

CONSTANTS

Description	Value
Acceleration of gravity on Earth (g)	9.81 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	9.11×10^{-31} kg
Proton rest mass	1.67×10^{-27} kg
Charge of electron	-1.60×10^{-19} C
Coulomb's constant (k_e)	9.0×10^9 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	6.02×10^{23} mol ⁻¹

FORMULAS

NOTES

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.

Mathematics	Matter and Its Interactions
$C = 2\pi r$ $A = \pi r^2$ $SA = 4\pi r^2$ $V = \frac{4}{3}\pi r^3$	$E = hf$ $E = mc^2$ $\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$ $hf = \phi + eV$ $\Delta x \Delta p \geq h$ $\Delta E \Delta t \geq h$ $p = \frac{h}{\lambda}$

FORMULAS (continued)

Motion and Stability: Forces and Interactions	Motion and Stability: Forces and Interactions in Fields and Circuits
$v_f = v_i + at$ $x_f = x_i + v_i t + \frac{1}{2} at^2$ $v_f^2 - v_i^2 = 2a(x_f - x_i)$ $F = -kx$ $F \leq \mu N$ $F \Delta t = \Delta p$ $\theta_f = \theta_i + \omega_i t + \frac{1}{2} \alpha t^2$ $\omega_f = \omega_i + \alpha t$ $v = r\omega$ $a = r\alpha$ $r = \frac{\sum mr}{\sum m}$ $I = \sum mr^2$ $\boldsymbol{\tau} = \mathbf{r} \times \mathbf{F}$ $\sum \boldsymbol{\tau} = I\boldsymbol{a}$ $\mathbf{L} = \mathbf{r} \times \mathbf{p}$ $L = I\omega$	$F = \frac{Gm_1m_2}{r^2}$ $F = \frac{k_e q_1 q_2}{r^2}$ $a_c = \frac{v^2}{r}$ $\mathbf{E} = \frac{\mathbf{F}}{q_0}$ $\mathbf{E} = \left \frac{\Delta V}{\Delta r} \right $ $V = \frac{k_e q}{r}$ $R = \frac{\rho \ell}{A}$ $V = IR$ $R_s = \sum R_i$ $\frac{1}{R_p} = \sum \frac{1}{R_i}$ $P = IV$ $C = \frac{Q}{V}$ $C_p = \sum C_i$ $\frac{1}{C} = \sum \frac{1}{C_i}$ $\mathbf{F} = q\mathbf{v} \times \mathbf{B}$ $\mathbf{F} = I\boldsymbol{\ell} \times \mathbf{B}$ $\mathcal{E}_{\text{ave}} = -\frac{\Delta \phi}{\Delta t}$ $\phi = B_{\perp} A$

FORMULAS (continued)

Energy	Waves and Their Applications in Technologies for Information Transfer
$W = F\Delta x$	$a = -\omega^2 x$
$KE = \frac{1}{2}mv^2$	$x = A \sin \omega t$
$KE = \frac{1}{2}I\omega^2$	$T = 2\pi\sqrt{\frac{m}{k}}$
$PE = mgh$	$T = 2\pi\sqrt{\frac{L}{g}}$
$PE = \frac{1}{2}kx^2$	$v = f\lambda$
$\Delta \ell = \alpha \ell_0 \Delta T$	$v = \sqrt{\frac{T}{\mu}}$
$Q = mc\Delta T$	$2L = n\lambda, n \text{ is an integer}$
$Q = mL$	$4L = n\lambda, n \text{ is odd}$
$\frac{Q}{\Delta t} = \frac{kA\Delta T}{d}$	$n_1 \sin \theta_1 = n_2 \sin \theta_2$
$PV = nRT$	$n = \frac{c}{v}$
$\frac{1}{2}m\overline{v^2} = \frac{3}{2}k_bT$	$\frac{1}{f} = \frac{1}{s_i} + \frac{1}{s_o}$
$\Delta E = Q - P\Delta V$	$M = \frac{h_i}{h_o} = -\frac{s_i}{s_o}$
	$d \sin \theta = m\lambda$
	$I = I_0 \cos^2 \theta$