

SAMPLE

Physics Formula Sheet

You may keep this Formula Sheet.

Motion and related energy transformations

velocity; acceleration	$v = \frac{\Delta s}{\Delta t}; \quad a = \frac{\Delta v}{\Delta t}$
equations for constant acceleration	$v = u + at$ $s = ut + \frac{1}{2}at^2$ $s = vt - \frac{1}{2}at^2$ $v^2 = u^2 + 2as$ $s = \frac{1}{2}(u + v)t$
Newton's second law	$\Sigma F = ma$
uniform circular motion	$F_{\text{net}} = \frac{mv^2}{r} \quad v = \frac{2\pi r}{T}$
Hooke's law	$F = -kx$
elastic potential energy	$E_s = \frac{1}{2}kx^2$
gravitational potential energy	$E_g = mg\Delta h$
kinetic energy	$E_k = \frac{1}{2}mv^2$
Newton's law of universal gravitation	$F_g = G \frac{m_1 m_2}{r^2}$
gravitational field	$g = G \frac{M}{r^2}$
impulse	$F\Delta t = m\Delta v$
momentum	$p = mv$

Einstein's special theory of relativity

Lorentz factor	$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$
time dilation	$t = \gamma t_0$
length contraction	$L = \frac{L_0}{\gamma}$
relativistic rest energy	$E_0 = mc^2$
relativistic total energy	$E_{\text{total}} = E_k + E_0 = \gamma mc^2$
relativistic kinetic energy	$E_k = (\gamma - 1)mc^2$

Fields and application of field concepts

uniform electric field between charged plates	$E = \frac{V}{d}$
energy transformations of charges in an electric field	$\frac{1}{2}mv^2 = qV$
field of a point charge	$E = k \frac{Q}{r^2}$
electric force on a charged particle	$F = qE$
Coulomb's law	$F = k \frac{q_1 q_2}{r^2}$
magnetic force on a moving charge	$F = qvB$
magnetic force on a current-carrying conductor	$F = nIlB$
radius of a charged particle in a uniform magnetic field	$r = \frac{mv}{qB}$

Generation and transmission of electricity

current; power	$I = \frac{V}{R}; P = VI$
resistors in series	$R_T = R_1 + R_2 + \dots$
resistors in parallel	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$
ideal transformer action	$\frac{N_1}{N_2} = \frac{V_1}{V_2} = \frac{I_2}{I_1}$
AC voltage and current	$V_{\text{RMS}} = \frac{1}{\sqrt{2}} V_{\text{peak}}$ $I_{\text{RMS}} = \frac{1}{\sqrt{2}} I_{\text{peak}}$
electromagnetic induction	$\varepsilon = -N \frac{\Delta \Phi_B}{\Delta t}$ $\Phi_B = B_{\perp} A$
transmission losses	$V_{\text{drop}} = I_{\text{line}} R_{\text{line}}$ $P_{\text{loss}} = I_{\text{line}}^2 R_{\text{line}}$

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Waves

wave equation	$v = f\lambda$
constructive interference	path difference = $n\lambda$
destructive interference	path difference = $\left(n + \frac{1}{2}\right)\lambda$
interference pattern spacing	$\Delta x = \frac{\lambda L}{d}$ when $L \gg d$

The nature of light and matter

photoelectric effect	$E_{k\max} = hf - \phi$
photon energy	$E = hf = \frac{hc}{\lambda}$
photon momentum	$p = \frac{h}{\lambda}$
de Broglie wavelength	$\lambda = \frac{h}{p}$

Data

acceleration due to gravity at Earth's surface	$g = 9.81 \text{ m s}^{-2}$
mass of the electron	$m_e = 9.11 \times 10^{-31} \text{ kg}$
magnitude of the charge of the electron	$q_e = 1.60 \times 10^{-19} \text{ C}$
Planck's constant	$h = 6.63 \times 10^{-34} \text{ J s}$ $h = 4.14 \times 10^{-15} \text{ eV s}$
speed of light in a vacuum	$c = 3.00 \times 10^8 \text{ m s}^{-1}$
universal gravitational constant	$G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$
mass of Earth	$M_E = 5.97 \times 10^{24} \text{ kg}$
radius of Earth	$R_E = 6.37 \times 10^6 \text{ m}$
Coulomb constant	$k = 8.99 \times 10^9 \text{ N m}^2 \text{ C}^{-2}$

Metric (SI) multipliers

$p = \text{pico} = 10^{-12}$	$n = \text{nano} = 10^{-9}$	$\mu = \text{micro} = 10^{-6}$	$m = \text{milli} = 10^{-3}$
$k = \text{kilo} = 10^3$	$M = \text{mega} = 10^6$	$G = \text{giga} = 10^9$	$T = \text{tera} = 10^{12}$

Unit conversions

1 tonne (t) = 10^3 kg
1 kilowatt hour (kW h) = $3.6 \times 10^6 \text{ J}$

Nomenclature

force due to gravity	F_g
terminology for force	$F_{\text{on A by B}}$
normal force	F_N