CODATA Recommended Values of the Fundamental Physical Constants: 2014*

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(Dated: 25 June 2015)

This document gives the 2014 self-consistent set of values of the constants and conversion factors of physics and chemistry recommended by the Committee on Data for Science and Technology (CODATA). These values are based on a least-squares adjustment that takes into account all data available up to 31 December 2014. The recommended values may also be found at physics.nist.gov/constants.

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TABLE I An abbreviated list of the CODATA recommended values of the fundamental constants of physics and chemistry based on the 2014 adjustment.

Quantity	Symbol	Numerical value	Unit	Relative std. uncert. u_r
speed of light in vacuum	c, c_0	$299\,792\,458$	$\mathrm{m\ s^{-1}}$	exact
magnetic constant	μ_0	$4\pi \times 10^{-7}$	$\mathrm{N\ A^{-2}}$	
		$= 12.566\,370\,614... \times 10^{-7}$	$\mathrm{N\ A^{-2}}$	exact
electric constant $1/\mu_0 c^2$	ϵ_0	$8.854\,187\,817... \times 10^{-12}$	$\mathrm{F\ m^{-1}}$	exact
Newtonian constant of gravitation	G	$6.674\,08(31) \times 10^{-11}$	$\mathrm{m^3\ kg^{-1}\ s^{-2}}$	4.7×10^{-5}
Planck constant	h	$6.626\,070\,040(81) \times 10^{-34}$	J s	1.2×10^{-8}
$h/2\pi$	$\hbar$	$1.054\,571\,800(13) \times 10^{-34}$	J s	1.2×10^{-8}
elementary charge	e	$1.602\,176\,6208(98) \times 10^{-19}$	C	6.1×10^{-9}
magnetic flux quantum $h/2e$	Φ_0	$2.067\,833\,831(13) \times 10^{-15}$	Wb	6.1×10^{-9}
conductance quantum $2e^2/h$	G_0	$7.748\,091\,7310(18) \times 10^{-5}$	S	2.3×10^{-10}
electron mass	m_e	$9.109\,383\,56(11) \times 10^{-31}$	kg	1.2×10^{-8}
proton mass	m_p	$1.672\,621\,898(21) \times 10^{-27}$	kg	1.2×10^{-8}
proton-electron mass ratio	$m_\mathrm{p}/m_\mathrm{e}$	$1836.152\,673\,89(17)$		9.5×10^{-11}
fine-structure constant $e^2/4\pi\epsilon_0\hbar c$	α	$7.297\,352\,5664(17) \times 10^{-3}$		2.3×10^{-10}
inverse fine-structure constant	α^{-1}	$137.035\,999\,139(31)$		2.3×10^{-10}
Rydberg constant $\alpha^2 m_\mathrm{e} c/2h$	R_∞	$10\,973\,731.568\,508(65)$	$\mathrm{m^{-1}}$	5.9×10^{-12}
Avogadro constant	N_A, L	$6.022\,140\,857(74) \times 10^{23}$	$\mathrm{mol^{-1}}$	1.2×10^{-8}
Faraday constant $N_\mathrm{A} e$	F	$96\,485.332\,89(59)$	$\mathrm{C\ mol^{-1}}$	6.2×10^{-9}
molar gas constant	R	$8.314\,4598(48)$	$\mathrm{J\ mol^{-1}\ K^{-1}}$	5.7×10^{-7}
Boltzmann constant R/N_A	k	$1.380\,648\,52(79) \times 10^{-23}$	$\mathrm{J\ K^{-1}}$	5.7×10^{-7}
Stefan-Boltzmann constant $(\pi^2/60)k^4/\hbar^3 c^2$	σ	$5.670\,367(13) \times 10^{-8}$	$\mathrm{W\ m^{-2}\ K^{-4}}$	2.3×10^{-6}
		Non-SI units accepted for use with the SI		
electron volt (e/C) J	eV	$1.602\,176\,6208(98) \times 10^{-19}$	J	6.1×10^{-9}
(unified) atomic mass unit $\frac{1}{12}m(^{12}\mathrm{C})$	u	$1.660\,539\,040(20) \times 10^{-27}$	kg	1.2×10^{-8}

TABLE II: The CODATA recommended values of the fundamental constants of physics and chemistry based on the 2014 adjustment.

