Fundamental Physical Constants — Extensive Listing

Quantity	Symbol	Value	Unit	Relative std. uncert. u_r
		UNIVERSAL		
speed of light in vacuum	c	$299\,792\,458$	m s^{-1}	exact
vacuum magnetic permeability $4\pi\alpha\hbar/e^2c$	μ_0	$1.256\,637\,062\,12(19) \times 10^{-6}$	N A^{-2}	1.5×10^{-10}
$\mu_0/(4\pi \times 10^{-7})$		$1.000\,000\,000\,55(15)$	N A^{-2}	1.5×10^{-10}
vacuum electric permittivity $1/\mu_0c^2$	ϵ_0	$8.854\,187\,8128(13) \times 10^{-12}$	F m^{-1}	1.5×10^{-10}
characteristic impedance of vacuum μ_0c	Z_0	$376.730\,313\,668(57)$	Ω	1.5×10^{-10}
Newtonian constant of gravitation	G	$6.674\,30(15) \times 10^{-11}$	m^3 kg^{-1} s^{-2}	2.2×10^{-5}
	$G/\hbar c$	$6.708\,83(15) \times 10^{-39}$	$(\mathrm{GeV}/c^2)^{-2}$	2.2×10^{-5}
Planck constant*	h	$6.626\,070\,15 \times 10^{-34}$	J Hz^{-1}	exact
		$4.135\,667\,696\ldots \times 10^{-15}$	eV Hz^{-1}	exact
	$\hbar$	$1.054\,571\,817\ldots \times 10^{-34}$	J s	exact
		$6.582\,119\,569\ldots \times 10^{-16}$	eV s	exact
	$\hbar c$	$197.326\,980\,4\ldots$	MeV fm	exact
Planck mass $(\hbar c/G)^{1/2}$	m_P	$2.176\,435(24) \times 10^{-8}$	kg	1.1×10^{-5}
energy equivalent	$m_\mathrm{P}c^2$	$1.220\,890(13) \times 10^{19}$	GeV	1.1×10^{-5}
Planck temperature $(\hbar c^5/G)^{1/2}/k$	T_P	$1.416\,785(16) \times 10^{32}$	K	1.1×10^{-5}
Planck length $\hbar/m_\mathrm{P}c = (\hbar G/c^3)^{1/2}$	l_P	$1.616\,255(18) \times 10^{-35}$	m	1.1×10^{-5}
Planck time $l_\mathrm{P}/c = (\hbar G/c^5)^{1/2}$	t_P	$5.391\,245(60) \times 10^{-44}$	s	1.1×10^{-5}
		ELECTROMAGNETIC		
elementary charge	e	$1.602\,176\,634 \times 10^{-19}$	C	exact
	$e/\hbar$	$1.519\,267\,447\ldots \times 10^{15}$	A J^{-1}	exact
magnetic flux quantum $2\pi\hbar/(2e)$	Φ_0	$2.067\,833\,848\ldots \times 10^{-15}$	Wb	exact
conductance quantum $2e^2/2\pi\hbar$	G_0	$7.748\,091\,729\ldots \times 10^{-5}$	S	exact
inverse of conductance quantum	G_0^{-1}	$12\,906.403\,72\ldots$	Ω	exact
Josephson constant $2e/h$	K_J	$483\,597.848\,4\ldots \times 10^{9}$	Hz V^{-1}	exact
von Klitzing constant $\mu_0c/2\alpha = 2\pi\hbar/e^2$	R_K	$25\,812.807\,45\ldots$	Ω	exact
Bohr magneton $e\hbar/2m_\mathrm{e}$	μ_B	$9.274\,010\,0783(28) \times 10^{-24}$	J T^{-1}	3.0×10^{-10}
		$5.788\,381\,8060(17) \times 10^{-5}$	eV T^{-1}	3.0×10^{-10}
	μ_B/h	$1.399\,624\,493\,61(42) \times 10^{10}$	Hz T^{-1}	3.0×10^{-10}
	μ_B/hc	$46.686\,447\,783(14)$	[m^{-1} T^{-1}]†	3.0×10^{-10}
	μ_B/k	$0.671\,713\,815\,63(20)$	K T^{-1}	3.0×10^{-10}
nuclear magneton $e\hbar/2m_\mathrm{p}$	μ_N	$5.050\,783\,7461(15) \times 10^{-27}$	J T^{-1}	3.1×10^{-10}
		$3.152\,451\,258\,44(96) \times 10^{-8}$	eV T^{-1}	3.1×10^{-10}
	μ_N/h	$7.622\,593\,2291(23)$	MHz T^{-1}	3.1×10^{-10}
	μ_N/hc	$2.542\,623\,413\,53(78) \times 10^{-2}$	[m^{-1} T^{-1}]†	3.1×10^{-10}
	μ_N/k	$3.658\,267\,7756(11) \times 10^{-4}$	K T^{-1}	3.1×10^{-10}
		ATOMIC AND NUCLEAR		
		General		
fine-structure constant $e^2/4\pi\epsilon_0\hbar c$	α	$7.297\,352\,5693(11) \times 10^{-3}$		1.5×10^{-10}
inverse fine-structure constant	α^{-1}	$137.035\,999\,084(21)$		1.5×10^{-10}
Rydberg frequency $\alpha^2m_\mathrm{e}c^2/2h = E_\mathrm{h}/2h$	cR_∞	$3.289\,841\,960\,2508(64) \times 10^{15}$	Hz	1.9×10^{-12}
energy equivalent	$hc\,R_\infty$	$2.179\,872\,361\,1035(42) \times 10^{-18}$	J	1.9×10^{-12}
		$13.605\,693\,122\,994(26)$	eV	1.9×10^{-12}
Rydberg constant	R_∞	$10\,973\,731.568\,160(21)$	[m^{-1}]†	1.9×10^{-12}
Bohr radius $\hbar/\alpha m_\mathrm{e}c = 4\pi\epsilon_0\hbar^2/m_\mathrm{e}e^2$	a_0	$5.291\,772\,109\,03(80) \times 10^{-11}$	m	1.5×10^{-10}
Hartree energy $\alpha^2m_\mathrm{e}c^2 = e^2/4\pi\epsilon_0a_0 = 2hcR_\infty$	E_h	$4.359\,744\,722\,2071(85) \times 10^{-18}$	J	1.9×10^{-12}
		$27.211\,386\,245\,988(53)$	eV	1.9×10^{-12}
quantum of circulation	$\pi\hbar/m_\mathrm{e}$	$3.636\,947\,5516(11) \times 10^{-4}$	m^2 s^{-1}	3.0×10^{-10}

