STUDY FORMULA BOOKLET

Edexcel International A Level Physics list of data, formulae and relationships

The IAL list prints 14 constants and equations by unit; you need not memorise them, but e.m.f., the potential divider and fringe spacing are not given.

IN THE BOOKLET printed in the official booklet LEARN IT not printed: students must recall it

Based on the official **Pearson Edexcel International Advanced Subsidiary/Advanced Level in Physics (YPH11/XPH11): List of data, formulae and relationships, as printed in the unit question papers (checked against the October 2023 WPH15/01 paper)**, with what to learn and exam tips added by CuratedPrep.

Data and constants

Acceleration of free fall Close to Earth's surface.	$g = 9.81\ \text{m s}^{-2}$	IN THE BOOKLET
Boltzmann constant	$k = 1.38 \times 10^{-23}\ \text{J K}^{-1}$	IN THE BOOKLET
Coulomb law constant	$k = \frac{1}{4\pi\varepsilon_0} = 8.99 \times 10^{9}\ \text{N m}^2\ \text{C}^{-2}$	IN THE BOOKLET
Electron charge	$e = -1.60 \times 10^{-19}\ \text{C}$	IN THE BOOKLET
Electron mass	$m_\text{e} = 9.11 \times 10^{-31}\ \text{kg}$	IN THE BOOKLET
Electronvolt	$1\ \text{eV} = 1.60 \times 10^{-19}\ \text{J}$	IN THE BOOKLET
Gravitational constant	$G = 6.67 \times 10^{-11}\ \text{N m}^2\ \text{kg}^{-2}$	IN THE BOOKLET
Gravitational field strength Close to Earth's surface.	$g = 9.81\ \text{N kg}^{-1}$	IN THE BOOKLET
Permittivity of free space	$\varepsilon_0 = 8.85 \times 10^{-12}\ \text{F m}^{-1}$	IN THE BOOKLET
Planck constant	$h = 6.63 \times 10^{-34}\ \text{J s}$	IN THE BOOKLET
Proton mass	$m_\text{p} = 1.67 \times 10^{-27}\ \text{kg}$	IN THE BOOKLET
Speed of light in a vacuum	$c = 3.00 \times 10^{8}\ \text{m s}^{-1}$	IN THE BOOKLET
Stefan-Boltzmann constant	$\sigma = 5.67 \times 10^{-8}\ \text{W m}^{-2}\ \text{K}^{-4}$	IN THE BOOKLET
Unified atomic mass unit	$u = 1.66 \times 10^{-27}\ \text{kg}$	IN THE BOOKLET

Unit 1: Mechanics

Displacement from average velocity s displacement, u initial velocity, v final velocity, t time.	$s = \frac{(u+v)t}{2}$	IN THE BOOKLET
Final velocity a is constant acceleration.	$v = u + at$	IN THE BOOKLET
Displacement with acceleration	$s = ut + \frac{1}{2}at^2$	IN THE BOOKLET
Velocity and displacement Use when time is not given or not wanted.	$v^2 = u^2 + 2as$	IN THE BOOKLET

Resultant force Newton's second law, for constant mass.	$\sum F = ma$	IN THE BOOKLET
Gravitational field strength Force per unit mass, in N kg^{-1}.	$g = \frac{F}{m}$	IN THE BOOKLET
Weight W in newtons, m in kg.	$W = mg$	IN THE BOOKLET
Moment of force x is the perpendicular distance from the line of action of F to the pivot.	$\text{moment} = Fx$	IN THE BOOKLET
Momentum p in kg m s^{-1}.	$p = mv$	IN THE BOOKLET
Work done s is measured along the force.	$\Delta W = F\Delta s$	IN THE BOOKLET
Kinetic energy	$E_\text{k} = \frac{1}{2}mv^2$	IN THE BOOKLET
Change in gravitational potential energy Near the Earth's surface only.	$\Delta E_\text{grav} = mg\Delta h$	IN THE BOOKLET
Power from energy transferred	$P = \frac{E}{t}$	IN THE BOOKLET
Power from work done	$P = \frac{W}{t}$	IN THE BOOKLET
Efficiency from energy	$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$	IN THE BOOKLET
Efficiency from power Same source and caveat as the line above.	$\text{efficiency} = \frac{\text{useful power output}}{\text{total power input}}$	IN THE BOOKLET