Quantity	Symbol	Numerical value	Unit	Relative std. uncert. u_r
UNIVERSAL				
speed of light in vacuum	c, c_0	$299\,792\,458$	m s^{-1}	exact
magnetic constant	μ_0	$4\pi \times 10^{-7}$	N A^{-2}	
		$= 12.566\,370\,614... \times 10^{-7}$	N A^{-2}	exact
electric constant $1/\mu_0 c^2$	ϵ_0	$8.854\,187\,817... \times 10^{-12}$	F m^{-1}	exact
characteristic impedance of vacuum $\mu_0 c$	Z_0	$376.730\,313\,461...$	Ω	exact
Newtonian constant of gravitation	G	$6.674\,08(31) \times 10^{-11}$	m^3 kg^{-1} s^{-2}	4.7×10^{-5}
	$G/\hbar c$	$6.708\,61(31) \times 10^{-39}$	$(\mathrm{GeV}/c^2)^{-2}$	4.7×10^{-5}
Planck constant	h	$6.626\,070\,040(81) \times 10^{-34}$	J s	1.2×10^{-8}
		$4.135\,667\,662(25) \times 10^{-15}$	eV s	6.1×10^{-9}
$h/2\pi$	$\hbar$	$1.054\,571\,800(13) \times 10^{-34}$	J s	1.2×10^{-8}
		$6.582\,119\,514(40) \times 10^{-16}$	eV s	6.1×10^{-9}
	$\hbar c$	$197.326\,9788(12)$	MeV fm	6.1×10^{-9}
Planck mass $(\hbar c/G)^{1/2}$	m_P	$2.176\,470(51) \times 10^{-8}$	kg	2.3×10^{-5}
energy equivalent	$m_\mathrm{P} c^2$	$1.220\,910(29) \times 10^{19}$	GeV	2.3×10^{-5}
Planck temperature $(\hbar c^5/G)^{1/2}/k$	T_P	$1.416\,808(33) \times 10^{32}$	K	2.3×10^{-5}
Planck length $\hbar/m_\mathrm{P} c = (\hbar G/c^3)^{1/2}$	l_P	$1.616\,229(38) \times 10^{-35}$	m	2.3×10^{-5}
Planck time $l_\mathrm{P}/c = (\hbar G/c^5)^{1/2}$	t_P	$5.391\,16(13) \times 10^{-44}$	s	2.3×10^{-5}
ELECTROMAGNETIC				
elementary charge	e	$1.602\,176\,6208(98) \times 10^{-19}$	C	6.1×10^{-9}
	e/h	$2.417\,989\,262(15) \times 10^{14}$	A J^{-1}	6.1×10^{-9}
magnetic flux quantum $h/2e$	Φ_0	$2.067\,833\,831(13) \times 10^{-15}$	Wb	6.1×10^{-9}
conductance quantum $2e^2/h$	G_0	$7.748\,091\,7310(18) \times 10^{-5}$	S	2.3×10^{-10}
inverse of conductance quantum	G_0^{-1}	$12\,906.403\,7278(29)$	Ω	2.3×10^{-10}
Josephson constant[1] $2e/h$	K_J	$483\,597.8525(30) \times 10^{9}$	Hz V^{-1}	6.1×10^{-9}
von Klitzing constant[2] $h/e^2 = \mu_0 c/2\alpha$	R_K	$25\,812.807\,4555(59)$	Ω	2.3×10^{-10}
Bohr magneton $e\hbar/2m_\mathrm{e}$	μ_B	$927.400\,9994(57) \times 10^{-26}$	J T^{-1}	6.2×10^{-9}
		$5.788\,381\,8012(26) \times 10^{-5}$	eV T^{-1}	4.5×10^{-10}
	μ_B/h	$13.996\,245\,042(86) \times 10^{9}$	Hz T^{-1}	6.2×10^{-9}
	μ_B/hc	$46.686\,448\,14(29)$	m^{-1} T^{-1}	6.2×10^{-9}
	μ_B/k	$0.671\,714\,05(39)$	K T^{-1}	5.7×10^{-7}
nuclear magneton $e\hbar/2m_\mathrm{p}$	μ_N	$5.050\,783\,699(31) \times 10^{-27}$	J T^{-1}	6.2×10^{-9}
		$3.152\,451\,2550(15) \times 10^{-8}$	eV T^{-1}	4.6×10^{-10}
	μ_N/h	$7.622\,593\,285(47)$	MHz T^{-1}	6.2×10^{-9}
	μ_N/hc	$2.542\,623\,432(16) \times 10^{-2}$	m^{-1} T^{-1}	6.2×10^{-9}
	μ_N/k	$3.658\,2690(21) \times 10^{-4}$	K T^{-1}	5.7×10^{-7}
ATOMIC AND NUCLEAR				
General				
fine-structure constant $e^2/4\pi\epsilon_0\hbar c$	α	$7.297\,352\,5664(17) \times 10^{-3}$		2.3×10^{-10}
inverse fine-structure constant	α^{-1}	$137.035\,999\,139(31)$		2.3×10^{-10}
Rydberg constant $\alpha^2 m_\mathrm{e} c/2h$	R_∞	$10\,973\,731.568\,508(65)$	m^{-1}	5.9×10^{-12}
	$R_\infty c$	$3.289\,841\,960\,355(19) \times 10^{15}$	Hz	5.9×10^{-12}
	$R_\infty hc$	$2.179\,872\,325(27) \times 10^{-18}$	J	1.2×10^{-8}
		$13.605\,693\,009(84)$	eV	6.1×10^{-9}
Bohr radius $\alpha/4\pi R_\infty = 4\pi\epsilon_0\hbar^2/m_\mathrm{e}e^2$	a_0	$0.529\,177\,210\,67(12) \times 10^{-10}$	m	2.3×10^{-10}
Hartree energy $e^2/4\pi\epsilon_0 a_0 = 2R_\infty hc = \alpha^2 m_\mathrm{e} c^2$	E_h	$4.359\,744\,650(54) \times 10^{-18}$	J	1.2×10^{-8}
		$27.211\,386\,02(17)$	eV	6.1×10^{-9}
quantum of circulation	$h/2m_\mathrm{e}$	$3.636\,947\,5486(17) \times 10^{-4}$	m^2 s^{-1}	4.5×10^{-10}
	h/m_e	$7.273\,895\,0972(33) \times 10^{-4}$	m^2 s^{-1}	4.5×10^{-10}
Electroweak				

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[1] See Table IV for the conventional value adopted internationally for realizing representations of the volt using the Josephson effect.

[2] See Table IV for the conventional value adopted internationally for realizing representations of the ohm using the quantum Hall effect.

