CONSTANTS

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

FORMULAS

Mathematics

$C = 2\pi r$

$A = \pi r^2$

$SA = 4\pi r^2$

$V = \frac{4}{3}\pi r^3$

(a, b) denotes a vector with an x-component of a and a y-component of b.

Force and Motion

$v_f = v_i + at$

$x_f = x_i + v_i t + \frac{1}{2}at^2$

$v_f^2 - v_i^2 = 2a(x_f - x_i)$

$a_c = \frac{v^2}{r}$

$\sum \mathbf{F} = m\mathbf{a}$

$F = -kx$

$F \leq \mu N$

$F = \frac{Gm_1m_2}{r^2}$

$\theta_f = \theta_i + \omega_i t + \frac{1}{2}\alpha t^2$

$\omega_f = \omega_i + \alpha t$

$v = r\omega$

$a = r\alpha$

$\mathbf{r}_{cm} = \frac{\sum m\mathbf{r}}{\sum m}$

$I = \sum mr^2$

$\boldsymbol{\tau} = \mathbf{r} \times \mathbf{F}$

$\sum \boldsymbol{\tau} = I\boldsymbol{\alpha}$

$P = \rho gh$

$F = \rho Vg$

$A_1v_1 = A_2v_2$

$P + \frac{1}{2}\rho v^2 + \rho gy = \text{constant}$

FORMULAS (continued)

Energy, Momentum, and Heat Transfer

$W = Fd \cos \theta$

$P = \frac{\Delta W}{\Delta t}$

$KE = \frac{1}{2}mv^2$

$PE = mgh$

$PE = \frac{1}{2}kx^2$

$\mathbf{p} = m\mathbf{v}$

$\Delta\mathbf{p} = \mathbf{F}\Delta t$

$\Delta\ell = \alpha\ell_0\Delta T$

$Q = mc\Delta T$

$Q = mL$

$\frac{\Delta Q}{\Delta t} = \frac{kA\Delta T}{d}$

$PV = nRT$

$\frac{1}{2}m\overline{v^2} = \frac{3}{2}k_bT$

$\Delta E = Q - W$

$W = P\Delta V$

$e = \frac{T_h - T_c}{T_h}$

$KE = \frac{1}{2}I\omega^2$

$\mathbf{L} = \mathbf{r} \times \mathbf{p}$

$L = I\omega$

$T_k = 273 + T_c$

Electricity and Magnetism

$F = \frac{k_e q_1 q_2}{r^2}$

$\mathbf{E} = \frac{\mathbf{F}}{q_0}$

$PE = qV$

$V = -Ed$

$V = \frac{k_e q}{r}$

$R = \frac{\rho\ell}{A}$

$V = IR$

$R = \sum R_i$

$\frac{1}{R} = \sum \frac{1}{R_i}$

$P = IV$

$C = \frac{Q}{V}$

$C = \sum C_i$

$\frac{1}{C} = \sum \frac{1}{C_i}$

$\mathbf{F} = q\mathbf{v} \times \mathbf{B}$

$\mathbf{F} = I\boldsymbol{\ell} \times \mathbf{B}$

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

$B = \frac{\mu_0 NI}{\ell}$

$\varepsilon_{ave} = -\frac{\Delta\phi}{\Delta t}$

$\phi = B_\perp A$

In questions on electricity and magnetism, the term *current* 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	
$n_1 \sin \theta_1 = n_2 \sin \theta_2$	
$n = \frac{c}{v}$	
$\frac{1}{f} = \frac{1}{s_i} + \frac{1}{s_0}$	
$M = \frac{h_i}{h_0} = -\frac{s_i}{s_0}$	
$d \sin \theta = m\lambda$	
$I = I_0 \cos^2 \theta$	

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.