

PHYSICS CONSTANTS AND FORMULAS

CONSTANTS

Description	Value
Acceleration of gravity on Earth (g)	9.80 m/s ²
Speed of light in a vacuum (c)	3.00×10^8 m/s
Planck's constant (h)	6.63×10^{-34} J•s = 4.14×10^{-15} eV•s
Electron rest mass (m_e)	9.11×10^{-31} kg
Proton rest mass (m_p)	1.67×10^{-27} kg
Elementary charge (e)	1.60×10^{-19} C
Coulomb's constant (k_e)	8.99×10^9 N•m ² /C ²
Boltzmann constant (k_b)	1.38×10^{-23} J/K
Gas constant (R)	8.31 J/(mol•K)
Gravitational constant (G)	6.67×10^{-11} N•m ² /kg ²
Permeability of free space (μ_0)	$4\pi \times 10^{-7}$ T•m/A
Avogadro's number (N_A)	6.02×10^{23} particles/mole
Heat of fusion of water (L_f)	3.33×10^5 J/kg
Heat of vaporization of water (L_v)	2.26×10^6 J/kg
Specific heat of water (c_w)	4.19×10^3 J/(kg•°C)
Density of water (ρ_w)	1.00×10^3 kg/m ³

FORMULAS

Mathematics	Force and Motion
$C = 2\pi r$	$v_f = v_i + at$
$A = \pi r^2$	$x_f = x_i + v_i t + \frac{1}{2} at^2$
$SA = 4\pi r^2$	$v_f^2 - v_i^2 = 2a(x_f - x_i)$
$V = \frac{4}{3}\pi r^3$	$a_c = \frac{v^2}{r}$
(a, b) denotes a vector with an x-component of a and a y-component of b .	$\Sigma \mathbf{F} = m\mathbf{a}$
	$F = -kx$
	$F \leq \mu N$
	$F = \frac{Gm_1m_2}{r^2}$
	$\theta_f = \theta_i + \omega_i t + \frac{1}{2} \alpha t^2$
	$\omega_f = \omega_i + \alpha t$
	$v = r\omega$
	$a = r\alpha$
	$\mathbf{r}_{cm} = \frac{\Sigma m\mathbf{r}}{\Sigma m}$
	$I = \Sigma mr^2$
	$\boldsymbol{\tau} = \mathbf{r} \times \mathbf{F} = rF \sin \theta$
	$\Sigma \boldsymbol{\tau} = I\boldsymbol{\alpha}$
	$P = \rho gh$
	$F = \rho Vg$
	$A_1v_1 = A_2v_2$
	$P + \frac{1}{2}\rho v^2 + \rho gy = \text{constant}$

FORMULAS (continued)

Energy, Momentum, and Heat Transfer	Electricity and Magnetism
$W = Fd \cos \theta$	$F = \frac{k_e q_1 q_2}{r^2}$
$P = \frac{\Delta W}{\Delta t} = Fv \cos \theta$	$\mathbf{E} = \frac{\mathbf{F}}{q_0}$
$KE = \frac{1}{2} mv^2$	$PE = qV$
$PE = mgh$	$V = -Ed$
$PE = \frac{1}{2} kx^2$	$V = \frac{k_e q}{r}$
Efficiency = $\frac{\text{Useful output energy}}{\text{Total input energy}} \times 100\%$	$R = \frac{\rho \ell}{A}$
$\mathbf{p} = m\mathbf{v}$	$V = IR$
$\Delta \mathbf{p} = \mathbf{F} \Delta t$	$I = \frac{\Delta q}{\Delta t}$
$\Delta \ell = \alpha \ell_0 \Delta T$	$R = \sum R_i$
$Q = mc \Delta T$	$\frac{1}{R} = \sum \frac{1}{R_i}$
$Q = mL$	$P = IV$
$\frac{\Delta Q}{\Delta t} = \frac{kA \Delta T}{d}$	$C = \frac{Q}{V}$
$\Delta S = \frac{Q}{T}$	$C = \sum C_i$
$PV = nRT$	$\frac{1}{C} = \sum \frac{1}{C_i}$
$\frac{1}{2} \overline{mv^2} = \frac{3}{2} k_b T$	$\mathbf{F} = q\mathbf{v} \times \mathbf{B}$
$\Delta E = Q - W$	$\mathbf{F} = I\ell \times \mathbf{B}$
$W = P \Delta V$	$B = \frac{\mu_0 I}{2\pi r}$
$e = \frac{T_h - T_c}{T_h}$	$B = \frac{\mu_0 NI}{\ell}$
$KE = \frac{1}{2} I \omega^2$	$\varepsilon_{\text{ave}} = -\frac{\Delta \phi}{\Delta t}$
$\mathbf{L} = \mathbf{r} \times \mathbf{p}$	$\phi = B_{\perp} A$
$L = I \omega$	
$T_K = 273 + T_C$	In questions on electricity and magnetism, the term <i>current</i> refers to "conventional current" and the use of the right-hand rule is assumed.

FORMULAS (continued)

Waves, Sound, and Light	Modern Physics
$T = \frac{2\pi}{\omega}$	$E = hf$
$a = -\omega^2 x$	$E = \gamma mc^2$
$x = A \sin \omega t$	$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$
$T = 2\pi \sqrt{\frac{m}{k}}$	$hf = \phi + eV$
$T = 2\pi \sqrt{\frac{L}{g}}$	$\Delta x \Delta p \geq h$
$v = f\lambda$	$\Delta E \Delta t \geq h$
$v = \sqrt{\frac{T}{\mu}}$	$p = \frac{h}{\lambda}$
$v = \sqrt{\frac{\gamma RT}{M}}$	
$2L = n\lambda$, n is an integer	
$4L = n\lambda$, n is odd	
$n_1 \sin \theta_1 = n_2 \sin \theta_2$	
$n = \frac{c}{v}$	
$\frac{1}{f} = \frac{1}{s_i} + \frac{1}{s_o}$	
$M = \frac{h_1}{h_0} = -\frac{s_1}{s_0}$	
$d \sin \theta = m\lambda$	
$I = I_0 \cos^2 \theta$	

NOTES FOR PHYSICS TEST

Not all formulas necessary are listed, nor are all formulas listed used on this test.

In questions on electricity and magnetism, the term *current* refers to "conventional current" and the use of the right-hand rule is assumed.