FORMULA SHEET

IB Physics data booklet guide for the 2025 syllabus

The booklet gives equations for themes A to E, constants and conversions, but not definitions or derived results such as Kepler's third law, which you must recall.

IN THE BOOKLET printed in the official booklet or sheet in the exam LEARN IT students must recall it

Mathematics and uncertainties

Printed at the front of the booklet and used in every theme.

Area of a triangle b base, h perpendicular height	$A = \frac{1}{2}bh$	IN THE BOOKLET
Area of a circle r radius	$A = \pi r^2$	IN THE BOOKLET
Circumference of a circle	$C = 2\pi r$	IN THE BOOKLET
Volume of a cuboid	$V = lwh$	IN THE BOOKLET
Volume of a cylinder	$V = \pi r^2 h$	IN THE BOOKLET
Volume of a prism A area of cross-section, h length	$V = Ah$	IN THE BOOKLET
Volume of a sphere	$V = \frac{4}{3}\pi r^3$	IN THE BOOKLET
Curved surface area of a cylinder	$A = 2\pi rh$	IN THE BOOKLET
Horizontal component of a vector θ is the angle to the horizontal	$A_H = A\cos\theta$	IN THE BOOKLET
Vertical component of a vector	$A_V = A\sin\theta$	IN THE BOOKLET
Tangent in terms of sine and cosine	$\tan\theta = \frac{\sin\theta}{\cos\theta}$	IN THE BOOKLET
Pythagorean identity	$\sin^2\theta + \cos^2\theta = 1$	IN THE BOOKLET
Uncertainty in a sum or difference Add absolute uncertainties	$y = a \pm b \Rightarrow \Delta y = \Delta a + \Delta b$	IN THE BOOKLET
Uncertainty in a product or quotient Add fractional (or percentage) uncertainties	$y = \frac{ab}{c} \Rightarrow \frac{\Delta y}{y} = \frac{\Delta a}{a} + \frac{\Delta b}{b} + \frac{\Delta c}{c}$	IN THE BOOKLET
Uncertainty in a power Multiply the fractional uncertainty by the power	$y = a^n \Rightarrow \frac{\Delta y}{y} = \lvert n\rvert\frac{\Delta a}{a}$	IN THE BOOKLET

Fundamental constants

Approximate values as printed in the booklet; use these in calculations unless a question gives others.

Acceleration of free fall Earth's surface	$g = 9.8\ \text{m s}^{-2}$	IN THE BOOKLET
Gravitational constant	$G = 6.67 \times 10^{-11}\ \text{N m}^2\ \text{kg}^{-2}$	IN THE BOOKLET

Avogadro constant	$N_A = 6.02 \times 10^{23}\ \text{mol}^{-1}$	IN THE BOOKLET
Gas constant	$R = 8.31\ \text{J K}^{-1}\ \text{mol}^{-1}$	IN THE BOOKLET
Boltzmann constant	$k_B = 1.38 \times 10^{-23}\ \text{J K}^{-1}$	IN THE BOOKLET
Stefan-Boltzmann constant	$\sigma = 5.67 \times 10^{-8}\ \text{W m}^{-2}\ \text{K}^{-4}$	IN THE BOOKLET
Coulomb constant	$k = 8.99 \times 10^{9}\ \text{N m}^2\ \text{C}^{-2}$	IN THE BOOKLET
Permittivity of free space	$\varepsilon_0 = 8.85 \times 10^{-12}\ \text{C}^2\ \text{N}^{-1}\ \text{m}^{-2}$	IN THE BOOKLET
Permeability of free space	$\mu_0 = 4\pi \times 10^{-7}\ \text{T m A}^{-1}$	IN THE BOOKLET
Speed of light in vacuum	$c = 3.00 \times 10^{8}\ \text{m s}^{-1}$	IN THE BOOKLET
Planck constant	$h = 6.63 \times 10^{-34}\ \text{J s}$	IN THE BOOKLET
Elementary charge	$e = 1.60 \times 10^{-19}\ \text{C}$	IN THE BOOKLET
Electron rest mass	$m_e = 9.110 \times 10^{-31}\ \text{kg} = 0.000549\ \text{u} = 0.511\ \text{MeV c}^{-2}$	IN THE BOOKLET
Proton rest mass	$m_p = 1.673 \times 10^{-27}\ \text{kg} = 1.007276\ \text{u} = 938\ \text{MeV c}^{-2}$	IN THE BOOKLET
Neutron rest mass	$m_n = 1.675 \times 10^{-27}\ \text{kg} = 1.008665\ \text{u} = 940\ \text{MeV c}^{-2}$	IN THE BOOKLET
Unified atomic mass unit	$1\ \text{u} = 1.661 \times 10^{-27}\ \text{kg} = 931.5\ \text{MeV c}^{-2}$	IN THE BOOKLET
Solar constant Intensity of sunlight at the top of Earth's atmosphere	$S = 1.36 \times 10^{3}\ \text{W m}^{-2}$	IN THE BOOKLET
Fermi radius Used in the nuclear radius relationship (HL)	$R_0 = 1.20 \times 10^{-15}\ \text{m}$	IN THE BOOKLET

