Physical Constants

Newtonian gravitational const.	G	$6.674\times10^{-11}\,\mathrm{N\cdot m^2/kg^2}$	
		$6.709\times10^{-39}\,\hbar c^5/\mathrm{GeV}^2$	
Avogadro number	N_A	$6.022141\times10^{23}\,\mathrm{mol}^{-1}$	
Boltzmann constant	k	$1.38065\times10^{-23}\,\mathrm{J/K}$	$8.61733\times10^{-5}\,\mathrm{eV/K}$
speed of light in vacuum	c	$2.99792\times10^{8}\,\mathrm{m/s}$	
reduced Planck's constant	$\hbar(=h/2\pi)$	$1.05449\times10^{-34}\,\mathrm{J\cdot s}$	
		$6.58151\times10^{-22}\,\mathrm{MeV\cdot s}$	
elementary charge	e	$1.6022\times10^{-19}\,\mathrm{C}$	
		$4.8032\times10^{-10}\,\mathrm{esu}$	$1.6022\times10^{-20}\,\mathrm{emu}$
electron mass	m_e	$9.10938\times10^{-31}\,\mathrm{kg}$	$0.5109989\,\mathrm{MeV}/c^2$
unified atomic mass unit	u	$1.660539\times10^{-27}\,\mathrm{kg}$	$931.4941\,\mathrm{MeV}/c^2$
vacuum permittivity	ϵ_0	$8.854187817\times10^{-12}\,\mathrm{F/m}$	electric constant
Fermi coupling constant	$G_F/(\hbar c)^3$	$1.16638\times10^{-5}\,\mathrm{GeV}^{-2}$	
Fine structure constant	α	0.00729735257	$(137.036)^{-1}$

Unit Conversion

1 inch =2.54 cm   1 pound(lb) = 0.4535923 kg

1 cal=4.185 J

Dimensions (suffix denotes power of energy in natural unit with H-L and $k=1$)

Length (m)	$[L]_{-1}$	Mass (kg)	$[M]_1$
Time (s)	$[T]_{-1}$	Current (A)	$[J]_1$
Momentum (N·s)	$[MLT^{-1}]_1$	Force (N)	$[MLT^{-2}]_2$
Work (J)	$[ML^2T^{-2}]_1$	Angular momentum (N·m·s)	$[ML^2T^{-1}]_0$
Power (W)	$[ML^2T^{-3}]_2$		
Moment (N·m)	$[ML^2T^{-2}]_1$	Moment of inertia (kg·m^2)	$[ML^2]_{-1}$
Pressure (Pa=N/m^2)	$[ML^{-1}T^{-2}]_4$		
Permittivity ϵ (F/m)	$[M^{-1}L^{-3}T^4J^2]_0$	Charge (C)	$[TJ]_0$
Electric field strength E (V/m)	$[MLT^{-3}J^{-1}]_2$	Electric flux density D (C/m^2)	$[L^{-2}TJ]_2$
Electric potential (V)	$[ML^2T^{-3}J^{-1}]_1$	Electric capacity (F)	$[M^{-1}L^{-2}T^4J^2]_{-1}$
Electric resistance (Ω)	$[ML^2T^{-3}J^{-2}]_0$	Permeability μ (H/m)	$[MLT^{-2}J^{-2}]_0$
Magnetic charge (Wb)	$[ML^2T^{-2}J^{-1}]_0$	Magnetic field strength H (A/m)	$[L^{-1}J]_2$
Magnetic vector potential	$[MLT^{-2}J^{-1}]_1$		
Magnetic flux density B (T)	$[MT^{-2}J^{-1}]_2$	Magnetic flux Φ (Wb =T·m^2)	$[ML^2T^{-2}J^{-1}]_0$
Inductance (H=Wb/A)	$[ML^2T^{-2}J^{-2}]_{-1}$		
Temperature (K)	$[\theta]_1$	Expansion coefficient (K^{-1})	$[\theta^{-1}]_{-1}$
Thermal capacity (J/K)	$[ML^2T^{-2}\theta^{-1}]_0$		
Thermal conductivity (W/m·K)	$[MLT^{-3}\theta^{-1}]_2$	Entropy (J/K)	$[ML^2T^{-2}\theta^{-1}]_0$

