e-4 | | atom |
| | | electron-proton magnetic moment ratio | -658.21068789 | 0.00000020 | | atom |
| | | electron-proton mass ratio | 5.44617021487e-4 | 0.00000000033e-4 | | atom |
| | | electron-tau mass ratio | 2.87585e-4 | 0.00019e-4 | | atom |
| | | electron-triton mass ratio | 1.819200062251e-4 | 0.00000000090e-4 | | atom |
| | | elementary charge over h-bar | 1.519267447e15 | 0 | A/J | |
| | | Fermi coupling constant | 1.1663787e-5 | 0.0000006e-5 | 1/GeV ² | |
| | | first radiation constant for spectral radiance | 1.191042972e-16 | 0 | W*m ² /sr | |
| | | Hartree energy in eV | 27.211386245988 | 0.000000000053 | eV | |
| | | hartree-atomic mass unit relationship | 2.92126232205e-8 | 0.00000000088e-8 | u | |
| | | hartree-electron volt relationship | 27.211386245988 | 0.000000000053 | eV | |
| | | hartree-hertz relationship | 6.579683920502e15 | 0.00000000013e15 | Hz | |
| | | hartree-inverse meter relationship | 2.1947463136320e7 | 0.000000000043e7 | 1/m | |
| | | hartree-joule relationship | 4.3597447222071e-18 | 0.000000000085e-18 | J | |
| | | hartree-kelvin relationship | 3.1577502480407e5 | 0.000000000061e5 | K | |
| | | hartree-kilogram relationship | 4.8508702095432e-35 | 0.000000000094e-35 | kg | |

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| Menu | Desc | Quantity | Value | Uncertainty | Unit | Category |
|------|------|--|---------------------|--------------------|--------|----------|
| | | helion g factor | -4.255250615 | 0.000000050 | | atom |
| | | helion magnetic moment | -1.074617532e-26 | 0.000000013e-26 | J/T | atom |
| | | helion magnetic moment to Bohr magneton ratio | -1.158740958e-3 | 0.000000014e-3 | | atom |
| | | helion magnetic moment to nuclear magneton ratio | -2.127625307 | 0.000000025 | | atom |
| | | helion mass | 5.0064127796e-27 | 0.0000000015e-27 | kg | atom |
| | | helion mass energy equivalent | 4.4995394125e-10 | 0.0000000014e-10 | J | atom |
| | | helion mass energy equivalent in MeV | 2808.39160743 | 0.000000085 | MeV | atom |
| | | helion mass in u | 3.014932247175 | 0.000000000097 | u | atom |
| | | helion molar mass | 3.01493224613e-3 | 0.00000000091e-3 | kg/mol | atom |
| | | helion relative atomic mass | 3.014932247175 | 0.000000000097 | | atom |
| | | helion shielding shift | 5.996743e-5 | 0.000010e-5 | | atom |
| | | helion-electron mass ratio | 5495.88528007 | 0.00000024 | | atom |
| | | helion-proton mass ratio | 2.99315267167 | 0.00000000013 | | atom |
| | | hertz-atomic mass unit relationship | 4.4398216652e-24 | 0.0000000013e-24 | u | |
| | | hertz-electron volt relationship | 4.135667696e-15 | 0 | eV | |
| | | hertz-hartree relationship | 1.5198298460570e-16 | 0.000000000029e-16 | E_h | |