Unit conversions

Also in the booklet: the metric (SI) prefix table from peta (10^{15}) to femto (10^{-15}), the electrical circuit symbols and the electromagnetic spectrum chart.

Radians and degrees	$1\ \text{rad} = \dfrac{180^\circ}{\pi}$	IN THE BOOKLET
Kelvin and Celsius	$T(\text{K}) = T(^\circ\text{C}) + 273$	IN THE BOOKLET
Light year	$1\ \text{ly} = 9.46 \times 10^{15}\ \text{m}$	IN THE BOOKLET
Parsec	$1\ \text{pc} = 3.26\ \text{ly}$	IN THE BOOKLET
Astronomical unit	$1\ \text{AU} = 1.50 \times 10^{11}\ \text{m}$	IN THE BOOKLET
Kilowatt-hour	$1\ \text{kWh} = 3.60 \times 10^{6}\ \text{J}$	IN THE BOOKLET
Planck constant times speed of light Handy for photon energy E = hc/λ	$hc = 1.99 \times 10^{-25}\ \text{J m} = 1.24 \times 10^{-6}\ \text{eV m}$	IN THE BOOKLET

A.1 Kinematics

Theme A, space, time and motion. SL and HL.

Displacement from average velocity u initial, v final velocity, t time; constant acceleration	$s = \frac{u+v}{2}t$	IN THE BOOKLET
Final velocity a acceleration	$v = u + at$	IN THE BOOKLET
Displacement	$s = ut + \frac{1}{2}at^2$	IN THE BOOKLET
Velocity without time	$v^2 = u^2 + 2as$	IN THE BOOKLET

A.2 Forces and momentum

Theme A. SL and HL.

Static friction limit mu_s coefficient of static friction, F_N normal force	$F_f \leq \mu_s F_N$	IN THE BOOKLET
Dynamic friction	$F_f = \mu_d F_N$	IN THE BOOKLET
Hooke's law k spring constant, x extension	$F_H = -kx$	IN THE BOOKLET
Viscous drag on a sphere eta fluid viscosity, r radius, v speed	$F_d = 6\pi\eta r v$	IN THE BOOKLET
Buoyancy ρ fluid density, V volume displaced	$F_b = \rho V g$	IN THE BOOKLET
Weight	$F_g = mg$	IN THE BOOKLET
Linear momentum	$p = mv$	IN THE BOOKLET
Impulse	$J = F\Delta t$	IN THE BOOKLET
Newton's second law The second form allows changing mass	$F = ma = \frac{\Delta p}{\Delta t}$	IN THE BOOKLET
Centripetal acceleration ω angular speed, T period	$a = \frac{v^2}{r} = \omega^2 r = \frac{4\pi^2 r}{T^2}$	IN THE BOOKLET
Speed in circular motion	$v = \frac{2\pi r}{T} = \omega r$	IN THE BOOKLET

A.3 Work, energy and power

Theme A. SL and HL.

Work done θ is the angle between force and displacement	$W = Fs\cos\theta$	IN THE BOOKLET
Kinetic energy	$E_k = \frac{1}{2}mv^2 = \frac{p^2}{2m}$	IN THE BOOKLET
Change in gravitational potential energy Near the Earth's surface only	$\Delta E_p = mg\Delta h$	IN THE BOOKLET
Elastic potential energy	$E_H = \frac{1}{2}k\,\Delta x^2$	IN THE BOOKLET

Power	$P = \frac{\Delta W}{\Delta t} = Fv$	IN THE BOOKLET
Efficiency	$\eta = \frac{E_{\text{output}}}{E_{\text{input}}} = \frac{P_{\text{output}}}{P_{\text{input}}}$	IN THE BOOKLET

A.4 Rigid body mechanics

Theme A. Higher level content only.

