

Constants

Gravity, Electricity, and Magnetism

Acceleration Due to Gravity or Gravitational Field Near Earth.....	a_g or $g = 9.81 \text{ m/s}^2$ or 9.81 N/kg
Gravitational Constant.....	$G = 6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$
Mass of Earth.....	$M_e = 5.98 \times 10^{24} \text{ kg}$
Radius of Earth.....	$R_e = 6.37 \times 10^6 \text{ m}$
Coulomb's Law Constant.....	$k = 8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$
Electron Volt.....	$1 \text{ eV} = 1.60 \times 10^{-19} \text{ J}$
Elementary Charge.....	$e = 1.60 \times 10^{-19} \text{ C}$
Index of Refraction of Air.....	$n = 1.00$
Speed of Light in Vacuum.....	$c = 3.00 \times 10^8 \text{ m/s}$

Atomic Physics

Energy of an Electron in the 1st Bohr Orbit of Hydrogen.....	$E_1 = -2.18 \times 10^{-18} \text{ J}$ or -13.6 eV
Planck's Constant.....	$h = 6.63 \times 10^{-34} \text{ J}\cdot\text{s}$ or $4.14 \times 10^{-15} \text{ eV}\cdot\text{s}$
Radius of 1st Bohr Orbit of Hydrogen.....	$r_1 = 5.29 \times 10^{-11} \text{ m}$
Rydberg's Constant for Hydrogen.....	$R_H = 1.10 \times 10^7 \frac{1}{\text{m}}$

Particles

	Rest Mass	Charge
Alpha Particle.....	$m_\alpha = 6.65 \times 10^{-27} \text{ kg}$	α^{2+}
Electron.....	$m_e = 9.11 \times 10^{-31} \text{ kg}$	e^-
Neutron.....	$m_n = 1.67 \times 10^{-27} \text{ kg}$	n^0
Proton.....	$m_p = 1.67 \times 10^{-27} \text{ kg}$	p^+

Trigonometry and Vectors

$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$c^2 = a^2 + b^2 - 2ab \cos C$$

For any Vector \vec{R}

$$R = \sqrt{R_x^2 + R_y^2}$$

$$\tan \theta = \frac{R_y}{R_x}$$

$$R_x = R \cos \theta$$

$$R_y = R \sin \theta$$

Graphing Calculator Window Format

x : [x_{\min} , x_{\max} , x_{sc1}]

y : [y_{\min} , y_{\max} , y_{sc1}]

Prefixes Used With SI Units

Prefix	Symbol	Exponential Value	Prefix	Symbol	Exponential Value
pico	p	10^{-12}	tera	T	10^{12}
nano	n	10^{-9}	giga	G	10^9
micro	μ	10^{-6}	mega	M	10^6
milli	m	10^{-3}	kilo	k	10^3
centi	c	10^{-2}	hecto	h	10^2
deci	d	10^{-1}	deka	da	10^1

Equations

Kinematics

$$\vec{v}_{\text{ave}} = \frac{\vec{d}}{t}$$

$$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t}$$

$$\vec{d} = \vec{v}_i t + \frac{1}{2} \vec{a} t^2$$

$$v = \frac{2\pi r}{T}$$

$$\vec{d} = \vec{v}_i t - \frac{1}{2} \vec{a} t^2$$

$$\vec{d} = \left(\frac{\vec{v}_i + \vec{v}_f}{2} \right) t$$

$$v_f^2 = v_i^2 + 2ad$$

$$a_c = \frac{v^2}{r}$$

Dynamics

$$\vec{F} = m\vec{a}$$

$$\vec{F}\Delta t = m\Delta\vec{v}$$

$$\vec{F}_g = m\vec{g}$$

$$F_f = \mu F_N$$

$$\vec{F}_s = -k\vec{x}$$

$$F_g = \frac{Gm_1 m_2}{r^2}$$

$$g = \frac{Gm_1}{r^2}$$

$$F_c = \frac{mv^2}{r}$$

$$F_c = \frac{4\pi^2 mr}{T^2}$$

Momentum and Energy

$$\vec{p} = m\vec{v}$$

$$W = Fd$$

$$W = \Delta E = Fd \cos \theta$$

$$P = \frac{W}{t} = \frac{\Delta E}{t}$$

$$E_k = \frac{1}{2} mv^2$$

$$E_p = mgh$$

$$E_p = \frac{1}{2} kx^2$$

Waves and Light

$$T = 2\pi\sqrt{\frac{m}{k}}$$

$$T = 2\pi\sqrt{\frac{L}{g}}$$

$$T = \frac{1}{f}$$

$$v = f\lambda$$

$$\frac{\lambda_1}{2} = t; \frac{\lambda_1}{4} = l$$

$$\frac{\sin \theta_1}{\sin \theta_2} = \frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2} = \frac{n_2}{n_1}$$

$$\lambda = \frac{xd}{Hl}$$

$$\lambda = \frac{d \sin \theta}{n}$$

$$m = \frac{h_1}{h_0} = \frac{-d_1}{d_0}$$

$$\frac{1}{f} = \frac{1}{d_0} + \frac{1}{d_i}$$

Atomic Physics

$$hf = E_{k,\text{max}} + W$$

$$W = hf_0$$

$$E_{k,\text{max}} = qV_{\text{stop}}$$

$$E = hf = \frac{hc}{\lambda}$$

$$\frac{1}{\lambda} = R_H \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$$

$$E_n = \frac{1}{n^2} E_1$$

$$r_n = n^2 r_1$$

$$N = N_0 \left(\frac{1}{2} \right)^n$$

Quantum Mechanics and Nuclear Physics

$$E = mc^2$$

$$p = \frac{h}{\lambda}$$

$$p = \frac{hf}{c}; E = pc$$

Electricity and Magnetism

$$F_e = \frac{kq_1 q_2}{r^2}$$

$$|\vec{E}| = \frac{kq_1}{r^2}$$

$$\vec{F}_e = \frac{q}{q}$$

$$|\vec{E}| = \frac{V}{d}$$

$$V = \frac{\Delta E}{q}$$

$$R = R_1 + R_2 + R_3$$

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$I_{\text{eff}} = 0.707 I_{\text{max}}$$

$$V = IR$$

$$P = IV$$

$$I = \frac{q}{t}$$

$$F_m = IIB_{\perp}$$

$$F_m = qvB_{\perp}$$

$$V = I\mathcal{B}_{\perp}$$

$$\frac{N_p}{N_s} = \frac{V_p}{V_s} = \frac{I_s}{I_p}$$

$$V_{\text{eff}} = 0.707 V_{\text{max}}$$