TABLE II: *(Continued).*

Quantity	Symbol	Numerical value	Unit	Relative std. uncert. $u_{\rm r}$
Fermi coupling constant[3]	$G_{\rm F}/(\hbar c)^3$	$1.166\,3787(6) \times 10^{-5}$	$\rm GeV^{-2}$	5.1×10^{-7}
weak mixing angle[4] $\theta_{\rm W}$ (on-shell scheme) $\sin^2\theta_{\rm W} = s^2_{\rm W} \equiv 1 - (m_{\rm W}/m_{\rm Z})^2$	$\sin^2\theta_{\rm W}$	0.2223(21)		9.5×10^{-3}
		Electron, $\rm e^-$		
electron mass	$m_{\rm e}$	$9.109\,383\,56(11) \times 10^{-31}$	kg	1.2×10^{-8}
		$5.485\,799\,090\,70(16) \times 10^{-4}$	u	2.9×10^{-11}
energy equivalent	$m_{\rm e}c^2$	$8.187\,105\,65(10) \times 10^{-14}$	J	1.2×10^{-8}
		$0.510\,998\,9461(31)$	MeV	6.2×10^{-9}
electron-muon mass ratio	$m_{\rm e}/m_{\mu}$	$4.836\,331\,70(11) \times 10^{-3}$		2.2×10^{-8}
electron-tau mass ratio	$m_{\rm e}/m_{\tau}$	$2.875\,92(26) \times 10^{-4}$		9.0×10^{-5}
electron-proton mass ratio	$m_{\rm e}/m_{\rm p}$	$5.446\,170\,213\,52(52) \times 10^{-4}$		9.5×10^{-11}
electron-neutron mass ratio	$m_{\rm e}/m_{\rm n}$	$5.438\,673\,4428(27) \times 10^{-4}$		4.9×10^{-10}
electron-deuteron mass ratio	$m_{\rm e}/m_{\rm d}$	$2.724\,437\,107\,484(96) \times 10^{-4}$		3.5×10^{-11}
electron-triton mass ratio	$m_{\rm e}/m_{\rm t}$	$1.819\,200\,062\,203(84) \times 10^{-4}$		4.6×10^{-11}
electron-helion mass ratio	$m_{\rm e}/m_{\rm h}$	$1.819\,543\,074\,854(88) \times 10^{-4}$		4.9×10^{-11}
electron to alpha particle mass ratio	$m_{\rm e}/m_{\alpha}$	$1.370\,933\,554\,798(45) \times 10^{-4}$		3.3×10^{-11}
electron charge to mass quotient	$-e/m_{\rm e}$	$-1.758\,820\,024(11) \times 10^{11}$	$\rm C\ kg^{-1}$	6.2×10^{-9}
electron molar mass $N_{\rm A}m_{\rm e}$	$M({\rm e}), M_{\rm e}$	$5.485\,799\,090\,70(16) \times 10^{-7}$	$\rm kg\ mol^{-1}$	2.9×10^{-11}
Compton wavelength $h/m_{\rm e}c$	$\lambda_{\rm C}$	$2.426\,310\,2367(11) \times 10^{-12}$	m	4.5×10^{-10}
$\lambda_{\rm C}/2\pi = \alpha a_0 = \alpha^2/4\pi R_\infty$	$\lambdabar_{\rm C}$	$386.159\,267\,64(18) \times 10^{-15}$	m	4.5×10^{-10}
classical electron radius $\alpha^2 a_0$	$r_{\rm e}$	$2.817\,940\,3227(19) \times 10^{-15}$	m	6.8×10^{-10}
Thomson cross section $(8\pi/3)r^2_{\rm e}$	$\sigma_{\rm e}$	$0.665\,245\,871\,58(91) \times 10^{-28}$	$\rm m^2$	1.4×10^{-9}
electron magnetic moment	$\mu_{\rm e}$	$-928.476\,4620(57) \times 10^{-26}$	$\rm J\ T^{-1}$	6.2×10^{-9}
to Bohr magneton ratio	$\mu_{\rm e}/\mu_{\rm B}$	$-1.001\,159\,652\,180\,91(26)$		2.6×10^{-13}
to nuclear magneton ratio	$\mu_{\rm e}/\mu_{\rm N}$	$-1838.281\,972\,34(17)$		9.5×10^{-11}
electron magnetic moment anomaly $\lvert\mu_{\rm e}\rvert/\mu_{\rm B} - 1$	$a_{\rm e}$	$1.159\,652\,180\,91(26) \times 10^{-3}$		2.3×10^{-10}
electron g-factor $-2(1 + a_{\rm e})$	$g_{\rm e}$	$-2.002\,319\,304\,361\,82(52)$		2.6×10^{-13}
electron-muon magnetic moment ratio	$\mu_{\rm e}/\mu_{\mu}$	$206.766\,9880(46)$		2.2×10^{-8}
electron-proton magnetic moment ratio	$\mu_{\rm e}/\mu_{\rm p}$	$-658.210\,6866(20)$		3.0×10^{-9}
electron to shielded proton magnetic moment ratio ($\rm H_2O$, sphere, 25 °C)	$\mu_{\rm e}/\mu'_{\rm p}$	$-658.227\,5971(72)$		1.1×10^{-8}
electron-neutron magnetic moment ratio	$\mu_{\rm e}/\mu_{\rm n}$	$960.920\,50(23)$		2.4×10^{-7}
electron-deuteron magnetic moment ratio	$\mu_{\rm e}/\mu_{\rm d}$	$-2143.923\,499(12)$		5.5×10^{-9}
electron to shielded helion magnetic moment ratio (gas, sphere, 25 °C)	$\mu_{\rm e}/\mu'_{\rm h}$	$864.058\,257(10)$		1.2×10^{-8}
electron gyromagnetic ratio $2\lvert\mu_{\rm e}\rvert/\hbar$	$\gamma_{\rm e}$	$1.760\,859\,644(11) \times 10^{11}$	$\rm s^{-1}\ T^{-1}$	6.2×10^{-9}
	$\gamma_{\rm e}/2\pi$	$28\,024.951\,64(17)$	$\rm MHz\ T^{-1}$	6.2×10^{-9}
		Muon, μ^-		
muon mass	m_{μ}	$1.883\,531\,594(48) \times 10^{-28}$	kg	2.5×10^{-8}
		$0.113\,428\,9257(25)$	u	2.2×10^{-8}
energy equivalent	$m_{\mu}c^2$	$1.692\,833\,774(43) \times 10^{-11}$	J	2.5×10^{-8}
		$105.658\,3745(24)$	MeV	2.3×10^{-8}
muon-electron mass ratio	$m_{\mu}/m_{\rm e}$	$206.768\,2826(46)$		2.2×10^{-8}
muon-tau mass ratio	m_{μ}/m_{τ}	$5.946\,49(54) \times 10^{-2}$		9.0×10^{-5}
muon-proton mass ratio	$m_{\mu}/m_{\rm p}$	$0.112\,609\,5262(25)$		2.2×10^{-8}
muon-neutron mass ratio	$m_{\mu}/m_{\rm n}$	$0.112\,454\,5167(25)$		2.2×10^{-8}
muon molar mass $N_{\rm A}m_{\mu}$	$M(\mu), M_{\mu}$	$0.113\,428\,9257(25) \times 10^{-3}$	$\rm kg\ mol^{-1}$	2.2×10^{-8}
muon Compton wavelength $h/m_{\mu}c$	$\lambda_{\rm C,\mu}$	$11.734\,441\,11(26) \times 10^{-15}$	m	2.2×10^{-8}
$\lambda_{\rm C,\mu}/2\pi$	$\lambdabar_{\rm C,\mu}$	$1.867\,594\,308(42) \times 10^{-15}$	m	2.2×10^{-8}

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[3] Value recommended by the Particle Data Group (Olive *et al.*, 2014).

[4] Based on the ratio of the masses of the W and Z bosons $m_{\rm W}/m_{\rm Z}$ recommended by the Particle Data Group (Olive *et al.*, 2014). The value for $\sin^2\theta_{\rm W}$ they recommend, which is based on a particular variant of the modified minimal subtraction ($\overline{\rm MS}$) scheme, is $\sin^2\hat{\theta}_{\rm W}(M_{\rm Z}) = 0.231\,26(5)$.