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Quantity	Symbol	Value	Unit	Relative std. uncert. u_{r}
	$2\pi\hbar/m_{\mathrm{e}}$	$7.273\,895\,1032(22) \times 10^{-4}$	m^2 s^{-1}	3.0×10^{-10}
Electroweak				
Fermi coupling constant[‡]	$G_{\mathrm{F}}/(\hbar c)^3$	$1.166\,3787(6) \times 10^{-5}$	GeV^{-2}	5.1×10^{-7}
weak mixing angle[§] θ_{W} (on-shell scheme) $\sin^2\theta_{\mathrm{W}} = s_{\mathrm{W}}^2 \equiv 1 - (m_{\mathrm{W}}/m_{\mathrm{Z}})^2$	$\sin^2\theta_{\mathrm{W}}$	$0.222\,90(30)$		1.3×10^{-3}
Electron, e$^-$				
electron mass	m_{e}	$9.109\,383\,7015(28) \times 10^{-31}$	kg	3.0×10^{-10}
		$5.485\,799\,090\,65(16) \times 10^{-4}$	u	2.9×10^{-11}
energy equivalent	$m_{\mathrm{e}}c^2$	$8.187\,105\,7769(25) \times 10^{-14}$	J	3.0×10^{-10}
		$0.510\,998\,950\,00(15)$	MeV	3.0×10^{-10}
electron-muon mass ratio	m_{e}/m_{μ}	$4.836\,331\,69(11) \times 10^{-3}$		2.2×10^{-8}
electron-tau mass ratio	m_{e}/m_{τ}	$2.875\,85(19) \times 10^{-4}$		6.8×10^{-5}
electron-proton mass ratio	$m_{\mathrm{e}}/m_{\mathrm{p}}$	$5.446\,170\,214\,87(33) \times 10^{-4}$		6.0×10^{-11}
electron-neutron mass ratio	$m_{\mathrm{e}}/m_{\mathrm{n}}$	$5.438\,673\,4424(26) \times 10^{-4}$		4.8×10^{-10}
electron-deuteron mass ratio	$m_{\mathrm{e}}/m_{\mathrm{d}}$	$2.724\,437\,107\,462(96) \times 10^{-4}$		3.5×10^{-11}
electron-triton mass ratio	$m_{\mathrm{e}}/m_{\mathrm{t}}$	$1.819\,200\,062\,251(90) \times 10^{-4}$		5.0×10^{-11}
electron-helion mass ratio	$m_{\mathrm{e}}/m_{\mathrm{h}}$	$1.819\,543\,074\,573(79) \times 10^{-4}$		4.3×10^{-11}
electron to alpha particle mass ratio	$m_{\mathrm{e}}/m_{\alpha}$	$1.370\,933\,554\,787(45) \times 10^{-4}$		3.3×10^{-11}
electron charge to mass quotient	$-e/m_{\mathrm{e}}$	$-1.758\,820\,010\,76(53) \times 10^{11}$	C kg^{-1}	3.0×10^{-10}
electron molar mass $N_{\mathrm{A}}m_{\mathrm{e}}$	$M(\mathrm{e}), M_{\mathrm{e}}$	$5.485\,799\,090\,65(16) \times 10^{-7}$	kg mol^{-1}	2.9×10^{-11}
reduced Compton wavelength $\hbar/m_{\mathrm{e}}c = \alpha a_0$	$\bar{\lambda}_{\mathrm{C}}$	$3.861\,592\,6796(12) \times 10^{-13}$	m	3.0×10^{-10}
Compton wavelength	λ_{C}	$2.426\,310\,238\,67(73) \times 10^{-12}$	[m][†]	3.0×10^{-10}
