

A Compilation of Physical Constants

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Abstract

This document provides a comprehensive list of physical constants used in modern physics, including their standard symbols, CODATA 2023 values, and SI units. These constants serve as the foundation for theoretical and experimental studies across multiple domains of science.

1. Fundamental Physical Constants

Constant	Symbol	Value (SI Units)
Speed of light in vacuum	c	$299\,792\,458\text{ ms}^{-1}$
Planck constant	h	$6.626\,070\,15 \times 10^{-34}\text{ Js}$
Reduced Planck constant	$\hbar$	$1.054\,571\,817 \times 10^{-34}\text{ Js}$
Gravitational constant	G	$6.674\,30 \times 10^{-11}\text{ m}^3\text{kg}^{-1}\text{s}^{-2}$
Elementary charge	e	$1.602\,176\,634 \times 10^{-19}\text{ C}$
Avogadro constant	N_A	$6.022\,140\,76 \times 10^{23}\text{ mol}^{-1}$
Boltzmann constant	k	$1.380\,649 \times 10^{-23}\text{ JK}^{-1}$
Gas constant	R	$8.314\,462\,618\text{ Jmol}^{-1}\text{K}^{-1}$
Fine-structure constant	α	$7.297\,352\,5693 \times 10^{-3}$ (dimensionless)
Vacuum permittivity	ϵ_0	$8.854\,187\,8128 \times 10^{-12}\text{ Fm}^{-1}$
Vacuum permeability	μ_0	$1.256\,637\,062\,12 \times 10^{-6}\text{ NA}^{-2}$
StefanBoltzmann constant	σ	$5.670\,374\,419 \times 10^{-8}\text{ Wm}^{-2}\text{K}^{-4}$
Wien displacement constant	b	$2.897\,771\,955 \times 10^{-3}\text{ mK}$
Rydberg constant	R_∞	$10\,973\,731.568\,160\text{ m}^{-1}$

2. Elementary Particle Masses

Particle	Symbol	Mass (kg)	Mass (MeV/ c^2)
Electron	m_e	$9.109\,383\,7015 \times 10^{-31}$	0.511
Proton	m_p	$1.672\,621\,923\,69 \times 10^{-27}$	938.272

Neutron	m_n	$1.674\,927\,498\,04 \times 10^{-27}$	939.565
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3. Other Notable Constants

Constant	Symbol	Value (SI Units)
Atomic mass unit	u	$1.660\,539\,066\,60 \times 10^{-27}$ kg
Planck length	ℓ_P	$1.616\,255 \times 10^{-35}$ m
Planck time	t_P	$5.391\,247 \times 10^{-44}$ s
Planck mass	m_P	$2.176\,434 \times 10^{-8}$ kg
Planck temperature	T_P	$1.416\,784 \times 10^{32}$ K
Electron volt	eV	$1.602\,176\,634 \times 10^{-19}$ J
Bohr radius	a_0	$5.291\,772\,109\,03 \times 10^{-11}$ m
Bohr magneton	μ_B	$9.274\,010\,0783 \times 10^{-24}$ JT ⁻¹
Faraday constant	F	96 485.332 12 Cmol ⁻¹
Josephson constant	K_J	$483\,597.848\,4 \times 10^9$ HzV ⁻¹
von Klitzing constant	R_K	25 812.807 45