Laser Physics: Table of physical constants useful in computing the values of various physical quantities

Constant Name	Usual Symbol	Current Value
Speed of light	c	$2.997\,924\,58\times10^{8}$ m/s
Elementary charge	e	$1.602\,177\times^{-19}$ C
Planck's constant	$\hbar$	$1.054\,573\times10^{-34}$ J·s
Gravitational constant	G	$6.672\,6\times10^{-11}$ N·m^2/kg^2
Fine structure constant	$\alpha = e^2/4\pi\epsilon_0\hbar c$	$1/137.036 \approx 1/137$
Stefan-Boltzmann constant	σ	5.6705×10^{-8} W/m^2·K^4
Boltzmann constant	k_B	$1.380\,7\times10^{-23}$ J/K
Avogadro's number	N_A	$6.022\,137\times10^{23}$ mol^{-1}
Solar mass	M_e	1.989×10^{30} kg
Solar radius	R_e	6.96×10^{8} m
Earth mass	M_E	5.976×10^{24} kg
Earth radius	R_E	6.374×10^{6} m
Earth-Sun distance (mean radius)	AU	1.496×10^{11} m
Earth-Moon distance (mean radius)		3.844×10^{8} m
Volume of a mole of an ideal gas at STP		22.414 liter
Air desnity at STP		1.293 kg/m^3
Triple point temperature of water		273.16 K

Convenient combinations of fundamental constants

Fine structure constant $\alpha = \dfrac{e^2}{4\pi\epsilon_0\hbar c}$	$1/137.036 \approx 1/137$
$\hbar c$	197.3271 eV· nm
k_BT	1/40 eV at 293K and 1/39 eV at 300K
Electron rest energy (mass) m_ec^2	0.5110 MeV
Proton rest energy (mass) m_pc^2	938.28 MeV
Neutron rest energy m_nc^2	939.57 MeV
Proton-electron mass ratio m_p/m_e	1836.15
Bohr radius $a_0 = \hbar/m_ec\alpha$	0.5292×10^{-10} m
Planck time $\sqrt{\hbar G/c^5}$	5.4×10^{-44} s
Compton wavelength of electron $\hbar/m_ec$	3.8616×10^{-13} m
1 calorie	4.1860 J
1 atm	1.1013×10^{5} Pa
1 degree	1.745×10^{-2} rad
1 parsec	3.09×10^{16} m

Energy of a photon can be calculated by using the formula

$$E = h\nu = \frac{2\pi\hbar c}{\lambda} = \frac{1238}{\lambda(\text{in nm})}\,\text{eV}$$

Important laser gain media and wavelengths
Gain media and pumps come in great variety of forms and generate radiation ranging from far infra-red (far-IR) to soft X-rays.
HCN far-IR laser (311, 337, 545, 676, 744 μm)
H_2O far-IR laser (28, 48, 120 μm)
CO_2 laser (9.6-10.6 μm)
CO laser (5.1-6.5 μm)
HF chemical laser (2.7-3.0 μm)
Nd:YAG laser (1.06 μm)
He:Ne laser (1.15 μm, 633 nm)
Ga-As semiconductor laser (870 nm)
Ruby laser (694 nm)
Rhodamine 6G dye laser (560-640 nm)
Argon-ion laser (488-514 nm)
Pulsed N_2 discharge laser (337 nm)
Pulsed H_2 discharge laser (160 nm)

Laser pumping methods

Gas discharge including dc, rf, and pulsed electrical discharges involving both direct electron excitation and two-stage collision pumping.

Optical pumping using flash lamps, arc lamps, semiconductor LEDs, other lasers and even direct sunlight.

Chemical reactions including chemical mixing, photolysis, and combustion.

Direct electrical pumping includes high-voltage electron beams directed into high-pressure gas cells and direct current injection into semiconductor injection lasers.

Nuclear pumping of gases by nuclear fission fragments when a gas laser tube is placed in close proximity of a nuclear reactor.

Supersonic expansion of gases, usually pre-heated by chemical reaction or electrical discharge, through supersonic expansion nozzles, to create the so-called gas-dynamic lasers.

Plasma pumping in hot dense plasmas, created by plasma piches, focused high-power laser pulses, or electrical pulses. There are reports of X-ray laser action in some laser materials pumped by the explosion of a nuclear bomb.