TABLE II: *(Continued).*

Quantity	Symbol	Numerical value	Unit	Relative std. uncert. $u_{\rm r}$
muon magnetic moment	μ_μ	$-4.490\,448\,26(10) \times 10^{-26}$	J T^{-1}	2.3×10^{-8}
to Bohr magneton ratio	$\mu_\mu/\mu_{\rm B}$	$-4.841\,970\,48(11) \times 10^{-3}$		2.2×10^{-8}
to nuclear magneton ratio	$\mu_\mu/\mu_{\rm N}$	$-8.890\,597\,05(20)$		2.2×10^{-8}
muon magnetic moment anomaly				
$\lvert\mu_\mu\rvert/(e\hbar/2m_\mu) - 1$	a_μ	$1.165\,920\,89(63) \times 10^{-3}$		5.4×10^{-7}
muon g-factor $-2(1 + a_\mu)$	g_μ	$-2.002\,331\,8418(13)$		6.3×10^{-10}
muon-proton magnetic moment ratio	$\mu_\mu/\mu_{\rm p}$	$-3.183\,345\,142(71)$		2.2×10^{-8}
Tau, τ^-				
tau mass[5]	m_τ	$3.167\,47(29) \times 10^{-27}$	kg	9.0×10^{-5}
		$1.907\,49(17)$	u	9.0×10^{-5}
energy equivalent	$m_\tau c^2$	$2.846\,78(26) \times 10^{-10}$	J	9.0×10^{-5}
		$1776.82(16)$	MeV	9.0×10^{-5}
tau-electron mass ratio	$m_\tau/m_{\rm e}$	$3477.15(31)$		9.0×10^{-5}
tau-muon mass ratio	m_τ/m_μ	$16.8167(15)$		9.0×10^{-5}
tau-proton mass ratio	$m_\tau/m_{\rm p}$	$1.893\,72(17)$		9.0×10^{-5}
tau-neutron mass ratio	$m_\tau/m_{\rm n}$	$1.891\,11(17)$		9.0×10^{-5}
tau molar mass $N_{\rm A}m_\tau$	$M(\tau), M_\tau$	$1.907\,49(17) \times 10^{-3}$	kg mol^{-1}	9.0×10^{-5}
tau Compton wavelength $h/m_\tau c$	$\lambda_{{\rm C},\tau}$	$0.697\,787(63) \times 10^{-15}$	m	9.0×10^{-5}
$\lambda_{{\rm C},\tau}/2\pi$	$\lambda\!\!\!^{-}_{{\rm C},\tau}$	$0.111\,056(10) \times 10^{-15}$	m	9.0×10^{-5}
Proton, p				
proton mass	$m_{\rm p}$	$1.672\,621\,898(21) \times 10^{-27}$	kg	1.2×10^{-8}
		$1.007\,276\,466\,879(91)$	u	9.0×10^{-11}
energy equivalent	$m_{\rm p}c^2$	$1.503\,277\,593(18) \times 10^{-10}$	J	1.2×10^{-8}
		$938.272\,0813(58)$	MeV	6.2×10^{-9}
proton-electron mass ratio	$m_{\rm p}/m_{\rm e}$	$1836.152\,673\,89(17)$		9.5×10^{-11}
proton-muon mass ratio	$m_{\rm p}/m_\mu$	$8.880\,243\,38(20)$		2.2×10^{-8}
proton-tau mass ratio	$m_{\rm p}/m_\tau$	$0.528\,063(48)$		9.0×10^{-5}
proton-neutron mass ratio	$m_{\rm p}/m_{\rm n}$	$0.998\,623\,478\,44(51)$		5.1×10^{-10}
proton charge to mass quotient	$e/m_{\rm p}$	$9.578\,833\,226(59) \times 10^{7}$	C kg^{-1}	6.2×10^{-9}
proton molar mass $N_{\rm A}m_{\rm p}$	$M({\rm p})$, $M_{\rm p}$	$1.007\,276\,466\,879(91) \times 10^{-3}$	kg mol^{-1}	9.0×10^{-11}
proton Compton wavelength $h/m_{\rm p}c$	$\lambda_{\rm C,p}$	$1.321\,409\,853\,96(61) \times 10^{-15}$	m	4.6×10^{-10}
$\lambda_{\rm C,p}/2\pi$	$\lambda\!\!\!^{-}_{\rm C,p}$	$0.210\,308\,910\,109(97) \times 10^{-15}$	m	4.6×10^{-10}
proton rms charge radius	$r_{\rm p}$	$0.8751(61) \times 10^{-15}$	m	7.0×10^{-3}
proton magnetic moment	$\mu_{\rm p}$	$1.410\,606\,7873(97) \times 10^{-26}$	J T^{-1}	6.9×10^{-9}
to Bohr magneton ratio	$\mu_{\rm p}/\mu_{\rm B}$	$1.521\,032\,2053(46) \times 10^{-3}$		3.0×10^{-9}
to nuclear magneton ratio	$\mu_{\rm p}/\mu_{\rm N}$	$2.792\,847\,3508(85)$		3.0×10^{-9}
proton g-factor $2\mu_{\rm p}/\mu_{\rm N}$	$g_{\rm p}$	$5.585\,694\,702(17)$		3.0×10^{-9}
proton-neutron magnetic moment ratio	$\mu_{\rm p}/\mu_{\rm n}$	$-1.459\,898\,05(34)$		2.4×10^{-7}
shielded proton magnetic moment (H_2O, sphere, 25 °C)	$\mu'_{\rm p}$	$1.410\,570\,547(18) \times 10^{-26}$	J T^{-1}	1.3×10^{-8}
to Bohr magneton ratio	$\mu'_{\rm p}/\mu_{\rm B}$	$1.520\,993\,128(17) \times 10^{-3}$		1.1×10^{-8}
to nuclear magneton ratio	$\mu'_{\rm p}/\mu_{\rm N}$	$2.792\,775\,600(30)$		1.1×10^{-8}
proton magnetic shielding correction				
$1 - \mu'_{\rm p}/\mu_{\rm p}$ (H_2O, sphere, 25 °C)	$\sigma'_{\rm p}$	$25.691(11) \times 10^{-6}$		4.4×10^{-4}
proton gyromagnetic ratio $2\mu_{\rm p}/\hbar$	$\gamma_{\rm p}$	$2.675\,221\,900(18) \times 10^{8}$	s^{-1} T^{-1}	6.9×10^{-9}
	$\gamma_{\rm p}/2\pi$	$42.577\,478\,92(29)$	MHz T^{-1}	6.9×10^{-9}
shielded proton gyromagnetic ratio				
$2\mu'_{\rm p}/\hbar$ (H_2O, sphere, 25 °C)	$\gamma'_{\rm p}$	$2.675\,153\,171(33) \times 10^{8}$	s^{-1} T^{-1}	1.3×10^{-8}
	$\gamma'_{\rm p}/2\pi$	$42.576\,385\,07(53)$	MHz T^{-1}	1.3×10^{-8}
Neutron, n				
neutron mass	$m_{\rm n}$	$1.674\,927\,471(21) \times 10^{-27}$	kg	1.2×10^{-8}
		$1.008\,664\,915\,88(49)$	u	4.9×10^{-10}

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[5] This and all other values involving m_τ are based on the value of $m_\tau c^2$ in MeV recommended by the Particle Data Group (Olive *et al.*, 2014).