Torque HL only. r distance from the axis	$\tau = Fr\sin\theta$	IN THE BOOKLET
Angular displacement from average angular velocity HL only. Uniform angular acceleration	$\Delta\theta = \frac{\omega_f + \omega_i}{2}t$	IN THE BOOKLET
Final angular velocity HL only. alpha angular acceleration	$\omega_f = \omega_i + \alpha t$	IN THE BOOKLET
Angular displacement HL only.	$\Delta\theta = \omega_i t + \frac{1}{2}\alpha t^2$	IN THE BOOKLET
Angular velocity without time HL only.	$\omega_f^2 = \omega_i^2 + 2\alpha\Delta\theta$	IN THE BOOKLET
Moment of inertia of point masses HL only. Shapes other than point masses are given in the question	$I = \sum mr^2$	IN THE BOOKLET
Newton's second law for rotation HL only.	$\tau = I\alpha$	IN THE BOOKLET
Angular momentum HL only.	$L = I\omega$	IN THE BOOKLET
Angular impulse HL only.	$\Delta L = \tau\Delta t = \Delta(I\omega)$	IN THE BOOKLET
Rotational kinetic energy HL only.	$E_k = \frac{1}{2}I\omega^2 = \frac{L^2}{2I}$	IN THE BOOKLET

A.5 Galilean and special relativity

Theme A. Higher level content only.

Galilean position HL only. Frame S' moves at speed v along x	$x' = x - vt$	IN THE BOOKLET
Galilean time HL only.	$t' = t$	IN THE BOOKLET
Galilean velocity addition HL only.	$u' = u - v$	IN THE BOOKLET
Lorentz factor HL only.	$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$	IN THE BOOKLET
Lorentz position HL only.	$x' = \gamma(x - vt)$	IN THE BOOKLET
Lorentz time HL only.	$t' = \gamma\left(t - \frac{vx}{c^2}\right)$	IN THE BOOKLET
Relativistic velocity addition HL only.	$u' = \frac{u - v}{1 - \frac{uv}{c^2}}$	IN THE BOOKLET

Spacetime interval HL only. Same in every inertial frame	$(\Delta s)^2 = (c\Delta t)^2 - \Delta x^2$	IN THE BOOKLET
Time dilation HL only. Δt_0 is the proper time	$\Delta t = \gamma\, \Delta t_0$	IN THE BOOKLET
Length contraction HL only. L_0 is the proper length	$L = \dfrac{L_0}{\gamma}$	IN THE BOOKLET
Angle of the moving frame on a spacetime diagram HL only.	$\tan\theta = \dfrac{v}{c}$	IN THE BOOKLET

B.1 Thermal energy transfers

Theme B, the particulate nature of matter. SL and HL.

Density	$\rho = \dfrac{m}{V}$	IN THE BOOKLET
Mean kinetic energy per particle (ideal gas) T in kelvin	$E_k = \dfrac{3}{2}k_B T$	IN THE BOOKLET
Thermal energy for a temperature change c specific heat capacity	$Q = mc\,\Delta T$	IN THE BOOKLET
Thermal energy for a phase change L specific latent heat	$Q = mL$	IN THE BOOKLET
Rate of conduction k thermal conductivity, A cross-section	$\dfrac{\Delta Q}{\Delta t} = kA\dfrac{\Delta T}{\Delta x}$	IN THE BOOKLET
Stefan-Boltzmann law (luminosity) L power radiated, A surface area	$L = \sigma A T^4$	IN THE BOOKLET
Apparent brightness d distance to the source	$b = \dfrac{L}{4\pi d^2}$	IN THE BOOKLET
Wien's displacement law	$\lambda_{\max} T = 2.9 \times 10^{-3}\ \mathrm{m\,K}$	IN THE BOOKLET

B.2 Greenhouse effect

Theme B. SL and HL.

Emissivity	$\text{emissivity} = \dfrac{\text{power radiated per unit area}}{\sigma T^4}$	IN THE BOOKLET
Albedo	$\text{albedo} = \dfrac{\text{total scattered power}}{\text{total incident power}}$	IN THE BOOKLET

B.3 Gas laws

Theme B. SL and HL.