classical electron radius $\alpha^2 a_0$	r_{e}	$2.817\,940\,3262(13) \times 10^{-15}$	m	4.5×10^{-10}
Thomson cross section $(8\pi/3)r_{\mathrm{e}}^2$	σ_{e}	$6.652\,458\,7321(60) \times 10^{-29}$	m^2	9.1×10^{-10}
electron magnetic moment	μ_{e}	$-9.284\,764\,7043(28) \times 10^{-24}$	J T^{-1}	3.0×10^{-10}
to Bohr magneton ratio	$\mu_{\mathrm{e}}/\mu_{\mathrm{B}}$	$-1.001\,159\,652\,181\,28(18)$		1.7×10^{-13}
to nuclear magneton ratio	$\mu_{\mathrm{e}}/\mu_{\mathrm{N}}$	$-1838.281\,971\,88(11)$		6.0×10^{-11}
electron magnetic moment anomaly $\lvert\mu_{\mathrm{e}}\rvert/\mu_{\mathrm{B}} - 1$	a_{e}	$1.159\,652\,181\,28(18) \times 10^{-3}$		1.5×10^{-10}
electron g-factor $-2(1 + a_{\mathrm{e}})$	g_{e}	$-2.002\,319\,304\,362\,56(35)$		1.7×10^{-13}
electron-muon magnetic moment ratio	$\mu_{\mathrm{e}}/\mu_{\mu}$	$206.766\,9883(46)$		2.2×10^{-8}
electron-proton magnetic moment ratio	$\mu_{\mathrm{e}}/\mu_{\mathrm{p}}$	$-658.210\,687\,89(20)$		3.0×10^{-10}
electron to shielded proton magnetic moment ratio (H_2O, sphere, 25 °C)	$\mu_{\mathrm{e}}/\mu'_{\mathrm{p}}$	$-658.227\,5971(72)$		1.1×10^{-8}
electron-neutron magnetic moment ratio	$\mu_{\mathrm{e}}/\mu_{\mathrm{n}}$	$960.920\,50(23)$		2.4×10^{-7}
electron-deuteron magnetic moment ratio	$\mu_{\mathrm{e}}/\mu_{\mathrm{d}}$	$-2143.923\,4915(56)$		2.6×10^{-9}
electron to shielded helion magnetic moment ratio (gas, sphere, 25 °C)	$\mu_{\mathrm{e}}/\mu'_{\mathrm{h}}$	$864.058\,257(10)$		1.2×10^{-8}
electron gyromagnetic ratio $2\lvert\mu_{\mathrm{e}}\rvert/\hbar$	γ_{e}	$1.760\,859\,630\,23(53) \times 10^{11}$	s^{-1} T^{-1}	3.0×10^{-10}
		$28\,024.951\,4242(85)$	MHz T^{-1}	3.0×10^{-10}
Muon, μ^-				
muon mass	m_{μ}	$1.883\,531\,627(42) \times 10^{-28}$	kg	2.2×10^{-8}
		$0.113\,428\,9259(25)$	u	2.2×10^{-8}
energy equivalent	$m_{\mu}c^2$	$1.692\,833\,804(38) \times 10^{-11}$	J	2.2×10^{-8}
		$105.658\,3755(23)$	MeV	2.2×10^{-8}
muon-electron mass ratio	m_{μ}/m_{e}	$206.768\,2830(46)$		2.2×10^{-8}
muon-tau mass ratio	m_{μ}/m_{τ}	$5.946\,35(40) \times 10^{-2}$		6.8×10^{-5}
muon-proton mass ratio	m_{μ}/m_{p}	$0.112\,609\,5264(25)$		2.2×10^{-8}