| | | hertz-inverse meter relationship | 3.335640951e-9 | 0 | 1/m | |
| | | hertz-joule relationship | 6.62607015e-34 | 0 | J | |
| | | hertz-kelvin relationship | 4.799243073e-11 | 0 | K | |
| | | hertz-kilogram relationship | 7.372497323e-51 | 0 | kg | |
| | | hyperfine transition frequency of Cs-133 | 9192631770 | 0 | Hz | |
| | | inverse fine-structure constant | 137.035999084 | 0.000000021 | | |
| | | inverse meter-atomic mass unit relationship | 1.33102505010e-15 | 0.00000000040e-15 | u | |
| | | inverse meter-electron volt relationship | 1.239841984e-6 | 0 | eV | |
| | | inverse meter-hartree relationship | 4.5563352529120e-8 | 0.0000000000088e-8 | E_h | |
| | | inverse meter-hertz relationship | 299792458 | 0 | Hz | |
| | | inverse meter-joule relationship | 1.986445857e-25 | 0 | J | |
| | | inverse meter-kelvin relationship | 1.438776877e-2 | 0 | K | |
| | | inverse meter-kilogram relationship | 2.210219094e-42 | 0 | kg | |
| | | inverse of conductance quantum | 12906.40372 | 0 | ohm | |
| | | Josephson constant | 483597.8484e9 | 0 | Hz/V | |
| | | joule-atomic mass unit relationship | 6.7005352565e9 | 0.0000000020e9 | u | |
| | | joule-electron volt relationship | 6.241509074e18 | 0 | eV | |
| | | joule-hartree relationship | 2.2937122783963e17 | 0.000000000045e17 | E_h | |
| | | joule-hertz relationship | 1.509190179e33 | 0 | Hz | |
| | | joule-inverse meter relationship | 5.034116567e24 | 0 | 1/m | |
| | | joule-kelvin relationship | 7.242970516e22 | 0 | K | |
| | | joule-kilogram relationship | 1.112650056e-17 | 0 | kg | |
| | | kelvin-atomic mass unit relationship | 9.2510873014e-14 | 0.0000000028e-14 | u | |
| | | kelvin-electron volt relationship | 8.617333262e-5 | 0 | eV | |
| | | kelvin-hartree relationship | 3.1668115634556e-6 | 0.000000000061e-6 | E_h | |
| | | kelvin-hertz relationship | 2.083661912e10 | 0 | Hz | |
| | | kelvin-inverse meter relationship | 69.50348004 | 0 | 1/m | |
| | | kelvin-joule relationship | 1.380649e-23 | 0 | J | |
| | | kelvin-kilogram relationship | 1.536179187e-40 | 0 | kg | |
| | | kilogram-atomic mass unit relationship | 6.0221407621e26 | 0.0000000018e26 | u | |
| | | kilogram-electron volt relationship | 5.609588603e35 | 0 | eV | |
| | | kilogram-hartree relationship | 2.0614857887409e34 | 0.000000000040e34 | E_h | |
| | | kilogram-hertz relationship | 1.356392489e50 | 0 | Hz | |
| | | kilogram-inverse meter relationship | 4.524438335e41 | 0 | 1/m | |
| | | kilogram-joule relationship | 8.987551787e16 | 0 | J | |
| | | kilogram-kelvin relationship | 6.509657260e39 | 0 | K | |
| | | lattice parameter of silicon | 5.431020511e-10 | 0.000000089e-10 | m | |
| | | lattice spacing of ideal Si (220) | 1.920155716e-10 | 0.000000032e-10 | m | |