Electromagnetic Units

$$\vec F = q\vec E \qquad \vec F = m\vec H \qquad \frac{\partial\rho}{\partial t} + \boldsymbol{\nabla}\cdot\vec j = 0$$

$$\vec F = \frac{1}{h_1\epsilon_0}\frac{q\,q'}{r^2}\frac{\vec r}{r} \qquad \vec F = \frac{1}{h_2\mu_0}\frac{m\,m'}{r^2}\frac{\vec r}{r} \qquad \vec F = \frac{1}{h_3 k}\frac{m\vec j\times\vec r}{r^3}$$

$$\Rightarrow \boldsymbol{\nabla}\cdot\vec E = \frac{4\pi}{h_1\epsilon_0}\rho \qquad \boldsymbol{\nabla}\times\vec H = \frac{4\pi}{h_3 k}\vec j + \frac{h_1\epsilon_0}{h_3 k}\frac{\partial\vec E}{\partial t} \qquad \boldsymbol{\nabla}\times\vec E = -\frac{h_2\mu_0}{h_3 k}\frac{\partial\vec H}{\partial t}$$

$$\vec F = q\,\vec E + \frac{h_2\mu_0}{h_3 k}\,q\vec v\times\vec H \ :\ \text{Lorentz force} \qquad \frac{h_3^2}{h_1 h_2}\frac{k^2}{\mu_0\epsilon_0} = c^2$$

$$S = \frac{h_3 k}{4\pi}\vec E\times\vec H \qquad E = \frac{1}{8\pi}\left(h_1\epsilon_0\vec E^{\,2} + h_2\mu_0\vec H^{\,2}\right) \qquad \alpha = \frac{e^2}{h_1\epsilon_0\hbar c}$$

	MKSA	esu	emu	Gauss	Heaviside-Lorentz
$h_1=h_2=h_3=$	4π	1	1	1	4π
ϵ_0	$\frac{1}{\mu_0 c^2}$	1	$\frac{1}{c^2}$	1	1
μ_0	$\frac{4\pi}{10^7}$	$\frac{1}{c^2}$	1	1	1
k	1	1	1	c	c
$\boldsymbol{\nabla}\cdot\vec D=$	ρ	$4\pi\rho$	$4\pi\rho$	$4\pi\rho$	ρ
$\boldsymbol{\nabla}\cdot\vec B=$	0	0	0	0	0
$\boldsymbol{\nabla}\times\vec H=$	$\vec j+\frac{1}{c}\frac{\partial\vec D}{\partial t}$	$4\pi\vec j+\frac{\partial\vec D}{\partial t}$	$4\pi\vec j+\frac{\partial\vec D}{\partial t}$	$\frac{4\pi}{c}\vec j+\frac{1}{c}\frac{\partial\vec D}{\partial t}$	$\frac{1}{c}\vec j+\frac{1}{c}\frac{\partial\vec D}{\partial t}$
$\boldsymbol{\nabla}\times\vec E=$	$-\frac{\partial\vec B}{\partial t}$	$-\frac{\partial\vec B}{\partial t}$	$-\frac{\partial\vec B}{\partial t}$	$-\frac{1}{c}\frac{\partial\vec B}{\partial t}$	$-\frac{1}{c}\frac{\partial\vec B}{\partial t}$
$\vec D=$	$\epsilon\vec E$	$\frac{\epsilon}{\epsilon_0}\vec E$	$\frac{\epsilon}{\epsilon_0 c^2}\vec E$	$\frac{\epsilon}{\epsilon_0}\vec E$	$\frac{\epsilon}{\epsilon_0}\vec E$
$\vec B=$	$\mu\vec H$	$\frac{\mu}{\mu_0 c^2}\vec H$	$\frac{\mu}{\mu_0}\vec H$	$\frac{\mu}{\mu_0}\vec H$	$\frac{\mu}{\mu_0}\vec H$

Natural Units with Heaviside-Lorentz

$$\hbar = c = 1 \qquad \epsilon_0 = \mu_0 = 1 \qquad [L^{-1}] = [T^{-1}] = [M] = [J] = [\mathcal{E}(ML^2T^{-2})]$$

$$\hbar\,c = 197\,\text{MeV}\cdot\text{fm}$$

$$1\text{kg} = 5.61\times10^{29}\text{MeV} \qquad 1\,\text{MeV} = 1.60\times10^{-13}\,\text{J} = 1.78\times10^{-30}\,\text{kg}\cdot c^2$$

$$1J = 6.24\times10^{12}\text{MeV}$$

$$1s = 3.00\times10^{23}\,\text{fm} = 1.52\times10^{21}\,\text{MeV}^{-1} \qquad 1s^{-1} = 6.58\times10^{-22}\,\text{MeV}$$

$$1m = 5.07\times10^{12}\text{MeV}^{-1}$$

$$1N = 1.23\text{MeV}^2$$

$$\frac{e^2}{4\pi\epsilon_0\,\hbar\,c} \rightarrow \frac{e^2}{4\pi} = \frac{1}{137} \qquad e = \sqrt{4\pi/137} = 0.303$$

$$1C = 1.89\times10^{18} \qquad 1V = 3.30\text{eV} \qquad 1V/m = 6.52\times10^{-19}\text{MeV}^2$$

$$1A = 1.24\times10^{-3}\text{MeV} \qquad 1T = 1.95\times10^{-10}\text{MeV}^2$$