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Quantity	Symbol	Value	Unit	Relative std. uncert. u_r
muon-neutron mass ratio	m_μ/m_n	$0.112\,454\,5170(25)$		2.2×10^{-8}
muon molar mass $N_\mathrm{A} m_\mu$	$M(\mu), M_\mu$	$1.134\,289\,259(25) \times 10^{-4}$	kg mol^{-1}	2.2×10^{-8}
reduced muon Compton wavelength $\hbar/m_\mu c$	$\bar{\lambda}_{\mathrm{C},\mu}$	$1.867\,594\,306(42) \times 10^{-15}$	m	2.2×10^{-8}
muon Compton wavelength	$\lambda_{\mathrm{C},\mu}$	$1.173\,444\,110(26) \times 10^{-14}$	[m]†	2.2×10^{-8}
muon magnetic moment	μ_μ	$-4.490\,448\,30(10) \times 10^{-26}$	J T^{-1}	2.2×10^{-8}
to Bohr magneton ratio	μ_μ/μ_B	$-4.841\,970\,47(11) \times 10^{-3}$		2.2×10^{-8}
to nuclear magneton ratio	μ_μ/μ_N	$-8.890\,597\,03(20)$		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	μ_μ/μ_p	$-3.183\,345\,142(71)$		2.2×10^{-8}
		Tau, τ^-		
tau mass¶	m_τ	$3.167\,54(21) \times 10^{-27}$	kg	6.8×10^{-5}
		$1.907\,54(13)$	u	6.8×10^{-5}
energy equivalent	$m_\tau c^2$	$2.846\,84(19) \times 10^{-10}$	J	6.8×10^{-5}
		$1776.86(12)$	MeV	6.8×10^{-5}
tau-electron mass ratio	m_τ/m_e	$3477.23(23)$		6.8×10^{-5}
tau-muon mass ratio	m_τ/m_μ	$16.8170(11)$		6.8×10^{-5}
tau-proton mass ratio	m_τ/m_p	$1.893\,76(13)$		6.8×10^{-5}
tau-neutron mass ratio	m_τ/m_n	$1.891\,15(13)$		6.8×10^{-5}
tau molar mass $N_\mathrm{A} m_\tau$	$M(\tau), M_\tau$	$1.907\,54(13) \times 10^{-3}$	kg mol^{-1}	6.8×10^{-5}
reduced tau Compton wavelength $\hbar/m_\tau c$	$\bar{\lambda}_{\mathrm{C},\tau}$	$1.110\,538(75) \times 10^{-16}$	m	6.8×10^{-5}
tau Compton wavelength	$\lambda_{\mathrm{C},\tau}$	$6.977\,71(47) \times 10^{-16}$	[m]†	6.8×10^{-5}
		Proton, p		
proton mass	m_p	$1.672\,621\,923\,69(51) \times 10^{-27}$	kg	3.1×10^{-10}
		$1.007\,276\,466\,621(53)$	u	5.3×10^{-11}
energy equivalent	$m_\mathrm{p} c^2$	$1.503\,277\,615\,98(46) \times 10^{-10}$	J	3.1×10^{-10}
		$938.272\,088\,16(29)$	MeV	3.1×10^{-10}
proton-electron mass ratio	$m_\mathrm{p}/m_\mathrm{e}$	$1836.152\,673\,43(11)$		6.0×10^{-11}
proton-muon mass ratio	m_p/m_μ	$8.880\,243\,37(20)$		2.2×10^{-8}
proton-tau mass ratio	m_p/m_τ	$0.528\,051(36)$		6.8×10^{-5}
proton-neutron mass ratio	$m_\mathrm{p}/m_\mathrm{n}$	$0.998\,623\,478\,12(49)$		4.9×10^{-10}
proton charge to mass quotient	e/m_p	$9.578\,833\,1560(29) \times 10^{7}$	C kg^{-1}	3.1×10^{-10}
proton molar mass $N_\mathrm{A} m_\mathrm{p}$	$M(\mathrm{p}), M_\mathrm{p}$	$1.007\,276\,466\,621(53) \times 10^{-3}$	kg mol^{-1}	5.3×10^{-11}
reduced proton Compton wavelength $\hbar/m_\mathrm{p} c$	$\bar{\lambda}_{\mathrm{C},\mathrm{p}}$	$2.103\,089\,103\,36(64) \times 10^{-16}$	m	3.1×10^{-10}
proton Compton wavelength	$\lambda_{\mathrm{C},\mathrm{p}}$	$1.321\,409\,855\,39(40) \times 10^{-15}$	[m]†	3.1×10^{-10}
proton rms charge radius	r_p	$8.414(19) \times 10^{-16}$	m	2.2×10^{-3}
proton magnetic moment	μ_p	$1.410\,606\,797\,36(60) \times 10^{-26}$	J T^{-1}	4.2×10^{-10}
to Bohr magneton ratio	$\mu_\mathrm{p}/\mu_\mathrm{B}$	$1.521\,032\,202\,30(46) \times 10^{-3}$		3.0×10^{-10}
to nuclear magneton ratio	$\mu_\mathrm{p}/\mu_\mathrm{N}$	$2.792\,847\,344\,63(82)$		2.9×10^{-10}
proton g-factor $2\mu_\mathrm{p}/\mu_\mathrm{N}$	g_p	$5.585\,694\,6893(16)$		2.9×10^{-10}
proton-neutron magnetic moment ratio	$\mu_\mathrm{p}/\mu_\mathrm{n}$	$-1.459\,898\,05(34)$		2.4×10^{-7}
shielded proton magnetic moment (H_2O, sphere, 25 °C)	μ'_p	$1.410\,570\,560(15) \times 10^{-26}$	J T^{-1}	1.1×10^{-8}
to Bohr magneton ratio	$\mu'_\mathrm{p}/\mu_\mathrm{B}$	$1.520\,993\,128(17) \times 10^{-3}$		1.1×10^{-8}
to nuclear magneton ratio	$\mu'_\mathrm{p}/\mu_\mathrm{N}$	$2.792\,775\,599(30)$		1.1×10^{-8}
proton magnetic shielding correction $1 - \mu'_\mathrm{p}/\mu_\mathrm{p}$ (H_2O, sphere, 25 °C)	σ'_p	$2.5689(11) \times 10^{-5}$		4.2×10^{-4}