Pressure	$P = \dfrac{F}{A}$	IN THE BOOKLET
Amount of substance N number of molecules	$n = \dfrac{N}{N_A}$	IN THE BOOKLET
Combined gas law T in kelvin	$\dfrac{PV}{T} = \text{constant}$	IN THE BOOKLET
Ideal gas law (moles)	$PV = nRT$	IN THE BOOKLET

Ideal gas law (molecules)	$PV = Nk_BT$	IN THE BOOKLET
Pressure from kinetic theory Mean square speed of the molecules	$P = \frac{1}{3}\rho\langle v^2\rangle$	IN THE BOOKLET
Internal energy of a monatomic ideal gas	$U = \frac{3}{2}nRT = \frac{3}{2}Nk_BT$	IN THE BOOKLET

B.4 Thermodynamics

Theme B. Higher level content only.

First law of thermodynamics HL only. Q heat added, W work done by the gas	$Q = \Delta U + W$	IN THE BOOKLET
Work done by a gas HL only. Constant pressure	$W = P\,\Delta V$	IN THE BOOKLET
Change in internal energy HL only. Monatomic ideal gas	$\Delta U = \frac{3}{2}nR\,\Delta T = \frac{3}{2}Nk_B\,\Delta T$	IN THE BOOKLET
Entropy change HL only.	$\Delta S = \frac{\Delta Q}{T}$	IN THE BOOKLET
Entropy and microstates HL only. Omega number of microstates	$S = k_B \ln \Omega$	IN THE BOOKLET
Adiabatic change (monatomic ideal gas) HL only.	$PV^{5/3} = \text{constant}$	IN THE BOOKLET
Efficiency of a heat engine HL only.	$\eta = \frac{\text{useful work}}{\text{input energy}}$	IN THE BOOKLET
Carnot efficiency HL only. Temperatures in kelvin	$\eta_{\text{Carnot}} = 1 - \frac{T_c}{T_h}$	IN THE BOOKLET

B.5 Current and circuits

Theme B. SL and HL.

Electric current	$I = \frac{\Delta q}{\Delta t}$	IN THE BOOKLET
Potential difference	$V = \frac{W}{q}$	IN THE BOOKLET
Resistance	$R = \frac{V}{I}$	IN THE BOOKLET
Resistivity A cross-sectional area, L length	$\rho = \frac{RA}{L}$	IN THE BOOKLET
Electrical power	$P = IV = I^2R = \frac{V^2}{R}$	IN THE BOOKLET
Resistors in series Same current I; voltages add	$R_s = R_1 + R_2 + \dots$	IN THE BOOKLET
Resistors in parallel Same voltage V; currents add	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$	IN THE BOOKLET
EMF and internal resistance R external resistance, r internal resistance	$\varepsilon = I(R + r)$	IN THE BOOKLET

C.1 Simple harmonic motion

Theme C, wave behaviour. The first group is SL and HL.

Defining equation of SHM	$a = -\omega^2 x$	IN THE BOOKLET
Period, frequency and angular frequency	$T = \frac{1}{f} = \frac{2\pi}{\omega}$	IN THE BOOKLET
Mass on a spring	$T = 2\pi\sqrt{\frac{m}{k}}$	IN THE BOOKLET
Simple pendulum Small angles	$T = 2\pi\sqrt{\frac{l}{g}}$	IN THE BOOKLET
Displacement HL only. x_0 amplitude, φ phase constant	$x = x_0 \sin(\omega t + \phi)$	IN THE BOOKLET
Velocity HL only.	$v = \omega x_0 \cos(\omega t + \phi)$	IN THE BOOKLET
Velocity from displacement HL only.	$v = \pm\omega\sqrt{x_0^2 - x^2}$	IN THE BOOKLET
Total energy HL only.	$E_T = \frac{1}{2}m\omega^2 x_0^2$	IN THE BOOKLET
Potential energy HL only.	$E_p = \frac{1}{2}m\omega^2 x^2$	IN THE BOOKLET

C.2 Wave model

Theme C. SL and HL.

Wave speed	$v = f\lambda = \frac{\lambda}{T}$	IN THE BOOKLET

C.3 Wave phenomena

Theme C. The first four rows are SL and HL.