Continued on next page

Continued from previous page

| Menu | Desc | Quantity | Value | Uncertainty | Unit | Category |
|------|------|---|-------------------|-------------------|----------------------------------|----------|
| | | Loschmidt constant (273.15 K, 100 kPa) | 2.651645804e25 | 0 | 1/m ³ | pchem |
| | | Loschmidt constant (273.15 K, 101.325 kPa) | 2.686780111e25 | 0 | 1/m ³ | pchem |
| | | luminous efficacy | 683 | 0 | lm/W | |
| | | molar mass constant | 0.99999999965e-3 | 0.00000000030e-3 | kg/mol | |
| | | molar mass of carbon-12 | 11.9999999958e-3 | 0.00000000036e-3 | kg/mol | |
| | | molar Planck constant | 3.990312712e-10 | 0 | J/Hz*mol | pchem |
| | | molar volume of ideal gas (273.15 K, 100 kPa) | 22.71095464e-3 | 0 | m ³ /mol | pchem |
| | | molar volume of ideal gas (273.15 K, 101.325 kPa) | 22.41396954e-3 | 0 | m ³ /mol | pchem |
| | | molar volume of silicon | 1.205883199e-5 | 0.000000060e-5 | m ³ /mol | |
| | | Molybdenum x unit | 1.00209952e-13 | 0.00000053e-13 | m | |
| | | muon g factor | -2.0023318418 | 0.0000000013 | | atom |
| | | muon magnetic moment anomaly | 1.16592089e-3 | 0.00000063e-3 | | atom |
| | | muon magnetic moment to Bohr magneton ratio | -4.84197047e-3 | 0.00000011e-3 | | atom |
| | | muon magnetic moment to nuclear magneton ratio | -8.89059703 | 0.00000020 | | atom |
| | | muon mass energy equivalent | 1.692833804e-11 | 0.000000038e-11 | J | atom |
| | | muon mass energy equivalent in MeV | 105.6583755 | 0.00000023 | MeV | atom |
| | | muon mass in u | 0.1134289259 | 0.0000000025 | u | atom |
| | | muon molar mass | 1.134289259e-4 | 0.000000025e-4 | kg/mol | atom |
| | | muon-electron mass ratio | 206.7682830 | 0.00000046 | | atom |
| | | muon-neutron mass ratio | 0.1124545170 | 0.0000000025 | | atom |
| | | muon-proton magnetic moment ratio | -3.183345142 | 0.000000071 | | atom |
| | | muon-proton mass ratio | 0.1126095264 | 0.0000000025 | | atom |
| | | muon-tau mass ratio | 5.94635e-2 | 0.00040e-2 | | atom |
| | | natural unit of action | 1.054571817e-34 | 0 | J*s | |
| | | natural unit of action in eV s | 6.582119569e-16 | 0 | eV*s | |
| | | natural unit of energy | 8.1871057769e-14 | 0.0000000025e-14 | J | |
| | | natural unit of energy in MeV | 0.51099895000 | 0.00000000015 | MeV | |
| | | natural unit of length | 3.8615926796e-13 | 0.0000000012e-13 | m | |
| | | natural unit of mass | 9.1093837015e-31 | 0.0000000028e-31 | kg | |
| | | natural unit of momentum | 2.73092453075e-22 | 0.00000000082e-22 | kg*m/s | |
| | | natural unit of time | 1.28808866819e-21 | 0.00000000039e-21 | s | |
| | | natural unit of velocity | 299792458 | 0 | m/s | |
| | | neutron g factor | -3.82608545 | 0.00000090 | | atom |
| | | neutron gyromagnetic ratio | 1.83247171e8 | 0.00000043e8 | 1/s*T | atom |
| | | neutron gyromagnetic ratio in MHz/T | 29.1646931 | 0.00000069 | MHz/T | atom |
| | | neutron magnetic moment to Bohr magneton ratio | -1.04187563e-3 | 0.00000025e-3 | | atom |
| | | neutron magnetic moment to nuclear magneton ratio | -1.91304273 | 0.00000045 | | atom |
| | | neutron mass energy equivalent | 1.50534976287e-10 | 0.00000000086e-10 | J | atom |
| | | neutron mass energy equivalent in MeV | 939.56542052 | 0.00000054 | MeV | atom |
| | | neutron mass in u | 1.00866491595 | 0.00000000049 | u | atom |
| | | neutron molar mass | 1.00866491560e-3 | 0.00000000057e-3 | kg/mol | atom |
| | | neutron relative atomic mass | 1.00866491595 | 0.00000000049 | | atom |
| | | neutron to shielded proton magnetic moment ratio | -0.68499694 | 0.00000016 | | atom |
| | | neutron-electron magnetic moment ratio | 1.04066882e-3 | 0.00000025e-3 | | atom |
| | | neutron-electron mass ratio | 1838.68366173 | 0.00000089 | | atom |
| | | neutron-muon mass ratio | 8.89248406 | 0.00000020 | | atom |
| | | neutron-proton magnetic moment ratio | -0.68497934 | 0.00000016 | | atom |
| | | neutron-proton mass difference | 2.30557435e-30 | 0.00000082e-30 | kg | atom |
| | | neutron-proton mass difference energy equivalent | 2.07214689e-13 | 0.00000074e-13 | J | atom |
| | | neutron-proton mass difference energy equivalent in MeV | 1.29333236 | 0.00000046 | MeV | atom |
| | | neutron-proton mass difference in u | 1.38844933e-3 | 0.00000049e-3 | u | atom |
| | | neutron-proton mass ratio | 1.00137841931 | 0.00000000049 | | atom |
| | | neutron-tau mass ratio | 0.528779 | 0.0000036 | | atom |
| | | Newtonian constant of gravitation over h-bar c | 6.70883e-39 | 0.00015e-39 | c ⁴ /GeV ² | |

