

# IB Physics SL & HL Formula Sheet

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Fundamental Constants		
Symbol	Quantity	Approximate value
$c$	Free space (vacuum) speed of light	$3.00 \times 10^8 \text{ m s}^{-1}$
$G$	Gravitational constant	$6.67 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$
$M_p$	Proton mass	$1.67 \times 10^{-27} \text{ kg}$
$m_e$	Electron mass	$9.11 \times 10^{-31} \text{ kg}$
$h$	Planck's constant	$6.63 \times 10^{-34} \text{ J s}$
$k$	Boltzmann constant	$1.38 \times 10^{-23} \text{ J K}^{-1}$
$R$	Gas constant	$8.31 \text{ J K}^{-1} \text{ mol}^{-1}$
$N_A$	Avogadro constant	$6.02 \times 10^{23} \text{ mol}^{-1}$
$\mu_0$	Free space permeability	$4\pi \times 10^{-7} \text{ T m A}^{-1}$
$\epsilon_0$	Free space permittivity	$8.85 \times 10^{-12} \text{ C}^2 \text{ J}^{-1} \text{ m}^{-1}$
$e$	Elementary charge	$1.60 \times 10^{-19} \text{ C}$
$m_u$	Atomic mass unit	$1.66 \times 10^{-27} \text{ kg}$
$m_p$	Proton rest mass	$1.67 \times 10^{-27} \text{ kg}$
$m_n$	Neutron rest mass	$1.67 \times 10^{-27} \text{ kg}$
$m_e$	Electron rest mass	$9.11 \times 10^{-31} \text{ kg}$
$\sigma$	Stefan-Boltzmann constant	$5.67 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$
$\alpha$	Fine structure constant	$7.30 \times 10^{-3}$
$\beta$	Refractive index of air	$1.0003$
$\mu_0$	Permeability of free space	$4\pi \times 10^{-7} \text{ T m A}^{-1}$
$\epsilon_0$	Permittivity of free space	$8.85 \times 10^{-12} \text{ C}^2 \text{ J}^{-1} \text{ m}^{-1}$

Metric Prefixes			
Symbol	Prefix	Factor	Value
$\text{p}$	pico	$10^{-12}$	$10^{-12}$
$\text{n}$	nano	$10^{-9}$	$10^{-9}$
$\mu$	micro	$10^{-6}$	$10^{-6}$
$\text{m}$	milli	$10^{-3}$	$10^{-3}$
$\text{c}$	centi	$10^{-2}$	$10^{-2}$
$\text{d}$	deci	$10^{-1}$	$10^{-1}$
$\text{D}$	deca	$10^1$	$10^1$
$\text{H}$	hecto	$10^2$	$10^2$
$\text{k}$	kilo	$10^3$	$10^3$
$\text{M}$	mega	$10^6$	$10^6$
$\text{G}$	giga	$10^9$	$10^9$
$\text{T}$	tera	$10^{12}$	$10^{12}$

Geometry and Trigonometry Equations	
Circumference (circle)	$C = 2\pi r$
Area (triangle)	$A = \frac{1}{2}bh$
Area (circle)	$A = \pi r^2$
Curved surface area (cylinder)	$A = 2\pi rh$
Surface area (sphere)	$A = 4\pi r^2$
Volume (sphere)	$V = \frac{4}{3}\pi r^3$
Volume (cylinder)	$V = \pi r^2 h$
Volume (cone)	$V = \frac{1}{3}\pi r^2 h$
Volume (pyramid)	$V = \frac{1}{3}Ab$
Volume (prism)	$V = Ab$
Trigonometric relationships	$\sin^2 \theta + \cos^2 \theta = 1$ $\tan \theta = \frac{\sin \theta}{\cos \theta}$
Vector Components	$A_x = A \cos \theta$ $A_y = A \sin \theta$ $A_x$ is the horizontal component of vector $A$ , $A_y$ is the vertical component of vector $A$ , $\theta$ is the angle relative to the horizontal

Unit Conversions	
1 year (yr)	$\frac{365 \text{ d}}{\text{yr}}$
Temperature (K)	$T(\text{K}) = T(^{\circ}\text{C}) + 273$
1 light year (ly)	$9.46 \times 10^{15} \text{ m}$
1 parsec (pc)	$3.26 \text{ ly}$
1 astronomical unit (AU)	$1.50 \times 10^{11} \text{ m}$
1 fathom (fath)	$1.83 \times 10^3 \text{ m}$
$\text{m}^3$	$1.36 \times 10^{-6} \text{ km}^3$

Uncertainty Calculations	
Addition and Subtraction	$\Delta x = a \pm b$ $\Delta x = \Delta a + \Delta b$
Multiplication and Division	$\Delta x = \frac{\Delta a}{a}$ $\Delta x = \frac{\Delta a}{a} + \frac{\Delta b}{b} + \frac{\Delta c}{c}$
Exponentiation	$\Delta x = a^n$ $\Delta x = n \left( \frac{\Delta a}{a} \right)$

Where  $a, b, c$  and  $n$  are quantities with absolute uncertainties  $\Delta a, \Delta b, \Delta c$  and  $\Delta x$

# Physics Hl Ib Revision Guide Schcl

**Arturo Cuomo**



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