STUDY FORMULA BOOKLET

AQA A Level Physics 7408 data and formulae booklet

The AQA 7408 booklet prints the constants, particle tables, core equations and all five options; weight, momentum, Q = It and the potential divider must be recalled.

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

Based on the official **A-level Physics data and formulae, version 1.6, for use in exams from the June 2017 series onwards (AQA 7408)**, with what to learn and exam tips added by CuratedPrep.

Data: fundamental constants and values

Printed as a table of quantity, symbol, value and units. Values are copied exactly as printed.

Fundamental constants and values

Quantity	Symbol	Value	Units
speed of light in vacuo	c	3.00×10^{8}	m s^{-1}
permeability of free space	μ_0	$4\pi \times 10^{-7}$	H m^{-1}
permittivity of free space	ε_0	8.85×10^{-12}	F m^{-1}
magnitude of the charge of electron	e	1.60×10^{-19}	C
the Planck constant	h	6.63×10^{-34}	J s
gravitational constant	G	6.67×10^{-11}	N m^2 kg^{-2}
the Avogadro constant	N_A	6.02×10^{23}	mol^{-1}
molar gas constant	R	8.31	J K^{-1} mol^{-1}
the Boltzmann constant	k	1.38×10^{-23}	J K^{-1}
the Stefan constant	σ	5.67×10^{-8}	W m^{-2} K^{-4}
the Wien constant	α	2.90×10^{-3}	m K
electron rest mass (equivalent to 5.5×10^{-4} u)	m_e	9.11×10^{-31}	kg
magnitude of electron charge/mass ratio	$\frac{e}{m_e}$	1.76×10^{11}	C kg^{-1}
proton rest mass (equivalent to 1.00728 u)	m_p	$1.67(3) \times 10^{-27}$	kg
proton charge/mass ratio	$\frac{e}{m_p}$	9.58×10^{7}	C kg^{-1}
neutron rest mass (equivalent to 1.00867 u)	m_n	$1.67(5) \times 10^{-27}$	kg
gravitational field strength	g	9.81	N kg^{-1}
acceleration due to gravity	g	9.81	m s^{-2}
atomic mass unit (1 u is equivalent to 931.5 MeV)	u	1.661×10^{-27}	kg

Algebraic and geometrical equations

Quadratic equation	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	IN THE BOOKLET
Arc length θ in radians.	$\text{arc length} = r\theta$	IN THE BOOKLET
Circumference of a circle	$C = 2\pi r$	IN THE BOOKLET

Area of a circle	$A = \pi r^2$	IN THE BOOKLET
Curved surface area of a cylinder	$A = 2\pi rh$	IN THE BOOKLET
Area of a sphere	$A = 4\pi r^2$	IN THE BOOKLET
Volume of a sphere	$V = \frac{4}{3}\pi r^3$	IN THE BOOKLET
Straight line graph Gradient m and intercept c. Not in the booklet.	$y = mx + c$	LEARN IT
Resolving a vector Trigonometry is not printed in the booklet.	$F_x = F\cos\theta, \quad F_y = F\sin\theta$	LEARN IT

Astronomical data

Body	Mass / kg	Mean radius / m
Sun	1.99×10^{30}	6.96×10^{8}
Earth	5.97×10^{24}	6.37×10^{6}

Particle physics

Printed as tables: the rest energies of particles, the properties of quarks and the properties of leptons. Antiquarks have opposite signs to quarks.

Quark content of the proton and neutron Not printed. Use the quark table to check the charge: uud gives +1, udd gives 0.	$\mathrm{p} = \mathrm{uud}, \quad \mathrm{n} = \mathrm{udd}$	LEARN IT
Beta-minus decay Not printed. Charge, baryon number and lepton number are all conserved.	$\mathrm{n} \rightarrow \mathrm{p} + \beta^- + \bar{\nu}_\mathrm{e}$	LEARN IT
Beta-plus decay Not printed.	$\mathrm{p} \rightarrow \mathrm{n} + \beta^+ + \nu_\mathrm{e}$	LEARN IT
Electron capture Not printed.	$\mathrm{p} + \mathrm{e}^- \rightarrow \mathrm{n} + \nu_\mathrm{e}$	LEARN IT

Particle physics: rest energies

The class and name of each particle are repeated on every row here; the booklet leaves them blank under the first entry.

Class	Name	Symbol	Rest energy / MeV
photon	photon	γ	0
lepton	neutrino	ν_e	0
lepton	neutrino	ν_μ	0
lepton	electron	$\mathrm{e}^\pm$	0.510999
lepton	muon	$\mu^\pm$	105.659
mesons	π meson	$\pi^\pm$	139.576
mesons	π meson	π^0	134.972
mesons	K meson	$\mathrm{K}^\pm$	493.821
mesons	K meson	K^0	497.762
baryons	proton	p	938.257
baryons	neutron	n	939.551

Properties of quarks

Antiquarks have opposite signs.