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Quantity	Symbol	Value	Unit	Relative std. uncert. u_{r}
proton gyromagnetic ratio $2\mu_{\mathrm{p}}/\hbar$	γ_{p}	$2.675\,221\,8744(11) \times 10^{8}$	$\mathrm{s^{-1}\,T^{-1}}$	4.2×10^{-10}
		$42.577\,478\,518(18)$	$\mathrm{MHz\,T^{-1}}$	4.2×10^{-10}
shielded proton gyromagnetic ratio $2\mu'_{\mathrm{p}}/\hbar$ (H_2O, sphere, 25 °C)	γ'_{p}	$2.675\,153\,151(29) \times 10^{8}$	$\mathrm{s^{-1}\,T^{-1}}$	1.1×10^{-8}
		$42.576\,384\,74(46)$	$\mathrm{MHz\,T^{-1}}$	1.1×10^{-8}
Neutron, n				
neutron mass	m_{n}	$1.674\,927\,498\,04(95) \times 10^{-27}$	kg	5.7×10^{-10}
		$1.008\,664\,915\,95(49)$	u	4.8×10^{-10}
energy equivalent	$m_{\mathrm{n}}c^2$	$1.505\,349\,762\,87(86) \times 10^{-10}$	J	5.7×10^{-10}
		$939.565\,420\,52(54)$	MeV	5.7×10^{-10}
neutron-electron mass ratio	$m_{\mathrm{n}}/m_{\mathrm{e}}$	$1838.683\,661\,73(89)$		4.8×10^{-10}
neutron-muon mass ratio	m_{n}/m_{μ}	$8.892\,484\,06(20)$		2.2×10^{-8}
neutron-tau mass ratio	m_{n}/m_{τ}	$0.528\,779(36)$		6.8×10^{-5}
neutron-proton mass ratio	$m_{\mathrm{n}}/m_{\mathrm{p}}$	$1.001\,378\,419\,31(49)$		4.9×10^{-10}
neutron-proton mass difference	$m_{\mathrm{n}} - m_{\mathrm{p}}$	$2.305\,574\,35(82) \times 10^{-30}$	kg	3.5×10^{-7}
		$1.388\,449\,33(49) \times 10^{-3}$	u	3.5×10^{-7}
energy equivalent	$(m_{\mathrm{n}} - m_{\mathrm{p}})c^2$	$2.072\,146\,89(74) \times 10^{-13}$	J	3.5×10^{-7}
		$1.293\,332\,36(46)$	MeV	3.5×10^{-7}
neutron molar mass $N_{\mathrm{A}}m_{\mathrm{n}}$	$M(\mathrm{n}), M_{\mathrm{n}}$	$1.008\,664\,915\,95(49) \times 10^{-3}$	$\mathrm{kg\,mol^{-1}}$	4.8×10^{-10}
reduced neutron Compton wavelength $\hbar/m_{\mathrm{n}}c$	$\bar{\lambda}_{\mathrm{C,n}}$	$2.100\,194\,1552(12) \times 10^{-16}$	m	5.7×10^{-10}
neutron Compton wavelength	$\lambda_{\mathrm{C,n}}$	$1.319\,590\,905\,81(75) \times 10^{-15}$	$[\mathrm{m}]^{\dagger}$	5.7×10^{-10}
neutron magnetic moment	μ_{n}	$-9.662\,3651(23) \times 10^{-27}$	$\mathrm{J\,T^{-1}}$	2.4×10^{-7}
to Bohr magneton ratio	$\mu_{\mathrm{n}}/\mu_{\mathrm{B}}$	$-1.041\,875\,63(25) \times 10^{-3}$		2.4×10^{-7}
to nuclear magneton ratio	$\mu_{\mathrm{n}}/\mu_{\mathrm{N}}$	$-1.913\,042\,73(45)$		2.4×10^{-7}