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| Menu | Desc | Quantity | Value | Uncertainty | Unit | Category |
|------|------|---|---------------------|---------------------|-------------------|----------|
| | | nuclear magneton in eV/T | 3.15245125844e-8 | 0.00000000096e-8 | eV/T | |
| | | nuclear magneton in inverse meter per tesla | 2.54262341353e-2 | 0.00000000078e-2 | 1/m*T | |
| | | nuclear magneton in K/T | 3.6582677756e-4 | 0.0000000011e-4 | K/T | |
| | | nuclear magneton in MHz/T | 7.6225932291 | 0.0000000023 | MHz/T | |
| | | Planck constant in eV/Hz | 4.135667696e-15 | 0 | eV/Hz | |
| | | Planck length | 1.616255e-35 | 0.000018e-35 | m | |
| | | Planck mass | 2.176434e-8 | 0.000024e-8 | kg | |
| | | Planck mass energy equivalent in GeV | 1.220890e19 | 0.000014e19 | GeV | |
| | | Planck temperature | 1.416784e32 | 0.000016e32 | K | |
| | | proton charge to mass quotient | 9.5788331560e7 | 0.0000000029e7 | C/kg | atom |
| | | proton g factor | 5.5856946893 | 0.0000000016 | | atom |
| | | proton gyromagnetic ratio | 2.6752218744e8 | 0.0000000011e8 | 1/s*T | atom |
| | | proton gyromagnetic ratio in MHz/T | 42.577478518 | 0.000000018 | MHz/T | atom |
| | | proton magnetic moment to Bohr magneton ratio | 1.52103220230e-3 | 0.00000000046e-3 | | atom |
| | | proton magnetic moment to nuclear magneton ratio | 2.79284734463 | 0.00000000082 | | atom |
| | | proton magnetic shielding correction | 2.5689e-5 | 0.0011e-5 | | atom |
| | | proton mass energy equivalent | 1.50327761598e-10 | 0.00000000046e-10 | J | atom |
| | | proton mass energy equivalent in MeV | 938.27208816 | 0.00000029 | MeV | atom |
| | | proton mass in u | 1.007276466621 | 0.000000000053 | u | atom |
| | | proton molar mass | 1.00727646627e-3 | 0.00000000031e-3 | kg/mol | atom |
| | | proton relative atomic mass | 1.007276466621 | 0.000000000053 | | atom |
| | | proton rms charge radius | 8.414e-16 | 0.019e-16 | m | atom |
| | | proton-electron mass ratio | 1836.15267343 | 0.00000011 | | atom |
| | | proton-muon mass ratio | 8.88024337 | 0.00000020 | | atom |
| | | proton-neutron magnetic moment ratio | -1.45989805 | 0.00000034 | | atom |
| | | proton-neutron mass ratio | 0.99862347812 | 0.00000000049 | | atom |
| | | proton-tau mass ratio | 0.528051 | 0.000036 | | atom |
| | | quantum of circulation | 3.6369475516e-4 | 0.0000000011e-4 | m ² /s | atom |
| | | quantum of circulation times 2 | 7.2738951032e-4 | 0.0000000022e-4 | m ² /s | atom |
| | | reduced Compton wavelength | 3.8615926796e-13 | 0.0000000012e-13 | m | |
| | | reduced muon Compton wavelength | 1.867594306e-15 | 0.000000042e-15 | m | |
| | | reduced neutron Compton wavelength | 2.1001941552e-16 | 0.0000000012e-16 | m | |
| | | reduced Planck constant in eV s | 6.582119569e-16 | 0 | eV*s | |
| | | reduced Planck constant times c in MeV fm | 197.3269804 | 0 | MeV*fm | |
| | | reduced proton Compton wavelength | 2.10308910336e-16 | 0.00000000064e-16 | m | |
| | | reduced tau Compton wavelength | 1.110538e-16 | 0.000075e-16 | m | |
| | | Rydberg constant times c in Hz | 3.2898419602508e15 | 0.000000000064e15 | Hz | |
| | | Rydberg constant times hc in eV | 13.605693122994 | 0.000000000026 | eV | |
| | | Rydberg constant times hc in J | 2.1798723611035e-18 | 0.0000000000042e-18 | J | |
| | | Sackur-Tetrode constant (1 K, 100 kPa) | -1.15170753706 | 0.000000000045 | | pchem |
| | | Sackur-Tetrode constant (1 K, 101.325 kPa) | -1.16487052358 | 0.000000000045 | | pchem |
| | | shielded helion gyromagnetic ratio | 2.037894569e8 | 0.000000024e8 | 1/s*T | atom |
| | | shielded helion gyromagnetic ratio in MHz/T | 32.43409942 | 0.000000038 | MHz/T | atom |
| | | shielded helion magnetic moment | -1.074553090e-26 | 0.000000013e-26 | J/T | atom |
| | | shielded helion magnetic moment to Bohr magneton ratio | -1.158671471e-3 | 0.000000014e-3 | | atom |
| | | shielded helion magnetic moment to nuclear magneton ratio | -2.127497719 | 0.000000025 | | atom |
| | | shielded helion to proton magnetic moment ratio | -0.7617665618 | 0.0000000089 | | atom |
| | | shielded helion to shielded proton magnetic moment ratio | -0.7617861313 | 0.0000000033 | | atom |
| | | shielded proton gyromagnetic ratio | 2.675153151e8 | 0.000000029e8 | 1/s*T | atom |
| | | shielded proton gyromagnetic ratio in MHz/T | 42.57638474 | 0.000000046 | MHz/T | atom |
| | | shielded proton magnetic moment | 1.410570560e-26 | 0.000000015e-26 | J/T | atom |
| | | shielded proton magnetic moment to Bohr magneton ratio | 1.520993128e-3 | 0.000000017e-3 | | atom |
| | | shielded proton magnetic moment to nuclear magneton ratio | 2.792775599 | 0.000000030 | | atom |
| | | shielding difference of d and p in HD | 2.0200e-8 | 0.0020e-8 | | atom |