Unit 1: Materials

Density	$\rho = \frac{m}{V}$	IN THE BOOKLET
Stokes' law Viscous drag on a small sphere of radius r moving at speed v through a fluid of viscosity eta.	$F = 6\pi\eta r v$	IN THE BOOKLET
Hooke's law k is the stiffness of the object, in N m^{-1}.	$\Delta F = k\Delta x$	IN THE BOOKLET
Stress Force per unit cross-sectional area.	$\sigma = \frac{F}{A}$	IN THE BOOKLET
Strain Change in length divided by original length.	$\varepsilon = \frac{\Delta x}{x}$	IN THE BOOKLET
Young modulus	$E = \frac{\sigma}{\varepsilon}$	IN THE BOOKLET
Elastic strain energy	$\Delta E_\text{el} = \frac{1}{2}F\Delta x$	IN THE BOOKLET

Unit 2: Waves and particle nature of light

Wave speed	$v = f\lambda$	IN THE BOOKLET

Speed of a transverse wave on a string T tension; μ mass per unit length.	$v = \sqrt{\frac{T}{\mu}}$	IN THE BOOKLET
Intensity of radiation	$I = \frac{P}{A}$	IN THE BOOKLET
Refraction at an interface	$n_1 \sin\theta_1 = n_2 \sin\theta_2$	IN THE BOOKLET
Refractive index	$n = \frac{c}{v}$	IN THE BOOKLET
Critical angle	$\sin C = \frac{1}{n}$	IN THE BOOKLET
Diffraction grating	$n\lambda = d\sin\theta$	IN THE BOOKLET
de Broglie wavelength	$\lambda = \frac{h}{p}$	IN THE BOOKLET
Photon energy	$E = hf$	IN THE BOOKLET
Einstein's photoelectric equation φ is the work function.	$hf = \phi + \frac{1}{2}mv_{\max}^2$	IN THE BOOKLET

Unit 2: Electricity

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
Electrical power (current and pd)	$P = VI$	IN THE BOOKLET
Electrical power (current and resistance)	$P = I^2R$	IN THE BOOKLET
Electrical power (pd and resistance)	$P = \frac{V^2}{R}$	IN THE BOOKLET
Electrical energy	$W = VIt$	IN THE BOOKLET
Resistivity ρ is resistivity in ohm metres.	$R = \frac{\rho l}{A}$	IN THE BOOKLET
Current and charge carriers	$I = nqvA$	IN THE BOOKLET
Resistors in series	$R = R_1 + R_2 + R_3$	IN THE BOOKLET
Resistors in parallel Same source and caveat as the line above.	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$	IN THE BOOKLET

Unit 4: Further mechanics

Impulse	$F\Delta t = \Delta p$	IN THE BOOKLET
Kinetic energy of a non-relativistic particle	$E_{\mathrm{k}} = \frac{p^2}{2m}$	IN THE BOOKLET
Linear and angular speed	$v = \omega r$	IN THE BOOKLET

Period of circular motion	$T = \frac{2\pi}{\omega}$	IN THE BOOKLET
Centripetal acceleration (speed)	$a = \frac{v^2}{r}$	IN THE BOOKLET
Centripetal acceleration (angular speed)	$a = r\omega^2$	IN THE BOOKLET
Centripetal force	$F = ma = \frac{mv^2}{r}$	IN THE BOOKLET
Centripetal force (angular speed)	$F = mr\omega^2$	IN THE BOOKLET

Unit 4: Electric and magnetic fields

Electric field	$E = \frac{F}{Q}$	IN THE BOOKLET
Coulomb's law	$F = \frac{Q_1 Q_2}{4\pi\varepsilon_0 r^2}$	IN THE BOOKLET
Electric field of a point charge	$E = \frac{Q}{4\pi\varepsilon_0 r^2}$	IN THE BOOKLET
Electric field between parallel plates	$E = \frac{V}{d}$	IN THE BOOKLET
Electric potential	$V = \frac{Q}{4\pi\varepsilon_0 r}$	IN THE BOOKLET
Capacitance	$C = \frac{Q}{V}$	IN THE BOOKLET
Energy stored in a capacitor (charge and pd)	$W = \frac{1}{2}QV$	IN THE BOOKLET
Energy stored in a capacitor (capacitance and pd)	$W = \frac{1}{2}CV^2$	IN THE BOOKLET
Energy stored in a capacitor (charge and capacitance)	$W = \frac{1}{2}\frac{Q^2}{C}$	IN THE BOOKLET
Capacitor discharge	$Q = Q_0 e^{-t/RC}$	IN THE BOOKLET

