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	$1.256\,637\,061\,27(20) \times 10^{-6}$	N A^{-2}	1.6×10^{-10}
$\mu_0/(4\pi \times 10^{-7})$		0.999 999 999 87(16)	N A^{-2}	1.6×10^{-10}
vacuum electric permittivity $1/\mu_0 c^2$	ϵ_0	$8.854\,187\,8188(14) \times 10^{-12}$	F m^{-1}	1.6×10^{-10}
characteristic impedance of vacuum $\mu_0 c$	Z_0	376.730 313 412(59)	Ω	1.6×10^{-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 ...	MeV fm	exact
Planck mass $(\hbar c/G)^{1/2}$	m_P	$2.176\,434(24) \times 10^{-8}$	kg	1.1×10^{-5}
energy equivalent	$m_P c^2$	$1.220\,890(14) \times 10^{19}$	GeV	1.1×10^{-5}
Planck temperature $(\hbar c^5/G)^{1/2}/k$	T_P	$1.416\,784(16) \times 10^{32}$	K	1.1×10^{-5}
Planck length $\hbar/m_P c = (\hbar G/c^3)^{1/2}$	l_P	$1.616\,255(18) \times 10^{-35}$	m	1.1×10^{-5}
Planck time $l_P/c = (\hbar G/c^5)^{1/2}$	t_P	$5.391\,247(60) \times 10^{-44}$	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 ...	Ω	exact
Josephson constant $2e/h$	K_J	$483\,597.848\,4\ldots \times 10^{9}$	Hz V^{-1}	exact
von Klitzing constant $\mu_0 c/2\alpha = 2\pi\hbar/e^2$	R_K	25 812.807 45 ...	Ω	exact
Bohr magneton $e\hbar/2m_e$	μ_B	$9.274\,010\,0657(29) \times 10^{-24}$	J T^{-1}	3.1×10^{-10}
		$5.788\,381\,7982(18) \times 10^{-5}$	eV T^{-1}	3.1×10^{-10}
	μ_B/h	$1.399\,624\,491\,71(44) \times 10^{10}$	Hz T^{-1}	3.1×10^{-10}
	μ_B/hc	46.686 447 719(15)	[m^{-1} T^{-1}]†	3.1×10^{-10}
	μ_B/k	0.671 713 814 72(21)	K T^{-1}	3.1×10^{-10}
nuclear magneton $e\hbar/2m_p$	μ_N	$5.050\,783\,7393(16) \times 10^{-27}$	J T^{-1}	3.1×10^{-10}
		$3.152\,451\,254\,17(98) \times 10^{-8}$	eV T^{-1}	3.1×10^{-10}
	μ_N/h	7.622 593 2188(24)	MHz T^{-1}	3.1×10^{-10}
	μ_N/hc	$2.542\,623\,410\,09(79) \times 10^{-2}$	[m^{-1} T^{-1}]†	3.1×10^{-10}
	μ_N/k	$3.658\,267\,7706(11) \times 10^{-4}$	K T^{-1}	3.1×10^{-10}
		ATOMIC AND NUCLEAR		
		General		
fine-structure constant $e^2/4\pi\epsilon_0\hbar c$	α	$7.297\,352\,5643(11) \times 10^{-3}$		1.6×10^{-10}
inverse fine-structure constant	α^{-1}	137.035 999 177(21)		1.6×10^{-10}
Rydberg frequency $\alpha^2 m_e c^2/2h = E_h/2h$	cR_∞	$3.289\,841\,960\,2500(36) \times 10^{15}$	Hz	1.1×10^{-12}
energy equivalent	$hc\,R_\infty$	$2.179\,872\,361\,1030(24) \times 10^{-18}$	J	1.1×10^{-12}
		13.605 693 122 990(15)	eV	1.1×10^{-12}
Rydberg constant	R_∞	10 973 731.568 157(12)	[m^{-1}]†	1.1×10^{-12}
Bohr radius $\hbar/\alpha m_e c = 4\pi\epsilon_0\hbar^2/m_e e^2$	a_0	$5.291\,772\,105\,44(82) \times 10^{-11}$	m	1.6×10^{-10}

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Quantity	Symbol	Value	Unit	Relative std. uncert. u_r
Hartree energy $\alpha^2 m_e c^2 = e^2/4\pi\epsilon_0 a_0 = 2hcR_\infty$	E_h	$4.359\,744\,722\,2060(48) \times 10^{-18}$	J	1.1×10^{-12}