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| Menu | Desc | Quantity | Value | Uncertainty | Unit | Category |
|------|------|--|------------------|------------------|----------------|----------|
| | | shielding difference of t and p in HT | 2.4140e-8 | 0.0020e-8 | | atom |
| | | standard-state pressure | 100000 | 0 | Pa | |
| | | tau Compton wavelength | 6.97771e-16 | 0.00047e-16 | m | atom |
| | | tau energy equivalent | 1776.86 | 0.12 | MeV | atom |
| | | tau mass | 3.16754e-27 | 0.00021e-27 | kg | atom |
| | | tau mass energy equivalent | 2.84684e-10 | 0.00019e-10 | J | atom |
| | | tau mass in u | 1.90754 | 0.00013 | u | atom |
| | | tau molar mass | 1.90754e-3 | 0.00013e-3 | kg/mol | atom |
| | | tau-electron mass ratio | 3477.23 | 0.23 | | atom |
| | | tau-muon mass ratio | 16.8170 | 0.0011 | | atom |
| | | tau-neutron mass ratio | 1.89115 | 0.00013 | | atom |
| | | tau-proton mass ratio | 1.89376 | 0.00013 | | atom |
| | | Thomson cross section | 6.6524587321e-29 | 0.0000000060e-29 | m ² | |
| | | triton g factor | 5.957924931 | 0.000000012 | | atom |
| | | triton magnetic moment | 1.5046095202e-26 | 0.0000000030e-26 | J/T | atom |
| | | triton magnetic moment to Bohr magneton ratio | 1.6223936651e-3 | 0.0000000032e-3 | | atom |
| | | triton magnetic moment to nuclear magneton ratio | 2.9789624656 | 0.0000000059 | | atom |
| | | triton mass | 5.0073567446e-27 | 0.0000000015e-27 | kg | atom |
| | | triton mass energy equivalent | 4.5003878060e-10 | 0.0000000014e-10 | J | atom |
| | | triton mass energy equivalent in MeV | 2808.92113298 | 0.000000085 | MeV | atom |
| | | triton mass in u | 3.01550071621 | 0.00000000012 | u | atom |
| | | triton molar mass | 3.01550071517e-3 | 0.00000000092e-3 | kg/mol | atom |
| | | triton relative atomic mass | 3.01550071621 | 0.00000000012 | | atom |
| | | triton to proton magnetic moment ratio | 1.0666399191 | 0.0000000021 | | atom |
| | | triton-electron mass ratio | 5496.92153573 | 0.000000027 | | atom |
| | | triton-proton mass ratio | 2.99371703414 | 0.00000000015 | | atom |
| | | von Klitzing constant | 25812.80745 | 0 | ohm | |
| | | W to Z mass ratio | 0.88153 | 0.00017 | | |
| | | weak mixing angle | 0.22290 | 0.00030 | | |
| | | Wien frequency displacement law constant | 5.878925757e10 | 0 | Hz/K | pchem |
| | | Wien wavelength displacement law constant | 2.897771955e-3 | 0 | m*K | pchem |