neutron g-factor $2\mu_{\mathrm{n}}/\mu_{\mathrm{N}}$	g_{n}	$-3.826\,085\,45(90)$		2.4×10^{-7}
neutron-electron magnetic moment ratio	$\mu_{\mathrm{n}}/\mu_{\mathrm{e}}$	$1.040\,668\,82(25) \times 10^{-3}$		2.4×10^{-7}
neutron-proton magnetic moment ratio	$\mu_{\mathrm{n}}/\mu_{\mathrm{p}}$	$-0.684\,979\,34(16)$		2.4×10^{-7}
neutron to shielded proton magnetic moment ratio (H_2O, sphere, 25 °C)	$\mu_{\mathrm{n}}/\mu'_{\mathrm{p}}$	$-0.684\,996\,94(16)$		2.4×10^{-7}
neutron gyromagnetic ratio $2\lvert\mu_{\mathrm{n}}\rvert/\hbar$	γ_{n}	$1.832\,471\,71(43) \times 10^{8}$	$\mathrm{s^{-1}\,T^{-1}}$	2.4×10^{-7}
		$29.164\,6931(69)$	$\mathrm{MHz\,T^{-1}}$	2.4×10^{-7}
Deuteron, d				
deuteron mass	m_{d}	$3.343\,583\,7724(10) \times 10^{-27}$	kg	3.0×10^{-10}
		$2.013\,553\,212\,745(40)$	u	2.0×10^{-11}
energy equivalent	$m_{\mathrm{d}}c^2$	$3.005\,063\,231\,02(91) \times 10^{-10}$	J	3.0×10^{-10}
		$1875.612\,942\,57(57)$	MeV	3.0×10^{-10}
deuteron-electron mass ratio	$m_{\mathrm{d}}/m_{\mathrm{e}}$	$3670.482\,967\,88(13)$		3.5×10^{-11}
deuteron-proton mass ratio	$m_{\mathrm{d}}/m_{\mathrm{p}}$	$1.999\,007\,501\,39(11)$		5.6×10^{-11}
deuteron molar mass $N_{\mathrm{A}}m_{\mathrm{d}}$	$M(\mathrm{d}), M_{\mathrm{d}}$	$2.013\,553\,212\,745(40) \times 10^{-3}$	$\mathrm{kg\,mol^{-1}}$	2.0×10^{-11}
deuteron rms charge radius	r_{d}	$2.127\,99(74) \times 10^{-15}$	m	3.5×10^{-4}
deuteron magnetic moment	μ_{d}	$4.330\,735\,094(11) \times 10^{-27}$	$\mathrm{J\,T^{-1}}$	2.6×10^{-9}
to Bohr magneton ratio	$\mu_{\mathrm{d}}/\mu_{\mathrm{B}}$	$4.669\,754\,570(12) \times 10^{-4}$		2.6×10^{-9}
to nuclear magneton ratio	$\mu_{\mathrm{d}}/\mu_{\mathrm{N}}$	$0.857\,438\,2338(22)$		2.6×10^{-9}
deuteron g-factor $\mu_{\mathrm{d}}/\mu_{\mathrm{N}}$	g_{d}	$0.857\,438\,2338(22)$		2.6×10^{-9}
deuteron-electron magnetic moment ratio	$\mu_{\mathrm{d}}/\mu_{\mathrm{e}}$	$-4.664\,345\,551(12) \times 10^{-4}$		2.6×10^{-9}
deuteron-proton magnetic moment ratio	$\mu_{\mathrm{d}}/\mu_{\mathrm{p}}$	$0.307\,012\,209\,39(79)$		2.6×10^{-9}
deuteron-neutron magnetic moment ratio	$\mu_{\mathrm{d}}/\mu_{\mathrm{n}}$	$-0.448\,206\,53(11)$		2.4×10^{-7}