		$27.211\,386\,245\,981(30)$	eV	1.1×10^{-12}
quantum of circulation	$\pi\hbar/m_e$	$3.636\,947\,5467(11) \times 10^{-4}$	$m^2\ s^{-1}$	3.1×10^{-10}
	$2\pi\hbar/m_e$	$7.273\,895\,0934(23) \times 10^{-4}$	$m^2\ s^{-1}$	3.1×10^{-10}
		Electroweak		
Fermi coupling constant‡	$G_F/(\hbar c)^3$	$1.166\,3787(6) \times 10^{-5}$	GeV^{-2}	5.1×10^{-7}
weak mixing angle§ θ_W (on-shell scheme)				
$\sin^2\theta_W = s_W^2 \equiv 1 - (m_W/m_Z)^2$	$\sin^2\theta_W$	$0.223\,05(23)$		1.0×10^{-3}
		Electron, e^-		
electron mass	m_e	$9.109\,383\,7139(28) \times 10^{-31}$	kg	3.1×10^{-10}
		$5.485\,799\,090\,441(97) \times 10^{-4}$	u	1.8×10^{-11}
energy equivalent	$m_e c^2$	$8.187\,105\,7880(26) \times 10^{-14}$	J	3.1×10^{-10}
		$0.510\,998\,950\,69(16)$	MeV	3.1×10^{-10}
electron-muon mass ratio	m_e/m_μ	$4.836\,331\,70(11) \times 10^{-3}$		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_e/m_p	$5.446\,170\,214\,889(94) \times 10^{-4}$		1.7×10^{-11}
electron-neutron mass ratio	m_e/m_n	$5.438\,673\,4416(22) \times 10^{-4}$		4.0×10^{-10}
electron-deuteron mass ratio	m_e/m_d	$2.724\,437\,107\,629(47) \times 10^{-4}$		1.7×10^{-11}
electron-triton mass ratio	m_e/m_t	$1.819\,200\,062\,327(68) \times 10^{-4}$		3.8×10^{-11}
electron-helion mass ratio	m_e/m_h	$1.819\,543\,074\,649(53) \times 10^{-4}$		2.9×10^{-11}
electron to alpha particle mass ratio	m_e/m_α	$1.370\,933\,554\,733(32) \times 10^{-4}$		2.4×10^{-11}
electron charge to mass quotient	$-e/m_e$	$-1.758\,820\,008\,38(55) \times 10^{11}$	$C\ kg^{-1}$	3.1×10^{-10}
electron molar mass $N_A m_e$	$M(e), M_e$	$5.485\,799\,0962(17) \times 10^{-7}$	$kg\ mol^{-1}$	3.1×10^{-10}
reduced Compton wavelength $\hbar/m_e c = \alpha a_0$	$\lambda\!\!\!^{-}_C$	$3.861\,592\,6744(12) \times 10^{-13}$	m	3.1×10^{-10}
Compton wavelength	λ_C	$2.426\,310\,235\,38(76) \times 10^{-12}$	[m]†	3.1×10^{-10}
classical electron radius $\alpha^2 a_0$	r_e	$2.817\,940\,3205(13) \times 10^{-15}$	m	4.7×10^{-10}
Thomson cross section $(8\pi/3)r_e^2$	σ_e	$6.652\,458\,7051(62) \times 10^{-29}$	m^2	9.3×10^{-10}
electron magnetic moment	μ_e	$-9.284\,764\,6917(29) \times 10^{-24}$	$J\ T^{-1}$	3.1×10^{-10}
to Bohr magneton ratio	μ_e/μ_B	$-1.001\,159\,652\,180\,46(18)$		1.8×10^{-13}
to nuclear magneton ratio	μ_e/μ_N	$-1838.281\,971\,877(32)$		1.7×10^{-11}
electron magnetic moment				
anomaly $\lvert\mu_e\rvert/\mu_B - 1$	a_e	$1.159\,652\,180\,46(18) \times 10^{-3}$		1.6×10^{-10}
electron g-factor $-2(1+a_e)$	g_e	$-2.002\,319\,304\,360\,92(36)$		1.8×10^{-13}
electron-muon magnetic moment ratio	μ_e/μ_μ	$206.766\,9881(46)$		2.2×10^{-8}
electron-proton magnetic moment ratio	μ_e/μ_p	$-658.210\,687\,89(19)$		3.0×10^{-10}
electron to shielded proton magnetic				