Snell's law n refractive index, θ measured from the normal	$\frac{n_1}{n_2} = \frac{\sin\theta_2}{\sin\theta_1} = \frac{v_2}{v_1}$	IN THE BOOKLET
Constructive interference n = 0, 1, 2, ...	$\text{path difference} = n\lambda$	IN THE BOOKLET
Destructive interference	$\text{path difference} = \left(n + \frac{1}{2}\right)\lambda$	IN THE BOOKLET
Young's double slit fringe spacing D slit to screen, d slit separation	$s = \frac{\lambda D}{d}$	IN THE BOOKLET
Single-slit diffraction (first minimum) HL only. b slit width, small angles	$\theta = \frac{\lambda}{b}$	IN THE BOOKLET
Diffraction grating HL only. d grating spacing, n order	$n\lambda = d\sin\theta$	IN THE BOOKLET

C.5 Doppler effect

Theme C. The first row is SL and HL.

Doppler shift (low speeds, light or sound) v relative speed of source and observer	$\frac{\Delta f}{f} = \frac{\Delta \lambda}{\lambda} \approx \frac{v}{c}$	IN THE BOOKLET
Moving source (sound) HL only. Minus when the source moves towards the observer	$f' = f\left(\frac{v}{v \pm u_s}\right)$	IN THE BOOKLET
Moving observer (sound) HL only. Plus when the observer moves towards the source	$f' = f\left(\frac{v \pm u_o}{v}\right)$	IN THE BOOKLET

D.1 Gravitational fields

Theme D, fields. The first two rows are SL and HL.

Newton's law of gravitation	$F = G\frac{m_1 m_2}{r^2}$	IN THE BOOKLET
Gravitational field strength	$g = \frac{F}{m} = G\frac{M}{r^2}$	IN THE BOOKLET
Gravitational potential energy HL only.	$E_p = -G\frac{m_1 m_2}{r}$	IN THE BOOKLET
Gravitational potential HL only.	$V_g = -G\frac{M}{r}$	IN THE BOOKLET
Field strength from potential gradient HL only.	$g = -\frac{\Delta V_g}{\Delta r}$	IN THE BOOKLET
Work in a gravitational field HL only.	$W = m\,\Delta V_g$	IN THE BOOKLET
Escape speed HL only.	$v_{\text{esc}} = \sqrt{\frac{2GM}{r}}$	IN THE BOOKLET
Orbital speed (circular orbit) HL only.	$v_{\text{orbital}} = \sqrt{\frac{GM}{r}}$	IN THE BOOKLET

D.2 Electric and magnetic fields

Theme D. The first three rows are SL and HL.

Coulomb's law	$F = k\frac{q_1 q_2}{r^2}, \quad k = \frac{1}{4\pi\varepsilon_0}$	IN THE BOOKLET
Electric field strength	$E = \frac{F}{q}$	IN THE BOOKLET
Uniform field between parallel plates	$E = \frac{V}{d}$	IN THE BOOKLET
Electric potential energy HL only.	$E_p = k\frac{q_1 q_2}{r}$	IN THE BOOKLET
Electric potential HL only.	$V_e = \frac{kQ}{r}$	IN THE BOOKLET
Field strength from potential gradient HL only.	$E = -\frac{\Delta V_e}{\Delta r}$	IN THE BOOKLET

Work in an electric field HL only.	$W = q\,\Delta V_e$	IN THE BOOKLET

D.3 Motion in electromagnetic fields

Theme D. SL and HL.

Force on a moving charge θ is the angle between v and B	$F = qvB\sin\theta$	IN THE BOOKLET
Force on a current-carrying wire	$F = BIL\sin\theta$	IN THE BOOKLET
Force per unit length between parallel wires r separation of the wires	$\frac{F}{L} = \mu_0\frac{I_1 I_2}{2\pi r}$	IN THE BOOKLET

D.4 Induction

Theme D. Higher level content only (there is no SL content in D.4).

Magnetic flux HL only. θ is the angle between B and the normal to the area	$\Phi = BA\cos\theta$	IN THE BOOKLET
Faraday's law HL only. N number of turns	$\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$	IN THE BOOKLET
EMF in a moving conductor HL only. Conductor moves perpendicular to B	$\varepsilon = BvL$	IN THE BOOKLET

E.1 Structure of the atom

Theme E, nuclear and quantum physics.

Photon energy SL and HL	$E = hf$	IN THE BOOKLET
Nuclear radius HL only. A nucleon number	$R = R_0 A^{1/3}$	IN THE BOOKLET
Hydrogen energy levels (Bohr model) HL only.	$E = -\frac{13.6}{n^2}\ \text{eV}$	IN THE BOOKLET
Quantised angular momentum (Bohr model) HL only.	$mvr = \frac{nh}{2\pi}$	IN THE BOOKLET

E.2 Quantum physics

Theme E. Higher level content only.

