

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
- $F = \rho gV$
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
- $\Delta x \Delta p = \frac{\hbar}{2}$
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

- $E = -\frac{13.6}{n^2} \text{ eV}$
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