Physics Formulas

Mechanics

- $F = ma$

  Newton's second law of motion

- $v = u + at$

  Equation for final velocity under constant acceleration

- $a = \frac{dv}{dt}$

  Definition of acceleration

- $s = ut + \frac{1}{2}at^2$

  Equation for displacement under constant acceleration

- $v^2 = u^2 + 2as$

  Equation for velocity squared

Thermodynamics

- $PV = nRT$

  Ideal gas law

- $Q = mc\Delta T$

  Equation for heat transfer

- $E = mc^2$

  Einstein's mass-energy equivalence

- $W = P\Delta V$

  Work done by a gas in an isobaric process

- $S = k_B \ln \Omega$

  Boltzmann entropy formula

Electromagnetism

- $V = IR$

  Ohm's law

- $F = qE$

  Force on a charge in an electric field

- $B = \frac{\mu_0 I}{2\pi r}$

  Magnetic field due to a current-carrying wire (Biot-Savart Law)

- $F = q(v \times B)$

  Lorentz force equation

- $E = -\frac{dB}{dt}$

  Faraday's law of induction

Optics

- $n = \frac{c}{v}$

  Refractive index formula

- $1/f = \frac{1}{d_o} + \frac{1}{d_i}$

  Lens formula

- $\theta_c = \sin^{-1}\left(\frac{n_2}{n_1}\right)$

  Critical angle for total internal reflection

- $I = I_0 \cos^2\theta$

  Malus's law for intensity of polarized light

- $m = \frac{h}{\lambda}$

  De Broglie wavelength formula

Fluid Mechanics

- $\rho = \frac{m}{V}$

  Density formula

- $F = \rho g V$

  Buoyant force formula

- $v = \frac{Q}{A}$

  Flow velocity in a pipe (continuity equation)

- $P = \frac{F}{A}$

  Pressure formula

- $\Delta P = RQ$

  Poiseuille's law for fluid flow in pipes

Modern Physics

- $E = hf$

  Energy of a photon

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

  De Broglie wavelength for particles

- $\alpha = \frac{e^2}{4\pi\epsilon_0\hbar c}$

  Fine-structure constant

- $p = \gamma mv$

  Relativistic momentum formula

- $t = \frac{t_0}{\sqrt{1 - v^2/c^2}}$

  Time dilation in special relativity

Waves

- $v = f\lambda$

  Wave velocity formula

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

  Period of a wave

- $v = v_0 + at$

  Equation for the velocity of a moving wave

- $I = \frac{P}{A}$

  Intensity of a wave

- $\Delta x \Delta p = \frac{h}{2}$

  Heisenberg's uncertainty principle

Astrophysics

- $F = G\frac{m_1 m_2}{r^2}$

  Newton's law of gravitation

- $T = \frac{2\pi}{\omega}$

  Orbital period for a circular orbit

- $L = r^2\omega$

  Angular momentum of a rotating object

- $v = \sqrt{GM/r}$

  Orbital velocity of a satellite

- $E = -\frac{GMm}{2r}$

  Gravitational potential energy of an object in orbit

Quantum Mechanics

- $E = -\frac{13{,}6}{n^2}$ eV

  Energy levels of hydrogen atom

- $\Psi = \frac{1}{\sqrt{2\pi}} e^{-x^2/2}$

  Wave function of a quantum harmonic oscillator

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

  De Broglie wavelength formula

- $H\Psi = E\Psi$

  Time-independent Schrödinger equation

- $p = mv$

  Classical momentum formula

Relativity

- $E^2 = (pc)^2 + (mc^2)^2$

  Energy-momentum relation

- $m = \frac{m_0}{\sqrt{1 - v^2/c^2}}$

  Relativistic mass formula

- $F = \gamma^3 F_0$

  Relativistic force formula

- $t' = \frac{t}{\sqrt{1 - v^2/c^2}}$

  Time dilation for moving observers

- $x' = \gamma(x - vt)$

  Relativistic position transformation