Photoelectric effect HL only. Phi work function	$E_{\max} = hf - \Phi$	IN THE BOOKLET
De Broglie wavelength HL only.	$\lambda = \frac{h}{p}$	IN THE BOOKLET
Compton shift HL only. Photon scattered by an electron	$\lambda_f - \lambda_i = \Delta\lambda = \frac{h}{m_e c}(1-\cos\theta)$	IN THE BOOKLET

E.3 Radioactive decay

Theme E. The first row is SL and HL.

Mass-energy equivalence SL and HL	$E = mc^2$	IN THE BOOKLET
Radioactive decay law HL only. λ decay constant	$N = N_0 e^{-\lambda t}$	IN THE BOOKLET
Activity HL only.	$A = \lambda N = \lambda N_0 e^{-\lambda t}$	IN THE BOOKLET
Half-life HL only.	$T_{1/2} = \dfrac{\ln 2}{\lambda}$	IN THE BOOKLET

E.5 Fusion and stars

Theme E. SL and HL.

Stellar parallax	$d(\text{parsec}) = \dfrac{1}{p(\text{arc-second})}$	IN THE BOOKLET

Learn these: not in the booklet

Velocity and acceleration as rates of change

$$v = \frac{\Delta s}{\Delta t}, \quad a = \frac{\Delta v}{\Delta t}$$

Conservation of linear momentum

$$\sum p_{\text{before}} = \sum p_{\text{after}}$$

Work-energy principle

$$W = \Delta E_k$$

Centripetal force

$$F = \frac{mv^2}{r} = m\omega^2 r$$

Equilibrium

$$\sum F = 0, \quad \sum \tau = 0$$

Translational, then rotational equilibrium (HL).

Kepler's third law

$$\frac{T^2}{r^3} = \text{constant}, \quad T^2 = \frac{4\pi^2 r^3}{GM}$$

The second form is for a circular orbit.

Critical angle (from Snell's law with a 90 degree refracted ray)

$$\sin\theta_c = \frac{n_2}{n_1}$$

Refractive index in terms of wave speed

$$n = \frac{c}{v}$$

Intensity of a wave

$$I = \frac{P}{A}, \quad I \propto \frac{1}{r^2}$$

The inverse square law is for a point source.

Standing waves, string fixed at both ends

$$\lambda = \frac{2L}{n}, \quad f_n = \frac{nv}{2L}$$

Terminal potential difference

$$V = \varepsilon - Ir$$

Charge and energy in a circuit

$$q = It, \quad E = Pt = IVt$$

Electric field of a point charge

$$E = \frac{kQ}{r^2}$$

Radius of a charged particle's circular path in a magnetic field

$$r = \frac{mv}{qB}$$

Energy gained by a charge through a potential difference

$$\Delta E_k = qV$$

Photon energy from wavelength

$$E = \frac{hc}{\lambda}$$

Energy level transition

$$hf = E_i - E_f$$

Photoelectric threshold frequency

$$hf_0 = \Phi$$

Mass defect and binding energy

$$\Delta m = Zm_p + (A - Z)m_n - m_{\text{nucleus}}, \quad E_b = \Delta m\, c^2$$

Half-life (whole numbers of half-lives, SL)

$$N = N_0 \left(\frac{1}{2}\right)^{t/T_{1/2}}$$

Stellar radius from luminosity and temperature

$$L = 4\pi R^2 \sigma T^4 \Rightarrow R = \sqrt{\frac{L}{4\pi\sigma T^4}}$$

SHM maximum values (HL)

$$v_{\max} = \omega x_0, \quad a_{\max} = \omega^2 x_0$$

Using the sheet in the exam

- Learn the layout by theme, so in the exam you can find an equation in seconds instead of scanning every page.
- Check what each angle means before substituting: in F = qvB sin theta it is the angle between the velocity and the field.
- Equations in the booklet give magnitudes only, so decide directions and signs yourself from the physics.
- Convert units before using constants: radians for angular quantities, kelvin for temperature, kilograms for mass, metres for lengths.
- Use the printed constants to the given precision, then quote your answer to the same number of significant figures as the data in the question.

Checked against the official documents: International Baccalaureate Diploma Programme Physics (first assessment 2025), Physics data booklet, first assessment 2025, version 1.0 (IB). Updated 31 October 2026. Boards update their booklets from time to time: always practise with the version your exam uses. More free sheets and topic worksheets at curatedprep.com.