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Quantity	Symbol	Value	Unit	Relative std. uncert. u_r
		Triton, t		
triton mass	m_t	$5.007\,356\,7446(15) \times 10^{-27}$	kg	3.0×10^{-10}
		$3.015\,500\,716\,21(12)$	u	4.0×10^{-11}
energy equivalent	$m_\mathrm{t}c^2$	$4.500\,387\,8060(14) \times 10^{-10}$	J	3.0×10^{-10}
		$2808.921\,132\,98(85)$	MeV	3.0×10^{-10}
triton-electron mass ratio	$m_\mathrm{t}/m_\mathrm{e}$	$5496.921\,535\,73(27)$		5.0×10^{-11}
triton-proton mass ratio	$m_\mathrm{t}/m_\mathrm{p}$	$2.993\,717\,034\,14(15)$		5.0×10^{-11}
triton molar mass $N_\mathrm{A}m_\mathrm{t}$	$M(\mathrm{t}), M_\mathrm{t}$	$3.015\,500\,716\,21(12) \times 10^{-3}$	kg mol^{-1}	4.0×10^{-11}
triton magnetic moment	μ_t	$1.504\,609\,5202(30) \times 10^{-26}$	J T^{-1}	2.0×10^{-9}
to Bohr magneton ratio	$\mu_\mathrm{t}/\mu_\mathrm{B}$	$1.622\,393\,6651(32) \times 10^{-3}$		2.0×10^{-9}
to nuclear magneton ratio	$\mu_\mathrm{t}/\mu_\mathrm{N}$	$2.978\,962\,4656(59)$		2.0×10^{-9}
triton g-factor $2\mu_\mathrm{t}/\mu_\mathrm{N}$	g_t	$5.957\,924\,931(12)$		2.0×10^{-9}
		Helion, h		
helion mass	m_h	$5.006\,412\,7796(15) \times 10^{-27}$	kg	3.0×10^{-10}
		$3.014\,932\,247\,175(97)$	u	3.2×10^{-11}
energy equivalent	$m_\mathrm{h}c^2$	$4.499\,539\,4125(14) \times 10^{-10}$	J	3.0×10^{-10}
		$2808.391\,607\,43(85)$	MeV	3.0×10^{-10}
helion-electron mass ratio	$m_\mathrm{h}/m_\mathrm{e}$	$5495.885\,280\,07(24)$		4.3×10^{-11}
helion-proton mass ratio	$m_\mathrm{h}/m_\mathrm{p}$	$2.993\,152\,671\,67(13)$		4.4×10^{-11}
helion molar mass $N_\mathrm{A}m_\mathrm{h}$	$M(\mathrm{h}), M_\mathrm{h}$	$3.014\,932\,247\,175(97) \times 10^{-3}$	kg mol^{-1}	3.2×10^{-11}
helion magnetic moment	μ_h	$-1.074\,617\,532(13) \times 10^{-26}$	J T^{-1}	1.2×10^{-8}
to Bohr magneton ratio	$\mu_\mathrm{h}/\mu_\mathrm{B}$	$-1.158\,740\,958(14) \times 10^{-3}$		1.2×10^{-8}
to nuclear magneton ratio	$\mu_\mathrm{h}/\mu_\mathrm{N}$	$-2.127\,625\,307(25)$		1.2×10^{-8}
helion g-factor $2\mu_\mathrm{h}/\mu_\mathrm{N}$	g_h	$-4.255\,250\,615(50)$		1.2×10^{-8}
shielded helion magnetic moment (gas, sphere, 25 °C)	μ'_h	$-1.074\,553\,090(13) \times 10^{-26}$	J T^{-1}	1.2×10^{-8}
to Bohr magneton ratio	$\mu'_\mathrm{h}/\mu_\mathrm{B}$	$-1.158\,671\,471(14) \times 10^{-3}$		1.2×10^{-8}
to nuclear magneton ratio	$\mu'_\mathrm{h}/\mu_\mathrm{N}$	$-2.127\,497\,719(25)$		1.2×10^{-8}
shielded helion to proton magnetic moment ratio (gas, sphere, 25 °C)	$\mu'_\mathrm{h}/\mu_\mathrm{p}$	$-0.761\,766\,5618(89)$		1.2×10^{-8}
shielded helion to shielded proton magnetic moment ratio (gas/H_2O, spheres, 25 °C)	$\mu'_\mathrm{h}/\mu'_\mathrm{p}$	$-0.761\,786\,1313(33)$		4.3×10^{-9}
shielded helion gyromagnetic ratio $2\lvert\mu'_\mathrm{h}\rvert/\hbar$ (gas, sphere, 25 °C)	γ'_h	$2.037\,894\,569(24) \times 10^{8}$	s^{-1} T^{-1}	1.2×10^{-8}
		$32.434\,099\,42(38)$	MHz T^{-1}	1.2×10^{-8}
		Alpha particle, α		
alpha particle mass	m_α	$6.644\,657\,3357(20) \times 10^{-27}$	kg	3.0×10^{-10}
		$4.001\,506\,179\,127(63)$	u	1.6×10^{-11}
energy equivalent	$m_\alpha c^2$	$5.971\,920\,1914(18) \times 10^{-10}$	J	3.0×10^{-10}
		$3727.379\,4066(11)$	MeV	3.0×10^{-10}
alpha particle to electron mass ratio	m_α/m_e	$7294.299\,541\,42(24)$		3.3×10^{-11}
alpha particle to proton mass ratio	m_α/m_p	$3.972\,599\,690\,09(22)$		5.5×10^{-11}
alpha particle molar mass $N_\mathrm{A}m_\alpha$	$M(\alpha), M_\alpha$	$4.001\,506\,179\,127(63) \times 10^{-3}$	kg mol^{-1}	1.6×10^{-11}
		PHYSICOCHEMICAL		
Avogadro constant	N_A	$6.022\,140\,76 \times 10^{23}$	mol^{-1}	exact
Boltzmann constant	k	$1.380\,649 \times 10^{-23}$	J K^{-1}	exact
		$8.617\,333\,262\ldots \times 10^{-5}$	eV K^{-1}	exact
	k/h	$2.083\,661\,912\ldots \times 10^{10}$	Hz K^{-1}	exact