TABLE II: *(Continued).*

Quantity	Symbol	Numerical value	Unit	Relative std. uncert. u_r
energy equivalent	$m_n c^2$	$1.505\,349\,739(19) \times 10^{-10}$	J	1.2×10^{-8}
		$939.565\,4133(58)$	MeV	6.2×10^{-9}
neutron-electron mass ratio	m_n/m_e	$1838.683\,661\,58(90)$		4.9×10^{-10}
neutron-muon mass ratio	m_n/m_μ	$8.892\,484\,08(20)$		2.2×10^{-8}
neutron-tau mass ratio	m_n/m_τ	$0.528\,790(48)$		9.0×10^{-5}
neutron-proton mass ratio	m_n/m_p	$1.001\,378\,418\,98(51)$		5.1×10^{-10}
neutron-proton mass difference	$m_n - m_p$	$2.305\,573\,77(85) \times 10^{-30}$	kg	3.7×10^{-7}
		$0.001\,388\,449\,00(51)$	u	3.7×10^{-7}
energy equivalent	$(m_n - m_p)c^2$	$2.072\,146\,37(76) \times 10^{-13}$	J	3.7×10^{-7}
		$1.293\,332\,05(48)$	MeV	3.7×10^{-7}
neutron molar mass $N_A m_n$	$M(n), M_n$	$1.008\,664\,915\,88(49) \times 10^{-3}$	kg mol^{-1}	4.9×10^{-10}
neutron Compton wavelength $h/m_n c$	$\lambda_{C,n}$	$1.319\,590\,904\,81(88) \times 10^{-15}$	m	6.7×10^{-10}
$\lambda_{C,n}/2\pi$	$\bar{\lambda}_{C,n}$	$0.210\,019\,415\,36(14) \times 10^{-15}$	m	6.7×10^{-10}
neutron magnetic moment	μ_n	$-0.966\,236\,50(23) \times 10^{-26}$	J T^{-1}	2.4×10^{-7}
to Bohr magneton ratio	μ_n/μ_B	$-1.041\,875\,63(25) \times 10^{-3}$		2.4×10^{-7}
to nuclear magneton ratio	μ_n/μ_N	$-1.913\,042\,73(45)$		2.4×10^{-7}
neutron g-factor $2\mu_n/\mu_N$	g_n	$-3.826\,085\,45(90)$		2.4×10^{-7}
neutron-electron magnetic moment ratio	μ_n/μ_e	$1.040\,668\,82(25) \times 10^{-3}$		2.4×10^{-7}
neutron-proton magnetic moment ratio	μ_n/μ_p	$-0.684\,979\,34(16)$		2.4×10^{-7}
neutron to shielded proton magnetic moment ratio (H_2O, sphere, 25 °C)	μ_n/μ'_p	$-0.684\,996\,94(16)$		2.4×10^{-7}
neutron gyromagnetic ratio $2\lvert\mu_n\rvert/\hbar$	γ_n	$1.832\,471\,72(43) \times 10^{8}$	s^{-1} T^{-1}	2.4×10^{-7}
	$\gamma_n/2\pi$	$29.164\,6933(69)$	MHz T^{-1}	2.4×10^{-7}
Deuteron, d				
deuteron mass	m_d	$3.343\,583\,719(41) \times 10^{-27}$	kg	1.2×10^{-8}
		$2.013\,553\,212\,745(40)$	u	2.0×10^{-11}
energy equivalent	$m_d c^2$	$3.005\,063\,183(37) \times 10^{-10}$	J	1.2×10^{-8}
		$1875.612\,928(12)$	MeV	6.2×10^{-9}
deuteron-electron mass ratio	m_d/m_e	$3670.482\,967\,85(13)$		3.5×10^{-11}
deuteron-proton mass ratio	m_d/m_p	$1.999\,007\,500\,87(19)$		9.3×10^{-11}
deuteron molar mass $N_A m_d$	$M(d), M_d$	$2.013\,553\,212\,745(40) \times 10^{-3}$	kg mol^{-1}	2.0×10^{-11}
deuteron rms charge radius	r_d	$2.1413(25) \times 10^{-15}$	m	1.2×10^{-3}
deuteron magnetic moment	μ_d	$0.433\,073\,5040(36) \times 10^{-26}$	J T^{-1}	8.3×10^{-9}
to Bohr magneton ratio	μ_d/μ_B	$0.466\,975\,4554(26) \times 10^{-3}$		5.5×10^{-9}
to nuclear magneton ratio	μ_d/μ_N	$0.857\,438\,2311(48)$		5.5×10^{-9}
deuteron g-factor μ_d/μ_N	g_d	$0.857\,438\,2311(48)$		5.5×10^{-9}
deuteron-electron magnetic moment ratio	μ_d/μ_e	$-4.664\,345\,535(26) \times 10^{-4}$		5.5×10^{-9}
deuteron-proton magnetic moment ratio	μ_d/μ_p	$0.307\,012\,2077(15)$		5.0×10^{-9}
deuteron-neutron magnetic moment ratio	μ_d/μ_n	$-0.448\,206\,52(11)$		2.4×10^{-7}
Triton, t				
triton mass	m_t	$5.007\,356\,665(62) \times 10^{-27}$	kg	1.2×10^{-8}
		$3.015\,500\,716\,32(11)$	u	3.6×10^{-11}
energy equivalent	$m_t c^2$	$4.500\,387\,735(55) \times 10^{-10}$	J	1.2×10^{-8}
		$2808.921\,112(17)$	MeV	6.2×10^{-9}
triton-electron mass ratio	m_t/m_e	$5496.921\,535\,88(26)$		4.6×10^{-11}
triton-proton mass ratio	m_t/m_p	$2.993\,717\,033\,48(22)$		7.5×10^{-11}
triton molar mass $N_A m_t$	$M(t), M_t$	$3.015\,500\,716\,32(11) \times 10^{-3}$	kg mol^{-1}	3.6×10^{-11}
triton magnetic moment	μ_t	$1.504\,609\,503(12) \times 10^{-26}$	J T^{-1}	7.8×10^{-9}
to Bohr magneton ratio	μ_t/μ_B	$1.622\,393\,6616(76) \times 10^{-3}$		4.7×10^{-9}
to nuclear magneton ratio	μ_t/μ_N	$2.978\,962\,460(14)$		4.7×10^{-9}
triton g-factor $2\mu_t/\mu_N$	g_t	$5.957\,924\,920(28)$		4.7×10^{-9}
Helion, h				
helion mass	m_h	$5.006\,412\,700(62) \times 10^{-27}$	kg	1.2×10^{-8}
		$3.014\,932\,246\,73(12)$	u	3.9×10^{-11}
energy equivalent	$m_h c^2$	$4.499\,539\,341(55) \times 10^{-10}$	J	1.2×10^{-8}
		$2808.391\,586(17)$	MeV	6.2×10^{-9}
helion-electron mass ratio	m_h/m_e	$5495.885\,279\,22(27)$		4.9×10^{-11}

TABLE II: *(Continued).*

Quantity	Symbol	Numerical value	Unit	Relative std. uncert. u_r
helion-proton mass ratio	m_h/m_p	$2.993\,152\,670\,46(29)$		9.6×10^{-11}
helion molar mass $N_A m_h$	$M(h), M_h$	$3.014\,932\,246\,73(12) \times 10^{-3}$	kg mol^{-1}	3.9×10^{-11}
helion magnetic moment	μ_h	$-1.074\,617\,522(14) \times 10^{-26}$	J T^{-1}	1.3×10^{-8}
to Bohr magneton ratio	μ_h/μ_B	$-1.158\,740\,958(14) \times 10^{-3}$		1.2×10^{-8}
to nuclear magneton ratio	μ_h/μ_N	$-2.127\,625\,308(25)$		1.2×10^{-8}
helion g-factor $2\mu_h/\mu_N$	g_h	$-4.255\,250\,616(50)$		1.2×10^{-8}
shielded helion magnetic moment (gas, sphere, 25 °C)	μ'_h	$-1.074\,553\,080(14) \times 10^{-26}$	J T^{-1}	1.3×10^{-8}
to Bohr magneton ratio	μ'_h/μ_B	$-1.158\,671\,471(14) \times 10^{-3}$		1.2×10^{-8}
to nuclear magneton ratio	μ'_h/μ_N	$-2.127\,497\,720(25)$		1.2×10^{-8}
shielded helion to proton magnetic moment ratio (gas, sphere, 25 °C)	μ'_h/μ_p	$-0.761\,766\,5603(92)$		1.2×10^{-8}
shielded helion to shielded proton magnetic moment ratio (gas/H_2O, spheres, 25 °C)	μ'_h/μ'_p	$-0.761\,786\,1313(33)$		4.3×10^{-9}
shielded helion gyromagnetic ratio $2\lvert\mu'_h\rvert/\hbar$ (gas, sphere, 25 °C)	γ'_h	$2.037\,894\,585(27) \times 10^{8}$	s^{-1} T^{-1}	1.3×10^{-8}
	$\gamma'_h/2\pi$	$32.434\,099\,66(43)$	MHz T^{-1}	1.3×10^{-8}
Alpha particle, α				
alpha particle mass	m_α	$6.644\,657\,230(82) \times 10^{-27}$	kg	1.2×10^{-8}
		$4.001\,506\,179\,127(63)$	u	1.6×10^{-11}
energy equivalent	$m_\alpha c^2$	$5.971\,920\,097(73) \times 10^{-10}$	J	1.2×10^{-8}
		$3727.379\,378(23)$	MeV	6.2×10^{-9}
alpha particle to electron mass ratio	m_α/m_e	$7294.299\,541\,36(24)$		3.3×10^{-11}
alpha particle to proton mass ratio	m_α/m_p	$3.972\,599\,689\,07(36)$		9.2×10^{-11}
alpha particle molar mass $N_A m_\alpha$	$M(\alpha), M_\alpha$	$4.001\,506\,179\,127(63) \times 10^{-3}$	kg mol^{-1}	1.6×10^{-11}
PHYSICOCHEMICAL				
Avogadro constant	N_A, L	$6.022\,140\,857(74) \times 10^{23}$	mol^{-1}	1.2×10^{-8}
atomic mass constant $m_u = \frac{1}{12}m(^{12}C) = 1$ u	m_u	$1.660\,539\,040(20) \times 10^{-27}$	kg	1.2×10^{-8}
energy equivalent	$m_u c^2$	$1.492\,418\,062(18) \times 10^{-10}$	J	1.2×10^{-8}
		$931.494\,0954(57)$	MeV	6.2×10^{-9}
Faraday constant[6] $N_A e$	F	$96\,485.332\,89(59)$	C mol^{-1}	6.2×10^{-9}
molar Planck constant	$N_A h$	$3.990\,312\,7110(18) \times 10^{-10}$	J s mol^{-1}	4.5×10^{-10}
	$N_A hc$	$0.119\,626\,565\,582(54)$	J m mol^{-1}	4.5×10^{-10}
molar gas constant	R	$8.314\,4598(48)$	J mol^{-1} K^{-1}	5.7×10^{-7}
Boltzmann constant R/N_A	k	$1.380\,648\,52(79) \times 10^{-23}$	J K^{-1}	5.7×10^{-7}
		$8.617\,3303(50) \times 10^{-5}$	eV K^{-1}	5.7×10^{-7}
	k/h	$2.083\,6612(12) \times 10^{10}$	Hz K^{-1}	5.7×10^{-7}
	k/hc	$69.503\,457(40)$	m^{-1} K^{-1}	5.7×10^{-7}
molar volume of ideal gas RT/p $T = 273.15$ K, $p = 100$ kPa	V_m	$22.710\,947(13) \times 10^{-3}$	m^3 mol^{-1}	5.7×10^{-7}
Loschmidt constant N_A/V_m	n_0	$2.651\,6467(15) \times 10^{25}$	m^{-3}	5.7×10^{-7}
molar volume of ideal gas RT/p $T = 273.15$ K, $p = 101.325$ kPa	V_m	$22.413\,962(13) \times 10^{-3}$	m^3 mol^{-1}	5.7×10^{-7}
Loschmidt constant N_A/V_m	n_0	$2.686\,7811(15) \times 10^{25}$	m^{-3}	5.7×10^{-7}
Sackur-Tetrode (absolute entropy) constant[7] $\frac{5}{2} + \ln[(2\pi m_u k T_1/h^2)^{3/2} k T_1/p_0]$				
$T_1 = 1$ K, $p_0 = 100$ kPa	S_0/R	$-1.151\,7084(14)$		1.2×10^{-6}
$T_1 = 1$ K, $p_0 = 101.325$ kPa		$-1.164\,8714(14)$		1.2×10^{-6}
Stefan-Boltzmann constant				