moment ratio (H_2O, sphere, 25 °C)	μ_e/μ'_p	$-658.227\,5856(27)$		4.1×10^{-9}
electron-neutron magnetic moment ratio	μ_e/μ_n	$960.920\,48(23)$		2.4×10^{-7}
electron-deuteron magnetic moment ratio	μ_e/μ_d	$-2143.923\,4921(56)$		2.6×10^{-9}
electron to shielded helion magnetic				
moment ratio (gas, sphere, 25 °C)	μ_e/μ'_h	$864.058\,239\,86(70)$		8.1×10^{-10}
electron gyromagnetic ratio $2\lvert\mu_e\rvert/\hbar$	γ_e	$1.760\,859\,627\,84(55) \times 10^{11}$	$s^{-1}\ T^{-1}$	3.1×10^{-10}
		$28\,024.951\,3861(87)$	$MHz\ T^{-1}$	3.1×10^{-10}
		Muon, μ^-		

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Quantity	Symbol	Value	Unit	Relative std. uncert. u_r
muon mass	m_μ	$1.883\,531\,627(42) \times 10^{-28}$	kg	2.2×10^{-8}
		$0.113\,428\,9257(25)$	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	$206.768\,2827(46)$		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	$0.112\,609\,5262(25)$		2.2×10^{-8}
muon-neutron mass ratio	m_μ/m_n	$0.112\,454\,5168(25)$		2.2×10^{-8}
muon molar mass $N_A m_\mu$	$M(\mu), M_\mu$	$1.134\,289\,258(25) \times 10^{-4}$	kg mol^{-1}	2.2×10^{-8}
reduced muon Compton wavelength $\hbar/m_\mu c$	$\lambda\!\!\!^{-}_{C,\mu}$	$1.867\,594\,306(42) \times 10^{-15}$	m	2.2×10^{-8}
muon Compton wavelength	$\lambda_{C,\mu}$	$1.173\,444\,110(26) \times 10^{-14}$	[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	$-4.841\,970\,48(11) \times 10^{-3}$		2.2×10^{-8}
to nuclear magneton ratio	μ_μ/μ_N	$-8.890\,597\,04(20)$		2.2×10^{-8}
muon magnetic moment anomaly				
$\lvert\mu_\mu\rvert/(e\hbar/2m_\mu) - 1$	a_μ	$1.165\,920\,62(41) \times 10^{-3}$		3.5×10^{-7}
muon g-factor $-2(1 + a_\mu)$	g_μ	$-2.002\,331\,841\,23(82)$		4.1×10^{-10}
muon-proton magnetic moment ratio	μ_μ/μ_p	$-3.183\,345\,146(71)$		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 $N_A m_\tau$	$M(\tau), M_\tau$	$1.907\,54(13) \times 10^{-3}$	kg mol^{-1}	6.8×10^{-5}
reduced tau Compton wavelength $\hbar/m_\tau c$	$\lambda\!\!\!^{-}_{C,\tau}$	$1.110\,538(75) \times 10^{-16}$	m	6.8×10^{-5}
tau Compton wavelength	$\lambda_{C,\tau}$	$6.977\,71(47) \times 10^{-16}$	[m]†	6.8×10^{-5}
		Proton, p		
proton mass	m_p	$1.672\,621\,925\,95(52) \times 10^{-27}$	kg	3.1×10^{-10}
		$1.007\,276\,466\,5789(83)$	u	8.3×10^{-12}
energy equivalent	$m_p c^2$	$1.503\,277\,618\,02(47) \times 10^{-10}$	J	3.1×10^{-10}
		$938.272\,089\,43(29)$	MeV	3.1×10^{-10}
proton-electron mass ratio	m_p/m_e	$1836.152\,673\,426(32)$		1.7×10^{-11}
proton-muon mass ratio	m_p/m_μ	$8.880\,243\,38(20)$		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_p/m_n	$0.998\,623\,477\,97(40)$		4.0×10^{-10}
proton charge to mass quotient	e/m_p	$9.578\,833\,1430(30) \times 10^{7}$	C kg^{-1}	3.1×10^{-10}