3.5 Code

You must first define the `MJR-generate-42-menu-code` by evaluating the code block in the `hp42s-meta.org` file.

```
(MJR-generate-42-menu-code "CONS"
  0
  tbl
  0
  nil
  'exit ;; Change to 'stay to prevent application exit after a constant is pushed to the stack
  'up ;; Change to 'exit to have the application exit when [EXIT] is pressed
  'auto
  #'MJR-local-only-gen-lab
  (lambda (atrg target row) (cl-structuring-bind (sym desc desc-long val uncertainty units cat) row
    (let ((print-desc 't) ;; Set to NIL to not print description
          (print-unit 't) ;; Set to NIL to not print units
          (let* ((dlen (length desc))
                 (ulen (length units))
                 (dsc1 (cond ((< dlen 15) (concat desc (if (and (< 0 ulen) print-unit) "[LF]"))
                              ((>= dlen 15) (substring desc 0 15))))
                 (dsc2 (if (> dlen 14)
                           (if (< dlen 22)
                               (concat (substring desc 15) (if (and (< 0 ulen) print-unit) "[LF]"))
```

```

(substring desc 15 22))))))
(mapconcat #'identity
  (cl-remove nil (list (message "%s" val)
    (and (< 0 dlen) print-desc
      (message "\%s\" dsc1))
    (and (< 0 dlen) print-desc dsc2
      (message "|-\%s\" dsc2))
    (and (< 0 ulen) print-unit
      (message "%s\%s\"
        (if (and (< 0 dlen) print-desc) "|-" ""))
        units)))
    "AVIEW")))
"\n")))))))

```

@@ (CONS)

@@@ DSC: Auto-generated menu program

LBL "CONS"

@@@ Page 1 of menu CONS

CLMENU

"univ"

KEY 1 GTO 02

"adpt"

KEY 2 GTO 03

"elec"

KEY 3 GTO 04

"pchg"

KEY 4 GTO 05

"atom"

KEY 5 GTO 06

"math"

KEY 6 GTO 07

KEY 9 GTO 00

MENU

STOP

GTO 00

@@@ Page 1 of menu univ

LBL 02

CLMENU

"h"

KEY 1 XEQ 09

"hbar"

KEY 2 XEQ 10

"c"

KEY 3 XEQ 11

"EO"

KEY 4 XEQ 12

"μ0"

KEY 5 XEQ 13

"G"

KEY 6 XEQ 14

KEY 7 GTO 08

KEY 8 GTO 08

KEY 9 GTO 01

MENU

STOP

GTO 00

@@@ Page 2 of menu univ

LBL 08

CLMENU

"tp"
KEY 1 XEQ 15
KEY 7 GTO 02
KEY 8 GTO 02
KEY 9 GTO 01
MENU
STOP
GTO 00
LBL 03 @@@@ Page 1 of menu adpt
CLMENU
"gacc"
KEY 1 XEQ 16
"atm"
KEY 2 XEQ 17
KEY 9 GTO 01
MENU
STOP
GTO 00
LBL 04 @@@@ Page 1 of menu elec
CLMENU
"mN"
KEY 1 XEQ 18
"uB"
KEY 2 XEQ 19
"e"
KEY 3 XEQ 20
"FO"
KEY 4 XEQ 21
"GO"
KEY 5 XEQ 22
KEY 9 GTO 01
MENU
STOP
GTO 00
LBL 05 @@@@ Page 1 of menu pchm
CLMENU
"mu"
KEY 1 XEQ 24
"F"
KEY 2 XEQ 25
"Na"
KEY 3 XEQ 26
"k"
KEY 4 XEQ 27
"R"
KEY 5 XEQ 28
"s"
KEY 6 XEQ 29
KEY 7 GTO 23
KEY 8 GTO 23
KEY 9 GTO 01
MENU
STOP
GTO 00
LBL 23 @@@@ Page 2 of menu pchm
CLMENU
"rc1"

```

KEY 1 XEQ 30
"xc2"
KEY 2 XEQ 31
KEY 7 GTO 05
KEY 8 GTO 05
KEY 9 GTO 01
MENU
STOP
GTO 00
LBL 06      @@@@ Page 1 of menu atom
CLMENU
"misc"
KEY 1 GTO 32
"mass"
KEY 2 GTO 33
"magm"
KEY 3 GTO 34
"rad"
KEY 4 GTO 35
"comp"
KEY 5 GTO 36
KEY 9 GTO 01
MENU
STOP
GTO 00
LBL 32      @@@@ Page 1 of menu misc
CLMENU
"a"
KEY 1 XEQ 37
"Eh"
KEY 2 XEQ 38
"Ry"
KEY 3 XEQ 39
KEY 9 GTO 06
MENU
STOP
GTO 00
LBL 33      @@@@ Page 1 of menu mass
CLMENU
"pro"
KEY 1 XEQ 40
"ele"
KEY 2 XEQ 41
"neut"
KEY 3 XEQ 42
"muon"
KEY 4 XEQ 43
KEY 9 GTO 06
MENU
STOP
GTO 00
LBL 34      @@@@ Page 1 of menu magm
CLMENU
"pro"
KEY 1 XEQ 44
"ele"
KEY 2 XEQ 45