Unit 4: Capacitor discharge, magnetic fields, induction and particle physics

Resistor-capacitor discharge: current	$I = I_0 e^{-t/RC}$	IN THE BOOKLET
Resistor-capacitor discharge: pd	$V = V_0 e^{-t/RC}$	IN THE BOOKLET
Log of charge	$\ln Q = \ln Q_0 - \frac{t}{RC}$	IN THE BOOKLET
Log of current	$\ln I = \ln I_0 - \frac{t}{RC}$	IN THE BOOKLET
Log of pd	$\ln V = \ln V_0 - \frac{t}{RC}$	IN THE BOOKLET
Force on a moving charge	$F = Bqv\sin\theta$	IN THE BOOKLET
Force on a current-carrying conductor	$F = BIl\sin\theta$	IN THE BOOKLET

Faraday's and Lenz's laws	$\varepsilon = -\frac{\mathrm{d}(N\phi)}{\mathrm{d}t}$	IN THE BOOKLET
Charged particle in a magnetic field	$r = \frac{p}{BQ}$	IN THE BOOKLET
Mass-energy	$\Delta E = c^2 \Delta m$	IN THE BOOKLET

Unit 5: Thermodynamics

Heating: specific heat capacity	$\Delta E = mc\Delta\theta$	IN THE BOOKLET
Heating: specific latent heat	$\Delta E = L\Delta m$	IN THE BOOKLET
Ideal gas equation	$pV = NkT$	IN THE BOOKLET
Molecular kinetic theory	$\frac{1}{2}m\langle c^2\rangle = \frac{3}{2}kT$	IN THE BOOKLET

Unit 5: Nuclear decay

Activity	$A = \lambda N$	IN THE BOOKLET
Rate of decay	$\frac{\mathrm{d}N}{\mathrm{d}t} = -\lambda N$	IN THE BOOKLET
Decay constant and half-life	$\lambda = \frac{\ln 2}{t_{1/2}}$	IN THE BOOKLET
Number of undecayed nuclei	$N = N_0 e^{-\lambda t}$	IN THE BOOKLET
Activity over time	$A = A_0 e^{-\lambda t}$	IN THE BOOKLET

Unit 5: Oscillations

Simple harmonic motion: force	$F = -kx$	IN THE BOOKLET
Simple harmonic motion: acceleration	$a = -\omega^2 x$	IN THE BOOKLET
Simple harmonic motion: displacement	$x = A\cos\omega t$	IN THE BOOKLET
Simple harmonic motion: velocity	$v = -A\omega\sin\omega t$	IN THE BOOKLET
Simple harmonic motion: acceleration against time	$a = -A\omega^2\cos\omega t$	IN THE BOOKLET
Period, frequency and angular frequency	$T = \frac{1}{f} = \frac{2\pi}{\omega}$	IN THE BOOKLET
Angular frequency	$\omega = 2\pi f$	IN THE BOOKLET
Mass on a spring	$T = 2\pi\sqrt{\frac{m}{k}}$	IN THE BOOKLET
Simple pendulum	$T = 2\pi\sqrt{\frac{l}{g}}$	IN THE BOOKLET

Unit 5: Astrophysics and cosmology

Gravitational field strength	$g = \frac{F}{m}$	IN THE BOOKLET
Gravitational force	$F = \frac{Gm_1m_2}{r^2}$	IN THE BOOKLET
Gravitational field of a point mass	$g = \frac{Gm}{r^2}$	IN THE BOOKLET
Gravitational potential	$V_{\text{grav}} = \frac{-Gm}{r}$	IN THE BOOKLET
Stefan-Boltzmann law	$L = \sigma A T^4$	IN THE BOOKLET
Wien's law	$\lambda_{\max} T = 2.898 \times 10^{-3}\ \text{m K}$	IN THE BOOKLET
Intensity of radiation	$I = \frac{L}{4\pi d^2}$	IN THE BOOKLET
Redshift of electromagnetic radiation	$z = \frac{\Delta\lambda}{\lambda} \approx \frac{\Delta f}{f} \approx \frac{v}{c}$	IN THE BOOKLET
Cosmological expansion	$v = H_0 d$	IN THE BOOKLET

Learn these: not in the booklet

Potential divider

$$V_{\text{out}} = \frac{R_2}{R_1 + R_2} V_{\text{in}}$$

R_2 is the resistor across which V_out is taken.

E.m.f. of a cell

$$\varepsilon = I(R + r)$$

R is the external resistance and r the internal resistance.

Terminal pd

$$V = \varepsilon - Ir$$

Terminal pd is less than the e.m.f. when a current flows.