proton molar mass $N_A m_p$	$M(\mathrm{p}), M_p$	$1.007\,276\,467\,64(31) \times 10^{-3}$	kg mol^{-1}	3.1×10^{-10}
reduced proton Compton wavelength $\hbar/m_p c$	$\lambda\!\!\!^{-}_{C,p}$	$2.103\,089\,100\,51(66) \times 10^{-16}$	m	3.1×10^{-10}
proton Compton wavelength	$\lambda_{C,p}$	$1.321\,409\,853\,60(41) \times 10^{-15}$	[m]†	3.1×10^{-10}
proton rms charge radius	r_p	$8.4075(64) \times 10^{-16}$	m	7.6×10^{-4}
proton magnetic moment	μ_p	$1.410\,606\,795\,45(60) \times 10^{-26}$	J T^{-1}	4.3×10^{-10}

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Quantity	Symbol	Value	Unit	Relative std. uncert. u_r
to Bohr magneton ratio	μ_p/μ_B	$1.521\,032\,202\,30(45) \times 10^{-3}$		3.0×10^{-10}
to nuclear magneton ratio	μ_p/μ_N	$2.792\,847\,344\,63(82)$		2.9×10^{-10}
proton g-factor $2\mu_p/\mu_N$	g_p	$5.585\,694\,6893(16)$		2.9×10^{-10}
proton-neutron magnetic moment ratio	μ_p/μ_n	$-1.459\,898\,02(34)$		2.4×10^{-7}
shielded proton magnetic moment (H_2O, sphere, 25 °C)	μ'_p	$1.410\,570\,5830(58) \times 10^{-26}$	J T^{-1}	4.1×10^{-9}
to Bohr magneton ratio	μ'_p/μ_B	$1.520\,993\,1551(62) \times 10^{-3}$		4.1×10^{-9}
to nuclear magneton ratio	μ'_p/μ_N	$2.792\,775\,648(11)$		4.1×10^{-9}
proton magnetic shielding correction $1-\mu'_p/\mu_p$ (H_2O, sphere, 25 °C)	σ'_p	$2.567\,15(41) \times 10^{-5}$		1.6×10^{-4}
proton gyromagnetic ratio $2\mu_p/\hbar$	γ_p	$2.675\,221\,8708(11) \times 10^{8}$	s^{-1} T^{-1}	4.3×10^{-10}
		$42.577\,478\,461(18)$	MHz T^{-1}	4.3×10^{-10}
shielded proton gyromagnetic ratio $2\mu'_p/\hbar$ (H_2O, sphere, 25 °C)	γ'_p	$2.675\,153\,194(11) \times 10^{8}$	s^{-1} T^{-1}	4.1×10^{-9}
		$42.576\,385\,43(17)$	MHz T^{-1}	4.1×10^{-9}
		Neutron, n		
neutron mass	m_n	$1.674\,927\,500\,56(85) \times 10^{-27}$	kg	5.1×10^{-10}
		$1.008\,664\,916\,06(40)$	u	4.0×10^{-10}
energy equivalent	$m_n c^2$	$1.505\,349\,765\,14(76) \times 10^{-10}$	J	5.1×10^{-10}
		$939.565\,421\,94(48)$	MeV	5.1×10^{-10}
neutron-electron mass ratio	m_n/m_e	$1838.683\,662\,00(74)$		4.0×10^{-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	$0.528\,779(36)$		6.8×10^{-5}
neutron-proton mass ratio	m_n/m_p	$1.001\,378\,419\,46(40)$		4.0×10^{-10}
neutron-proton mass difference	$m_n - m_p$	$2.305\,574\,61(67) \times 10^{-30}$	kg	2.9×10^{-7}
		$1.388\,449\,48(40) \times 10^{-3}$	u	2.9×10^{-7}
energy equivalent	$(m_n - m_p)c^2$	$2.072\,147\,12(60) \times 10^{-13}$	J	2.9×10^{-7}
		$1.293\,332\,51(38)$	MeV	2.9×10^{-7}
neutron molar mass $N_A m_n$	$M(n), M_n$	$1.008\,664\,917\,12(51) \times 10^{-3}$	kg mol^{-1}	5.1×10^{-10}
reduced neutron Compton wavelength $\hbar/m_n c$	$\lambda\!\!\!^{-}_{C,n}$	$2.100\,194\,1520(11) \times 10^{-16}$	m	5.1×10^{-10}