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[6] The numerical value of F to be used in coulometric chemical measurements is 96 485.3251(12) [1.2×10^{-8}] when the relevant current is measured in terms of representations of the volt and ohm based on the Josephson and quantum Hall effects and the internationally adopted conventional values of the Josephson and von Klitzing constants K_{J-90} and R_{K-90} given in Table IV.

[7] The entropy of an ideal monoatomic gas of relative atomic mass A_r is given by $S = S_0 + \frac{3}{2}R \ln A_r - R \ln(p/p_0) + \frac{5}{2}R \ln(T/\mathrm{K})$.

TABLE II: *(Continued).*

Quantity	Symbol	Numerical value	Unit	Relative std. uncert. u_r
$(\pi^2/60)k^4/\hbar^3c^2$	σ	$5.670\,367(13) \times 10^{-8}$	W m^{-2} K^{-4}	2.3×10^{-6}
first radiation constant $2\pi hc^2$	c_1	$3.741\,771\,790(46) \times 10^{-16}$	W m^2	1.2×10^{-8}
first radiation constant for spectral radiance $2hc^2$	$c_{1\mathrm{L}}$	$1.191\,042\,953(15) \times 10^{-16}$	W m^2 sr^{-1}	1.2×10^{-8}
second radiation constant hc/k	c_2	$1.438\,777\,36(83) \times 10^{-2}$	m K	5.7×10^{-7}
Wien displacement law constants				
$b = \lambda_\mathrm{max}T = c_2/4.965\,114\,231...$	b	$2.897\,7729(17) \times 10^{-3}$	m K	5.7×10^{-7}
$b' = \nu_\mathrm{max}/T = 2.821\,439\,372...\, c/c_2$	b'	$5.878\,9238(34) \times 10^{10}$	Hz K^{-1}	5.7×10^{-7}

References

Olive, K. A., *et al.*, and Particle Data Center, 2014, Chin. Phys. C **38**, 090001.

TABLE III The variances, covariances, and correlation coefficients of the values of a selected group of constants based on the 2014 CODATA adjustment. The numbers in bold above the main diagonal are 10^{16} times the numerical values of the relative covariances; the numbers in bold on the main diagonal are 10^{16} times the numerical values of the relative variances; and the numbers in italics below the main diagonal are the correlation coefficients.[1]

	α	h	e	m_e	N_A	m_e/m_μ	F
α	**0.0005**	**0.0005**	**0.0005**	**−0.0005**	**0.0005**	**−0.0010**	**0.0010**
h	*0.0176*	**1.5096**	**0.7550**	**1.5086**	**−1.5086**	**−0.0010**	**−0.7536**
e	*0.0361*	*0.9998*	**0.3778**	**0.7540**	**−0.7540**	**−0.0010**	**−0.3763**
m_e	*−0.0193*	*0.9993*	*0.9985*	**1.5097**	**−1.5097**	**0.0011**	**−0.7556**
N_A	*0.0193*	*−0.9993*	*−0.9985*	*−1.0000*	**1.5097**	**−0.0011**	**0.7557**
m_e/m_μ	*−0.0202*	*−0.0004*	*−0.0007*	*0.0004*	*−0.0004*	**4.9471**	**−0.0021**
F	*0.0745*	*−0.9957*	*−0.9939*	*−0.9985*	*0.9985*	*−0.0015*	**0.3794**

[1] The relative covariance is $u_r(x_i, x_j) = u(x_i, x_j)/(x_i x_j)$, where $u(x_i, x_j)$ is the covariance of x_i and x_j; the relative variance is $u_r^2(x_i) = u_r(x_i, x_i)$: and the correlation coefficient is $r(x_i, x_j) = u(x_i, x_j)/[u(x_i)u(x_j)]$.

TABLE IV Internationally adopted values of various quantities.

Quantity	Symbol	Numerical value	Unit	Relative std. uncert. u_r
relative atomic mass[1] of ^{12}C	$A_r(^{12}\mathrm{C})$	12		exact
molar mass constant	M_u	1×10^{-3}	kg mol^{-1}	exact
molar mass of ^{12}C	$M(^{12}\mathrm{C})$	12×10^{-3}	kg mol^{-1}	exact
conventional value of Josephson constant[2]	K_{J-90}	483 597.9	GHz V^{-1}	exact
conventional value of von Klitzing constant[3]	R_{K-90}	25 812.807	Ω	exact
standard-state pressure		100	kPa	exact
standard atmosphere		101.325	kPa	exact

[1] The relative atomic mass $A_r(X)$ of particle X with mass $m(X)$ is defined by $A_r(X) = m(X)/m_u$, where $m_u = m(^{12}\mathrm{C})/12 = M_u/N_A = 1$ u is the atomic mass constant, M_u is the molar mass constant, N_A is the Avogadro constant, and u is the unified atomic mass unit. Thus the mass of particle X is $m(X) = A_r(X)$ u and the molar mass of X is $M(X) = A_r(X)M_u$.