E.m.f. as energy per charge

$$\varepsilon = \frac{W}{Q}$$

Frequency and period

$$f = \frac{1}{T}$$

The booklet prints this only inside the oscillations equation.

Phase difference and path difference

$$\Delta\phi = \frac{\text{path difference}}{\lambda} \times 360^\circ$$

Interference condition

$$\text{path difference} = n\lambda \ (\text{constructive}),\ \left(n + \tfrac{1}{2}\right)\lambda \ (\text{destructive})$$

Fringe separation in a double-slit experiment

$$w = \frac{\lambda D}{s}$$

w fringe spacing, D slit-to-screen distance, s slit separation.

Stationary wave on a string, fundamental

$$f = \frac{1}{2L}\sqrt{\frac{T}{\mu}}$$

Combine v = f λ, λ = 2L and v = sqrt(T/μ).

Work done by a force at an angle

$$\Delta W = F \Delta s \cos\theta$$

The booklet prints only F times s; take the component along the motion.

Resolving a vector

$$F_x = F\cos\theta, \quad F_y = F\sin\theta$$

Upthrust

$$\text{upthrust} = \text{weight of fluid displaced}$$

Conservation of momentum

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

Applies to any collision with no external force.

Threshold frequency and work function

$$\phi = hf_0$$

At the threshold frequency the photoelectron has no kinetic energy.

Energy levels

$$hf = E_1 - E_2$$

Photon frequency for a transition between two energy levels.

Straight line graphs

$$y = mx + c$$

Use with ln plots: the gradient of ln V against t is -1/RC.

Percentage uncertainty

$$\%\ \text{uncertainty} = \frac{\Delta X}{X} \times 100$$

Add percentage uncertainties when multiplying or dividing; multiply by the power for X^n.

Elastic collision

$$\sum E_{\text{k,before}} = \sum E_{\text{k,after}}$$

Kinetic energy is conserved only in an elastic collision.

Radians

$$\theta = \frac{s}{r}, \quad 2\pi \text{ rad} = 360^\circ$$

Time constant

$$\tau = RC$$

Time for the charge to fall to 1/e of its initial value.

Energy gained by a charge through a pd

$$W = QV$$

For an electron, eV equals the gain in kinetic energy: eV = 1/2 m v^2.

Orbital speed from gravitation

$$v = \sqrt{\frac{GM}{r}}$$

Set GMm/r^2 equal to mv^2/r.

Orbital period (derive it)

$$T^2 = \frac{4\pi^2 r^3}{GM}$$

Celsius to kelvin

$$T/\text{K} = \theta/^\circ\text{C} + 273$$

Boyle's law

$$pV = \text{constant}$$

For a fixed mass of gas at constant temperature.

Pressure law

$$\frac{p}{T} = \text{constant}$$

For a fixed mass of gas at constant volume, with T in kelvin.

MeV to joules

$$1\ \text{MeV} = 10^6\ \text{eV} = 1.60 \times 10^{-13}\ \text{J}$$

Quark charges

$$\text{up} = +\tfrac{2}{3}e, \quad \text{down} = -\tfrac{1}{3}e$$

Check charge, baryon number and lepton number in particle equations.

Using the booklet in the exam

- Find the unit first. The list is organised as Unit 1 (mechanics and materials), Unit 2 (waves and electricity), Unit 4 (further mechanics, fields and particles) and Unit 5 (thermodynamics, radiation, oscillations and cosmology), and the equation you want sits under its unit heading.
- Gravitational field strength g = F/m is printed twice, under Forces in Unit 1 and again under Astrophysics and cosmology in Unit 5. It is the same equation.
- The Coulomb law constant is printed as k = $1/(4\pi\varepsilon_0)$ with its value. The list's own forms use ε_0 in F, E and V, so use $\varepsilon_0 = 8.85 \times 10^{-12}$ F m^{-1} unless a question asks for k.
- Stefan-Boltzmann law is printed as $L = \sigma AT^4$ only. For a spherical star substitute $A = 4\pi r^2$; do not wait for a separate equation.
- The list gives equations but no definitions. Write e.m.f., the potential divider and path difference conditions from memory, and use the list for everything else.

Based on: Pearson Edexcel International A Level Physics (IAL), List of data, formulae and relationships, printed at the back of each IAL Physics question paper; specification Issue 3, July 2021. Statistical tables are calculated by CuratedPrep to the same layout. Updated 31 October 2026. Always practise with the version of the official booklet your exam uses. More free sheets and topic worksheets at curatedprep.com.