neutron Compton wavelength	$\lambda_{C,n}$	$1.319\,590\,903\,82(67) \times 10^{-15}$	[m]†	5.1×10^{-10}
neutron magnetic moment	μ_n	$-9.662\,3653(23) \times 10^{-27}$	J T^{-1}	2.4×10^{-7}
to Bohr magneton ratio	μ_n/μ_B	$-1.041\,875\,65(25) \times 10^{-3}$		2.4×10^{-7}
to nuclear magneton ratio	μ_n/μ_N	$-1.913\,042\,76(45)$		2.4×10^{-7}
neutron g-factor $2\mu_n/\mu_N$	g_n	$-3.826\,085\,52(90)$		2.4×10^{-7}
neutron-electron magnetic moment ratio	μ_n/μ_e	$1.040\,668\,84(24) \times 10^{-3}$		2.4×10^{-7}
neutron-proton magnetic moment ratio	μ_n/μ_p	$-0.684\,979\,35(16)$		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	$1.832\,471\,74(43) \times 10^{8}$	s^{-1} T^{-1}	2.4×10^{-7}
		$29.164\,6935(69)$	MHz T^{-1}	2.4×10^{-7}
		Deuteron, d		
deuteron mass	m_d	$3.343\,583\,7768(10) \times 10^{-27}$	kg	3.1×10^{-10}
		$2.013\,553\,212\,544(15)$	u	7.4×10^{-12}
energy equivalent	$m_d c^2$	$3.005\,063\,234\,91(94) \times 10^{-10}$	J	3.1×10^{-10}

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Quantity	Symbol	Value	Unit	Relative std. uncert. u_r
		$1875.612\,945\,00(58)$	MeV	3.1×10^{-10}
deuteron-electron mass ratio	m_d/m_e	$3670.482\,967\,655(63)$		1.7×10^{-11}
deuteron-proton mass ratio	m_d/m_p	$1.999\,007\,501\,2699(84)$		4.2×10^{-12}
deuteron molar mass $N_A m_d$	$M(d), M_d$	$2.013\,553\,214\,66(63) \times 10^{-3}$	kg mol^{-1}	3.1×10^{-10}
deuteron rms charge radius	r_d	$2.127\,78(27) \times 10^{-15}$	m	1.3×10^{-4}
deuteron magnetic moment	μ_d	$4.330\,735\,087(11) \times 10^{-27}$	J T^{-1}	2.6×10^{-9}
to Bohr magneton ratio	μ_d/μ_B	$4.669\,754\,568(12) \times 10^{-4}$		2.6×10^{-9}
to nuclear magneton ratio	μ_d/μ_N	$0.857\,438\,2335(22)$		2.6×10^{-9}
deuteron g-factor μ_d/μ_N	g_d	$0.857\,438\,2335(22)$		2.6×10^{-9}
deuteron-electron magnetic moment ratio	μ_d/μ_e	$-4.664\,345\,550(12) \times 10^{-4}$		2.6×10^{-9}
deuteron-proton magnetic moment ratio	μ_d/μ_p	$0.307\,012\,209\,30(79)$		2.6×10^{-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	$5.007\,356\,7512(16) \times 10^{-27}$	kg	3.1×10^{-10}
		$3.015\,500\,715\,97(10)$	u	3.4×10^{-11}
energy equivalent	$m_t c^2$	$4.500\,387\,8119(14) \times 10^{-10}$	J	3.1×10^{-10}
		$2808.921\,136\,68(88)$	MeV	3.1×10^{-10}
triton-electron mass ratio	m_t/m_e	$5496.921\,535\,51(21)$		3.8×10^{-11}
triton-proton mass ratio	m_t/m_p	$2.993\,717\,034\,03(10)$		3.4×10^{-11}
triton molar mass $N_A m_t$	$M(t), M_t$	$3.015\,500\,719\,13(94) \times 10^{-3}$	kg mol^{-1}	3.1×10^{-10}
triton magnetic moment	μ_t	$1.504\,609\,5178(30) \times 10^{-26}$	J T^{-1}	2.0×10^{-9}
to Bohr magneton ratio	μ_t/μ_B	$1.622\,393\,6648(32) \times 10^{-3}$		2.0×10^{-9}
to nuclear magneton ratio	μ_t/μ_N	$2.978\,962\,4650(59)$		2.0×10^{-9}