```

```

"neut"
KEY 3 XEQ 46
"muon"
KEY 4 XEQ 47
KEY 9 GTO 06
MENU
STOP
GTO 00
LBL 35          @@@@ Page 1 of menu rad
CLMENU
"bohr"
KEY 1 XEQ 48
"ele"
KEY 2 XEQ 49
KEY 9 GTO 06
MENU
STOP
GTO 00
LBL 36          @@@@ Page 1 of menu comp
CLMENU
"std"
KEY 1 XEQ 50
"pro"
KEY 2 XEQ 51
"neut"
KEY 3 XEQ 52
"muon"
KEY 4 XEQ 53
KEY 9 GTO 06
MENU
STOP
GTO 00
LBL 07          @@@@ Page 1 of menu math
CLMENU
"grat"
KEY 1 XEQ 54
"emc"
KEY 2 XEQ 55
"omga"
KEY 3 XEQ 56
"lapl"
KEY 4 XEQ 57
KEY 9 GTO 01
MENU
STOP
GTO 00
LBL 00 @@@@ Application Exit
EXITALL
RTN
LBL 09          @@@@ Action for menu key h
6.62607015e-34
"Planck Constant"
|-[LF]"
|-[J/Hz"
AVIEW
RTN
LBL 10          @@@@ Action for menu key hbar

```

```

1.054571817e-34
"Dirac Constant[LF]"
└"J*s"
AVIEW
RTN
LBL 11   @@@@ Action for menu key c
299792458
"Speed of Light[LF]"
└"m/s"
AVIEW
RTN
LBL 12   @@@@ Action for menu key EO
8.8541878128e-12
"Vac Ele Permitt"
└"ivity[LF]"
└"F/m"
AVIEW
RTN
LBL 13   @@@@ Action for menu key μ0
1.25663706212e-06
"Vac Mag Permeab"
└"ility[LF]"
└"N/A^2"
AVIEW
RTN
LBL 14   @@@@ Action for menu key G
6.6743e-11
"Gravitational C"
└"onstant"
└"m^3/kg*s^2"
AVIEW
RTN
LBL 15   @@@@ Action for menu key tp
5.391247e-44
"Planck Time[LF]"
└"s"
AVIEW
RTN
LBL 16   @@@@ Action for menu key gacc
9.80665
"Earth Std Grav "
└"Accel[LF]"
└"m/s"
AVIEW
RTN
LBL 17   @@@@ Action for menu key atm
101325
"Standard Atmosp"
└"here[LF]"
└"Pa"
AVIEW
RTN
LBL 18   @@@@ Action for menu key mN
5.0507837461e-27
"Nuclear Magneto"
└"n[LF]"
└"J/*T"

```

```

AVIEW
RTN
LBL 19   @@@@ Action for menu key μB
9.2740100783e-24
"Bohr Magneton[LF]"
└"J/T"
AVIEW
RTN
LBL 20   @@@@ Action for menu key e
1.602176634e-19
"Elementary Char"
└"ge[LF]"
└"C"
AVIEW
RTN
LBL 21   @@@@ Action for menu key F0
2.067833848e-15
"Mag flux quantu"
└"m[LF]"
└"wb"
AVIEW
RTN
LBL 22   @@@@ Action for menu key G0
7.748091729e-05
"Conductance Qua"
└"ntum[LF]"
└"S"
AVIEW
RTN
LBL 24   @@@@ Action for menu key mu
1.6605390666e-27
"Atomic Mass Uni"
└"t[LF]"
└"kg"
AVIEW
RTN
LBL 25   @@@@ Action for menu key F
96485.33212
"Faraday[LF]"
└"C/mol"
AVIEW
RTN
LBL 26   @@@@ Action for menu key Na
6.02214076e+23
"Avogadro's Numb"
└"er[LF]"
└"1/mol"
AVIEW
RTN
LBL 27   @@@@ Action for menu key k
1.380649e-23
"Boltzmann Const"
└"ant[LF]"
└"J/K"
AVIEW
RTN
LBL 28   @@@@ Action for menu key R