Fundamental Physical Constants — Extensive Listing

Quantity	Symbol	Value	Unit	Relative std. uncert. u_r
	k/hc	$69.503\,480\,04\ldots$	[m^{-1} K^{-1}][†]	exact
atomic mass constant[∥]				
$m_\mathrm{u} = \frac{1}{12}m(^{12}\mathrm{C}) = 2hcR_\infty/\alpha^2c^2A_\mathrm{r}(\mathrm{e})$	m_u	$1.660\,539\,066\,60(50) \times 10^{-27}$	kg	3.0×10^{-10}
energy equivalent	$m_\mathrm{u}c^2$	$1.492\,418\,085\,60(45) \times 10^{-10}$	J	3.0×10^{-10}
		$931.494\,102\,42(28)$	MeV	3.0×10^{-10}
molar mass constant[∥]	M_u	$0.999\,999\,999\,65(30) \times 10^{-3}$	kg mol^{-1}	3.0×10^{-10}
molar mass[∥] of carbon-12 $A_\mathrm{r}(^{12}\mathrm{C})M_\mathrm{u}$	$M(^{12}\mathrm{C})$	$11.999\,999\,9958(36) \times 10^{-3}$	kg mol^{-1}	3.0×10^{-10}
molar Planck constant	$N_\mathrm{A}h$	$3.990\,312\,712\ldots \times 10^{-10}$	J Hz^{-1} mol^{-1}	exact
molar gas constant $N_\mathrm{A}k$	R	$8.314\,462\,618\ldots$	J mol^{-1} K^{-1}	exact
Faraday constant $N_\mathrm{A}e$	F	$96\,485.332\,12\ldots$	C mol^{-1}	exact
standard-state pressure		100 000	Pa	exact
standard atmosphere		101 325	Pa	exact
molar volume of ideal gas RT/p				
$T = 273.15$ K, $p = 100$ kPa	V_m	$22.710\,954\,64\ldots \times 10^{-3}$	m^3 mol^{-1}	exact
or standard-state pressure				
Loschmidt constant $N_\mathrm{A}/V_\mathrm{m}$	n_0	$2.651\,645\,804\ldots \times 10^{25}$	m^{-3}	exact
molar volume of ideal gas RT/p				
$T = 273.15$ K, $p = 101.325$ kPa	V_m	$22.413\,969\,54\ldots \times 10^{-3}$	m^3 mol^{-1}	exact
or standard atmosphere				
Loschmidt constant $N_\mathrm{A}/V_\mathrm{m}$	n_0	$2.686\,780\,111\ldots \times 10^{25}$	m^{-3}	exact
Sackur-Tetrode (absolute entropy) constant[**]				
$\frac{5}{2} + \ln[(m_\mathrm{u}kT_1/2\pi\hbar^2)^{3/2}kT_1/p_0]$				
$T_1 = 1$ K, $p_0 = 100$ kPa	S_0/R	$-1.151\,707\,537\,06(45)$		3.9×10^{-10}
or standard-state pressure				
$T_1 = 1$ K, $p_0 = 101.325$ kPa		$-1.164\,870\,523\,58(45)$		3.9×10^{-10}
or standard atmosphere				
Stefan-Boltzmann constant				
$(\pi^2/60)k^4/\hbar^3c^2$	σ	$5.670\,374\,419\ldots \times 10^{-8}$	W m^{-2} K^{-4}	exact
first radiation constant for spectral				
radiance $2hc^2\,\mathrm{sr}^{-1}$	$c_{1\mathrm{L}}$	$1.191\,042\,972\ldots \times 10^{-16}$	[W m^2 sr^{-1}][††]	exact
first radiation constant $2\pi hc^2 = \pi\,\mathrm{sr}\,c_{1\mathrm{L}}$	c_1	$3.741\,771\,852\ldots \times 10^{-16}$	[W m^2][††]	exact
second radiation constant hc/k	c_2	$1.438\,776\,877\ldots \times 10^{-2}$	[m K][†]	exact
Wien displacement law constants				
$b = \lambda_\mathrm{max}T = c_2/4.965\,114\,231...$	b	$2.897\,771\,955\ldots \times 10^{-3}$	[m K][†]	exact
$b' = \nu_\mathrm{max}/T = 2.821\,439\,372...\,c/c_2$	b'	$5.878\,925\,757\ldots \times 10^{10}$	Hz K^{-1}	exact

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[*] The energy of a photon with frequency ν expressed in unit Hz is $E = h\nu$ in J. Unitary time evolution of the state of this photon is given by $\exp(-iEt/\hbar)|\varphi\rangle$, where $|\varphi\rangle$ is the photon state at time $t = 0$ and time is expressed in unit s. The ratio $Et/\hbar$ is a phase.

[†] The full description of m^{-1} is cycles or periods per meter and that of m is meter per cycle (m/cycle). The scientific community is aware of the implied use of these units. It traces back to the conventions for phase and angle and the use of unit Hz versus cycles/s. No solution has been agreed upon.

[‡] Value recommended by the Particle Data Group (Tanabashi, *et al.*, 2018).

[§] Based on the ratio of the masses of the W and Z bosons $m_\mathrm{W}/m_\mathrm{Z}$ recommended by the Particle Data Group (Tanabashi, *et al.*, 2018). The value for $\sin^2\theta_\mathrm{W}$ they recommend, which is based on a variant of the modified minimal subtraction ($\overline{\mathrm{MS}}$) scheme, is $\sin^2\hat{\theta}_\mathrm{W}(M_\mathrm{Z}) = 0.231\,22(4)$.

[¶] This and other constants involving m_τ are based on $m_\tau c^2$ in MeV recommended by the Particle Data Group (Tanabashi, *et al.*, 2018).

[∥] The relative atomic mass $A_\mathrm{r}(X)$ of particle X with mass $m(X)$ is defined by $A_\mathrm{r}(X) = m(X)/m_\mathrm{u}$, where $m_\mathrm{u} = m(^{12}\mathrm{C})/12 = 1$ u is the atomic mass constant and u is the unified atomic mass unit. Moreover, the mass of particle X is $m(X) = A_\mathrm{r}(X)$ u and the molar mass of X is $M(X) = A_\mathrm{r}(X)M_\mathrm{u}$, where $M_\mathrm{u} = N_\mathrm{A}$ u is the molar mass constant and N_A is the Avogadro constant.

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

[††] The full description of m^2 is $\mathrm{m}^{-2} \times (\mathrm{m/cycle})^4$. See also footnote for m^{-1}.