triton g-factor $2\mu_t/\mu_N$	g_t	$5.957\,924\,930(12)$		2.0×10^{-9}
		Helion, h		
helion mass	m_h	$5.006\,412\,7862(16) \times 10^{-27}$	kg	3.1×10^{-10}
		$3.014\,932\,246\,932(74)$	u	2.5×10^{-11}
energy equivalent	$m_h c^2$	$4.499\,539\,4185(14) \times 10^{-10}$	J	3.1×10^{-10}
		$2808.391\,611\,12(88)$	MeV	3.1×10^{-10}
helion-electron mass ratio	m_h/m_e	$5495.885\,279\,84(16)$		2.9×10^{-11}
helion-proton mass ratio	m_h/m_p	$2.993\,152\,671\,552(70)$		2.4×10^{-11}
helion molar mass $N_A m_h$	$M(h), M_h$	$3.014\,932\,250\,10(94) \times 10^{-3}$	kg mol^{-1}	3.1×10^{-10}
helion magnetic moment	μ_h	$-1.074\,617\,551\,98(93) \times 10^{-26}$	J T^{-1}	8.7×10^{-10}
to Bohr magneton ratio	μ_h/μ_B	$-1.158\,740\,980\,83(94) \times 10^{-3}$		8.1×10^{-10}
to nuclear magneton ratio	μ_h/μ_N	$-2.127\,625\,3498(17)$		8.1×10^{-10}
helion g-factor $2\mu_h/\mu_N$	g_h	$-4.255\,250\,6995(34)$		8.1×10^{-10}
shielded helion magnetic moment (gas, sphere, 25 °C)	μ'_h	$-1.074\,553\,110\,35(93) \times 10^{-26}$	J T^{-1}	8.7×10^{-10}
to Bohr magneton ratio	μ'_h/μ_B	$-1.158\,671\,494\,57(94) \times 10^{-3}$		8.1×10^{-10}
to nuclear magneton ratio	μ'_h/μ_N	$-2.127\,497\,7624(17)$		8.1×10^{-10}
shielded helion to proton magnetic moment ratio (gas, sphere, 25 °C)	μ'_h/μ_p	$-0.761\,766\,577\,21(66)$		8.6×10^{-10}
shielded helion to shielded proton magnetic moment ratio (gas/H_2O, spheres, 25 °C)	μ'_h/μ'_p	$-0.761\,786\,1334(31)$		4.0×10^{-9}

Fundamental Physical Constants — Extensive Listing

Quantity	Symbol	Value	Unit	Relative std. uncert. u_r
shielded helion gyromagnetic ratio				
$2\lvert\mu'_h\rvert/\hbar$ (gas, sphere, 25 °C)	γ'_h	$2.037\,894\,6078(18) \times 10^{8}$	$s^{-1}\ T^{-1}$	8.7×10^{-10}
		$32.434\,100\,033(28)$	MHz T^{-1}	8.7×10^{-10}
		Alpha particle, α		
alpha particle mass	m_α	$6.644\,657\,3450(21) \times 10^{-27}$	kg	3.1×10^{-10}
		$4.001\,506\,179\,129(62)$	u	1.6×10^{-11}
energy equivalent	$m_\alpha c^2$	$5.971\,920\,1997(19) \times 10^{-10}$	J	3.1×10^{-10}
		$3727.379\,4118(12)$	MeV	3.1×10^{-10}
alpha particle to electron mass ratio	m_α/m_e	$7294.299\,541\,71(17)$		2.4×10^{-11}
alpha particle to proton mass ratio	m_α/m_p	$3.972\,599\,690\,252(70)$		1.8×10^{-11}
alpha particle rms charge radius	r_α	$1.6785(21) \times 10^{-15}$	m	1.2×10^{-3}
alpha particle molar mass $N_A m_\alpha$	$M(\alpha), M_\alpha$	$4.001\,506\,1833(12) \times 10^{-3}$	kg mol^{-1}	3.1×10^{-10}
		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
	k/hc	$69.503\,480\,04\ldots$	$[m^{-1}\ K^{-1}]^{\dagger}$	exact
atomic mass constant$^{\parallel}$				
$m_u = \frac{1}{12}m(^{12}C) = 2hc\,R_\infty/\alpha^2c^2A_r(e)$	m_u	$1.660\,539\,068\,92(52) \times 10^{-27}$	kg	3.1×10^{-10}