[2] This is the value adopted internationally for realizing representations of the volt using the Josephson effect.

[3] This is the value adopted internationally for realizing representations of the ohm using the quantum Hall effect.

TABLE V Values of some x-ray-related quantities based on the 2014 CODATA adjustment of the values of the constants.

Quantity	Symbol	Numerical value	Unit	Relative std. uncert. u_r
Cu x unit: $\lambda(\mathrm{CuK}\alpha_1)/1\,537.400$	$\mathrm{xu}(\mathrm{CuK}\alpha_1)$	$1.002\,076\,97(28) \times 10^{-13}$	m	2.8×10^{-7}
Mo x unit: $\lambda(\mathrm{MoK}\alpha_1)/707.831$	$\mathrm{xu}(\mathrm{MoK}\alpha_1)$	$1.002\,099\,52(53) \times 10^{-13}$	m	5.3×10^{-7}
ångstrom star: $\lambda(\mathrm{WK}\alpha_1)/0.209\,010\,0$	Å*	$1.000\,014\,95(90) \times 10^{-10}$	m	9.0×10^{-7}
lattice parameter[1] of Si (in vacuum, 22.5 °C)	a	$543.102\,0504(89) \times 10^{-12}$	m	1.6×10^{-8}
{220} lattice spacing of Si $a/\sqrt{8}$ (in vacuum, 22.5 °C)	d_{220}	$192.015\,5714(32) \times 10^{-12}$	m	1.6×10^{-8}
molar volume of Si $M(\mathrm{Si})/\rho(\mathrm{Si}) = N_A a^3/8$ (in vacuum, 22.5 °C)	$V_m(\mathrm{Si})$	$12.058\,832\,14(61) \times 10^{-6}$	m^3 mol^{-1}	5.1×10^{-8}

[1] This is the lattice parameter (unit cell edge length) of an ideal single crystal of naturally occurring Si free of impurities and imperfections, and is deduced from measurements on extremely pure and nearly perfect single crystals of Si by correcting for the effects of impurities.

TABLE VI The values in SI units of some non-SI units based on the 2014 CODATA adjustment of the values of the constants.

Quantity	Symbol	Numerical value	Unit	Relative std. uncert. u_{r}
Non-SI units accepted for use with the SI				
electron volt: (e/C) J	eV	1.602 176 6208(98) $\times 10^{-19}$	J	6.1×10^{-9}
(unified) atomic mass unit: $\frac{1}{12}m(^{12}\mathrm{C})$	u	1.660 539 040(20) $\times 10^{-27}$	kg	1.2×10^{-8}
Natural units (n.u.)				
n.u. of velocity	c, c_0	299 792 458	m s^{-1}	exact
n.u. of action: $h/2\pi$	$\hbar$	1.054 571 800(13) $\times 10^{-34}$	J s	1.2×10^{-8}
		6.582 119 514(40) $\times 10^{-16}$	eV s	6.1×10^{-9}
	$\hbar c$	197.326 9788(12)	MeV fm	6.1×10^{-9}
n.u. of mass	m_{e}	9.109 383 56(11) $\times 10^{-31}$	kg	1.2×10^{-8}
n.u. of energy	$m_{\mathrm{e}}c^2$	8.187 105 65(10) $\times 10^{-14}$	J	1.2×10^{-8}
		0.510 998 9461(31)	MeV	6.2×10^{-9}
n.u. of momentum	$m_{\mathrm{e}}c$	2.730 924 488(34) $\times 10^{-22}$	kg m s^{-1}	1.2×10^{-8}
		0.510 998 9461(31)	MeV/c	6.2×10^{-9}
n.u. of length: $\hbar/m_{\mathrm{e}}c$	$\lambda\!\!\!^{-}_{\mathrm{C}}$	386.159 267 64(18) $\times 10^{-15}$	m	4.5×10^{-10}
n.u. of time	$\hbar/m_{\mathrm{e}}c^2$	1.288 088 667 12(58) $\times 10^{-21}$	s	4.5×10^{-10}
Atomic units (a.u.)				
a.u. of charge	e	1.602 176 6208(98) $\times 10^{-19}$	C	6.1×10^{-9}
a.u. of mass	m_{e}	9.109 383 56(11) $\times 10^{-31}$	kg	1.2×10^{-8}
a.u. of action: $h/2\pi$	$\hbar$	1.054 571 800(13) $\times 10^{-34}$	J s	1.2×10^{-8}
a.u. of length: Bohr radius (bohr) $\alpha/4\pi R_\infty$	a_0	0.529 177 210 67(12) $\times 10^{-10}$	m	2.3×10^{-10}
a.u. of energy: Hartree energy (hartree) $e^2/4\pi\epsilon_0 a_0 = 2R_\infty hc = \alpha^2 m_{\mathrm{e}}c^2$	E_{h}	4.359 744 650(54) $\times 10^{-18}$	J	1.2×10^{-8}
a.u. of time	$\hbar/E_{\mathrm{h}}$	2.418 884 326 509(14) $\times 10^{-17}$	s	5.9×10^{-12}
a.u. of force	E_{h}/a_0	8.238 723 36(10) $\times 10^{-8}$	N	1.2×10^{-8}
a.u. of velocity: αc	$a_0 E_{\mathrm{h}}/\hbar$	2.187 691 262 77(50) $\times 10^{6}$	m s^{-1}	2.3×10^{-10}
a.u. of momentum	$\hbar/a_0$	1.992 851 882(24) $\times 10^{-24}$	kg m s^{-1}	1.2×10^{-8}
a.u. of current	$eE_{\mathrm{h}}/\hbar$	6.623 618 183(41) $\times 10^{-3}$	A	6.1×10^{-9}
a.u. of charge density	e/a_0^3	1.081 202 3770(67) $\times 10^{12}$	C m^{-3}	6.2×10^{-9}
a.u. of electric potential	E_{h}/e	27.211 386 02(17)	V	6.1×10^{-9}
a.u. of electric field	E_{h}/ea_0	5.142 206 707(32) $\times 10^{11}$	V m^{-1}	6.1×10^{-9}
a.u. of electric field gradient	E_{h}/ea_0^2	9.717 362 356(60) $\times 10^{21}$	V m^{-2}	6.2×10^{-9}
a.u. of electric dipole moment	ea_0	8.478 353 552(52) $\times 10^{-30}$	C m	6.2×10^{-9}
a.u. of electric quadrupole moment	ea_0^2	4.486 551 484(28) $\times 10^{-40}$	C m^2	6.2×10^{-9}
a.u. of electric polarizability	$e^2a_0^2/E_{\mathrm{h}}$	1.648 777 2731(11) $\times 10^{-41}$	C^2 m^2 J^{-1}	6.8×10^{-10}
a.u. of 1st hyperpolarizability	$e^3a_0^3/E_{\mathrm{h}}^2$	3.206 361 329(20) $\times 10^{-53}$	C^3 m^3 J^{-2}	6.2×10^{-9}
a.u. of 2nd hyperpolarizability	$e^4a_0^4/E_{\mathrm{h}}^3$	6.235 380 085(77) $\times 10^{-65}$	C^4 m^4 J^{-3}	1.2×10^{-8}
a.u. of magnetic flux density	$\hbar/ea_0^2$	2.350 517 550(14) $\times 10^{5}$	T	6.2×10^{-9}
a.u. of magnetic dipole moment: $2\mu_{\mathrm{B}}$	$\hbar e/m_{\mathrm{e}}$	1.854 801 999(11) $\times 10^{-23}$	J T^{-1}	6.2×10^{-9}
a.u. of magnetizability	$e^2a_0^2/m_{\mathrm{e}}$	7.891 036 5886(90) $\times 10^{-29}$	J T^{-2}	1.1×10^{-9}
a.u. of permittivity: $10^7/c^2$	e^2/a_0E_{h}	1.112 650 056 ... $\times 10^{-10}$	F m^{-1}	exact