```

```

8.314462618
"Ideal Gas Const"
└"ant[LF]"
└"J/mol*K"
AVIEW
RTN
LBL 29      @@@@ Action for menu key s
5.670374419e-08
"Stefan Constant"
└"[LF]"
└"W/m^2*K^4"
AVIEW
RTN
LBL 30      @@@@ Action for menu key rc1
3.741771852e-16
"First Radiation"
└" Cnst[LF]"
└"W*m^2"
AVIEW
RTN
LBL 31      @@@@ Action for menu key rc2
0.01438776877
"Second Radiatio"
└"n Cnst[LF]"
└"m*K"
AVIEW
RTN
LBL 37      @@@@ Action for menu key a
0.0072973525693
"Fine Structure"
AVIEW
RTN
LBL 38      @@@@ Action for menu key Eh
4.3597447222071e-18
"Hartree Energy[LF]"
└"J"
AVIEW
RTN
LBL 39      @@@@ Action for menu key Ry
10973731.56816
"Rydberg Constan"
└"t[LF]"
└"1/m"
AVIEW
RTN
LBL 40      @@@@ Action for menu key pro
1.67262192369e-27
"Proton Mass[LF]"
└"kg"
AVIEW
RTN
LBL 41      @@@@ Action for menu key ele
9.1093837015e-31
"Electron Mass[LF]"
└"kg"
AVIEW
RTN

```



```

LBL 42   @@@@ Action for menu key neut
1.67492749804e-27
"Neutron Mass[LF]"
└"kg"
AVIEW
RTN
LBL 43   @@@@ Action for menu key muon
1.883531627e-28
"Muon Mass[LF]"
└"kg"
AVIEW
RTN
LBL 44   @@@@ Action for menu key pro
1.41060679736e-26
"Proton Mag Mom[LF]"
└"J/T"
AVIEW
RTN
LBL 45   @@@@ Action for menu key ele
-9.2847647043e-24
"Electron Mag Mo"
└"m[LF]"
└"J/T"
AVIEW
RTN
LBL 46   @@@@ Action for menu key neut
-9.6623651e-27
"Neutron Mag Mom"
└"[LF]"
└"J/T"
AVIEW
RTN
LBL 47   @@@@ Action for menu key muon
-4.4904483e-26
"Muon Mag Mom[LF]"
└"J/T"
AVIEW
RTN
LBL 48   @@@@ Action for menu key bohr
5.29177210903e-11
"Bohr Radius[LF]"
└"m"
AVIEW
RTN
LBL 49   @@@@ Action for menu key ele
2.8179403262e-15
"Electron Radius"
└"[LF]"
└"m"
AVIEW
RTN
LBL 50   @@@@ Action for menu key std
2.42631023867e-12
"Compton Wavelen"
└"gth[LF]"
└"m"
AVIEW

```

```
RTN
LBL 51      @@@@ Action for menu key pro
1.32140985539e-15
"Proton Compton "
├"waveln[LF]"
├"m"
AVIEW
RTN
LBL 52      @@@@ Action for menu key neut
1.31959090581e-15
"Neutron Compton"
├" waveln"
├"m"
AVIEW
RTN
LBL 53      @@@@ Action for menu key muon
1.17344411e-14
"Nuon Compton wa"
├"veln[LF]"
├"m"
AVIEW
RTN
LBL 54      @@@@ Action for menu key grat
1.618033988749894
"Golden ratio"
AVIEW
RTN
LBL 55      @@@@ Action for menu key emc
0.577215664901532
"Eul-Masc"
AVIEW
RTN
LBL 56      @@@@ Action for menu key omga
0.567143290409783
"Omega"
AVIEW
RTN
LBL 57      @@@@ Action for menu key lapl
0.662743419349181
"Laplace limit"
AVIEW
RTN
@@@ Free labels start at: 58
END
```

4 EOF