energy equivalent	$m_u c^2$	$1.492\,418\,087\,68(46) \times 10^{-10}$	J	3.1×10^{-10}
		$931.494\,103\,72(29)$	MeV	3.1×10^{-10}
molar mass constant$^{\parallel}$	M_u	$1.000\,000\,001\,05(31) \times 10^{-3}$	kg mol^{-1}	3.1×10^{-10}
molar mass$^{\parallel}$ of carbon-12 $A_r(^{12}C)M_u$	$M(^{12}C)$	$12.000\,000\,0126(37) \times 10^{-3}$	kg mol^{-1}	3.1×10^{-10}
molar Planck constant	$N_A h$	$3.990\,312\,712\ldots \times 10^{-10}$	J Hz^{-1} mol^{-1}	exact
molar gas constant $N_A k$	R	$8.314\,462\,618\ldots$	J mol^{-1} K^{-1}	exact
Faraday constant $N_A e$	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 or standard-state pressure	V_m	$22.710\,954\,64\ldots \times 10^{-3}$	m^3 mol^{-1}	exact
Loschmidt constant N_A/V_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 or standard atmosphere	V_m	$22.413\,969\,54\ldots \times 10^{-3}$	m^3 mol^{-1}	exact
Loschmidt constant N_A/V_m	n_0	$2.686\,780\,111\ldots \times 10^{25}$	m^{-3}	exact
Sackur-Tetrode (absolute entropy) constant**				
$\frac{5}{2} + \ln[(m_u kT_1/2\pi\hbar^2)^{3/2}kT_1/p_0]$				
$T_1 = 1$ K, $p_0 = 100$ kPa or standard-state pressure	S_0/R	$-1.151\,707\,534\,96(47)$		4.1×10^{-10}
$T_1 = 1$ K, $p_0 = 101.325$ kPa or standard atmosphere		$-1.164\,870\,521\,49(47)$		4.0×10^{-10}
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

Fundamental Physical Constants — Extensive Listing

Quantity	Symbol	Value	Unit	Relative std. uncert. u_r
first radiation constant for spectral radiance $2hc^2\,\mathrm{sr}^{-1}$	c_{1L}	$1.191\,042\,972\ldots \times 10^{-16}$	$[\mathrm{W\,m^2\,sr^{-1}}]^{\dagger}$	exact
first radiation constant $2\pi hc^2 = \pi\,\mathrm{sr}\,c_{1L}$	c_1	$3.741\,771\,852\ldots \times 10^{-16}$	$[\mathrm{W\,m^2}]^{\dagger}$	exact
second radiation constant hc/k	c_2	$1.438\,776\,877\ldots \times 10^{-2}$	$[\mathrm{m\,K}]^{\dagger}$	exact
Wien displacement law constants				
$b = \lambda_{\mathrm{max}}T = c_2/4.965\,114\,231...$	b	$2.897\,771\,955\ldots \times 10^{-3}$	$[\mathrm{m\,K}]^{\dagger}$	exact
$b' = \nu_{\mathrm{max}}/T = 2.821\,439\,372...\,c/c_2$	b'	$5.878\,925\,757\ldots \times 10^{10}$	$\mathrm{Hz\,K^{-1}}$	exact

* 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 symbol [m] denotes m/(Hz s). If angles are dimensionless, as in the current SI, then Hz s = 1. If angles have a dimension, then Hz s = cycle.

‡ Value recommended by the Particle Data Group (Workman, *et al.*, 2022).

§ 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 (Workman, *et al.*, 2022). 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 (Workman, *et al.*, 2022).

‖ 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 $S = S_0 + \frac{3}{2}R\,\ln A_{\mathrm{r}} - R\,\ln(p/p_0) + \frac{5}{2}R\,\ln(T/\mathrm{K})$.