TABLE VII The values of some energy equivalents derived from the relations $E = mc^2 = hc/\lambda = h\nu = kT$, and based on the 2010 CODATA adjustment of the values of the constants; 1 eV = (e/C) J, 1 u = $m_\mathrm{u} = \frac{1}{12}m(^{12}\mathrm{C}) = 10^{-3}$ kg mol$^{-1}/N_\mathrm{A}$, and $E_\mathrm{h} = 2R_\infty hc = \alpha^2 m_\mathrm{e}c^2$ is the Hartree energy (hartree).

	Relevant unit			
	J	kg	m^{-1}	Hz
1 J	(1 J) = 1 J	(1 J)/c^2 = $1.112\,650\,056\ldots \times 10^{-17}$ kg	(1 J)/hc = $5.034\,116\,651(62) \times 10^{24}$ m^{-1}	(1 J)/h = $1.509\,190\,205(19) \times 10^{33}$ Hz
1 kg	(1 kg)c^2 = $8.987\,551\,787\ldots \times 10^{16}$ J	(1 kg) = 1 kg	(1 kg)c/h = $4.524\,438\,411(56) \times 10^{41}$ m^{-1}	(1 kg)c^2/h = $1.356\,392\,512(17) \times 10^{50}$ Hz
1 m^{-1}	(1 m^{-1})hc = $1.986\,445\,824(24) \times 10^{-25}$ J	(1 m^{-1})h/c = $2.210\,219\,057(27) \times 10^{-42}$ kg	(1 m^{-1}) = 1 m^{-1}	(1 m^{-1})c = 299 792 458 Hz
1 Hz	(1 Hz)h = $6.626\,070\,040(81) \times 10^{-34}$ J	(1 Hz)h/c^2 = $7.372\,497\,201(91) \times 10^{-51}$ kg	(1 Hz)/c = $3.335\,640\,951\ldots \times 10^{-9}$ m^{-1}	(1 Hz) = 1 Hz
1 K	(1 K)k = $1.380\,648\,52(79) \times 10^{-23}$ J	(1 K)k/c^2 = $1.536\,178\,65(88) \times 10^{-40}$ kg	(1 K)k/hc = $69.503\,457(40)$ m^{-1}	(1 K)k/h = $2.083\,6612(12) \times 10^{10}$ Hz
1 eV	(1 eV) = $1.602\,176\,6208(98) \times 10^{-19}$ J	(1 eV)/c^2 = $1.782\,661\,907(11) \times 10^{-36}$ kg	(1 eV)/hc = $8.065\,544\,005(50) \times 10^{5}$ m^{-1}	(1 eV)/h = $2.417\,989\,262(15) \times 10^{14}$ Hz
1 u	(1 u)c^2 = $1.492\,418\,062(18) \times 10^{-10}$ J	(1 u) = $1.660\,539\,040(20) \times 10^{-27}$ kg	(1 u)c/h = $7.513\,006\,6166(34) \times 10^{14}$ m^{-1}	(1 u)c^2/h = $2.252\,342\,7206(10) \times 10^{23}$ Hz
1 E_h	(1 E_h) = $4.359\,744\,650(54) \times 10^{-18}$ J	(1 E_h)/c^2 = $4.850\,870\,129(60) \times 10^{-35}$ kg	(1 E_h)/hc = $2.194\,746\,313\,702(13) \times 10^{7}$ m^{-1}	(1 E_h)/h = $6.579\,683\,920\,711(39) \times 10^{15}$ Hz

TABLE VIII The values of some energy equivalents derived from the relations $E = mc^2 = hc/\lambda = h\nu = kT$, and based on the 2010 CODATA adjustment of the values of the constants; 1 eV = (e/C) J, 1 u = $m_\mathrm{u} = \frac{1}{12}m(^{12}\mathrm{C}) = 10^{-3}$ kg mol$^{-1}/N_\mathrm{A}$, and $E_\mathrm{h} = 2R_\infty hc = \alpha^2 m_\mathrm{e}c^2$ is the Hartree energy (hartree).

	Relevant unit			
	K	eV	u	E_h
1 J	(1 J)/k = $7.242\,9731(42) \times 10^{22}$ K	(1 J) = $6.241\,509\,126(38) \times 10^{18}$ eV	(1 J)/c^2 = $6.700\,535\,363(82) \times 10^{9}$ u	(1 J) = $2.293\,712\,317(28) \times 10^{17}$ E_h
1 kg	(1 kg)c^2/k = $6.509\,6595(37) \times 10^{39}$ K	(1 kg)c^2 = $5.609\,588\,650(34) \times 10^{35}$ eV	(1 kg) = $6.022\,140\,857(74) \times 10^{26}$ u	(1 kg)c^2 = $2.061\,485\,823(25) \times 10^{34}$ E_h
1 m^{-1}	(1 m^{-1})hc/k = $1.438\,777\,36(83) \times 10^{-2}$ K	(1 m^{-1})hc = $1.239\,841\,9739(76) \times 10^{-6}$ eV	(1 m^{-1})h/c = $1.331\,025\,049\,00(61) \times 10^{-15}$ u	(1 m^{-1})hc = $4.556\,335\,252\,767(27) \times 10^{-8}$ E_h
1 Hz	(1 Hz)h/k = $4.799\,2447(28) \times 10^{-11}$ K	(1 Hz)h = $4.135\,667\,662(25) \times 10^{-15}$ eV	(1 Hz)h/c^2 = $4.439\,821\,6616(20) \times 10^{-24}$ u	(1 Hz)h = $1.519\,829\,846\,0088(90) \times 10^{-16}$ E_h
1 K	(1 K) = 1 K	(1 K)k = $8.617\,3303(50) \times 10^{-5}$ eV	(1 K)k/c^2 = $9.251\,0842(53) \times 10^{-14}$ u	(1 K)k = $3.166\,8105(18) \times 10^{-6}$ E_h
1 eV	(1 eV)/k = $1.160\,452\,21(67) \times 10^{4}$ K	(1 eV) = 1 eV	(1 eV)/c^2 = $1.073\,544\,1105(66) \times 10^{-9}$ u	(1 eV) = $3.674\,932\,248(23) \times 10^{-2}$ E_h
1 u	(1 u)c^2/k = $1.080\,954\,38(62) \times 10^{13}$ K	(1 u)c^2 = $931.494\,0954(57) \times 10^{6}$ eV	(1 u) = 1 u	(1 u)c^2 = $3.423\,177\,6902(16) \times 10^{7}$ E_h
1 E_h	(1 E_h)/k = $3.157\,7513(18) \times 10^{5}$ K	(1 E_h) = $27.211\,386\,02(17)$ eV	(1 E_h)/c^2 = $2.921\,262\,3197(13) \times 10^{-8}$ u	(1 E_h) = 1 E_h