Type	Charge	Baryon number	Strangeness
u	$+\frac{2}{3}e$	$+\frac{1}{3}$	0
d	$-\frac{1}{3}e$	$+\frac{1}{3}$	0
s	$-\frac{1}{3}e$	$+\frac{1}{3}$	-1

Properties of leptons

Type	Members	Lepton number
Particles	e^-, ν_e; μ^-, ν_μ	$+1$
Antiparticles	e^+, $\bar{\nu}_\mathrm{e}$, μ^+, $\bar{\nu}_\mu$	-1

Photons and energy levels

Photon energy	$E = hf = \dfrac{hc}{\lambda}$	IN THE BOOKLET
Photoelectric effect φ is the work function.	$hf = \phi + E_{\mathrm{k(max)}}$	IN THE BOOKLET
Energy levels	$hf = E_1 - E_2$	IN THE BOOKLET
de Broglie wavelength	$\lambda = \dfrac{h}{p} = \dfrac{h}{mv}$	IN THE BOOKLET
Threshold frequency Set E_k(max) = 0 in the photoelectric equation.	$\phi = hf_0$	LEARN IT
Stopping potential Not printed. Learn the link between stopping potential and maximum kinetic energy.	$eV_\mathrm{s} = E_{\mathrm{k(max)}}$	LEARN IT

Waves

Wave speed	$c = f\lambda$	IN THE BOOKLET
Period	$f = \dfrac{1}{T}$	IN THE BOOKLET
First harmonic on a string T is tension, μ is mass per unit length.	$f = \dfrac{1}{2l}\sqrt{\dfrac{T}{\mu}}$	IN THE BOOKLET
Fringe spacing (double slit) s is slit separation, D is distance to screen.	$w = \dfrac{\lambda D}{s}$	IN THE BOOKLET
Diffraction grating	$d\sin\theta = n\lambda$	IN THE BOOKLET
Refractive index	$n = \dfrac{c}{c_\mathrm{s}}$	IN THE BOOKLET
Law of refraction	$n_1 \sin\theta_1 = n_2 \sin\theta_2$	IN THE BOOKLET
Critical angle	$\sin\theta_\mathrm{c} = \dfrac{n_2}{n_1} \quad (n_1 > n_2)$	IN THE BOOKLET

Path difference for constructive interference For destructive interference use (n + 1/2) λ. Not in the booklet.	$\text{path difference} = n\lambda$	LEARN IT

Mechanics

Moment of a force	$\text{moment} = Fd$	IN THE BOOKLET
Velocity	$v = \dfrac{\Delta s}{\Delta t}$	IN THE BOOKLET
Acceleration	$a = \dfrac{\Delta v}{\Delta t}$	IN THE BOOKLET
Equations of motion	$v = u + at$	IN THE BOOKLET
Equations of motion	$s = \left(\dfrac{u+v}{2}\right)t$	IN THE BOOKLET
Equations of motion	$v^2 = u^2 + 2as$	IN THE BOOKLET
Equations of motion	$s = ut + \dfrac{at^2}{2}$	IN THE BOOKLET
Force	$F = ma$	IN THE BOOKLET
Force as rate of change of momentum	$F = \dfrac{\Delta(mv)}{\Delta t}$	IN THE BOOKLET
Impulse	$F\Delta t = \Delta(mv)$	IN THE BOOKLET
Work done	$W = Fs\cos\theta$	IN THE BOOKLET
Kinetic energy	$E_\text{k} = \frac{1}{2}mv^2$	IN THE BOOKLET
Change in gravitational potential energy	$\Delta E_\text{p} = mg\Delta h$	IN THE BOOKLET
Power	$P = \dfrac{\Delta W}{\Delta t},\ \ P = Fv$	IN THE BOOKLET
Efficiency	$\text{efficiency} = \dfrac{\text{useful output power}}{\text{input power}}$	IN THE BOOKLET
Weight Not in the AQA booklet. Edexcel IAL prints it.	$W = mg$	LEARN IT
Momentum Not in the AQA booklet. Edexcel IAL and OCR print it.	$p = mv$	LEARN IT

Materials

Density	$\rho = \dfrac{m}{V}$	IN THE BOOKLET
Hooke's law	$F = k\Delta L$	IN THE BOOKLET
Tensile stress	$\text{stress} = \dfrac{F}{A}$	IN THE BOOKLET
Tensile strain	$\text{strain} = \dfrac{\Delta L}{L}$	IN THE BOOKLET
Young modulus	$E = \dfrac{\text{tensile stress}}{\text{tensile strain}}$	IN THE BOOKLET

Energy stored in a stretched material	$E = \frac{1}{2}F\Delta L$	IN THE BOOKLET

Electricity

Current	$I = \dfrac{\Delta Q}{\Delta t}$	IN THE BOOKLET
Potential difference	$V = \dfrac{W}{Q}$	IN THE BOOKLET
Resistance	$R = \dfrac{V}{I}$	IN THE BOOKLET
Resistivity	$\rho = \dfrac{RA}{L}$	IN THE BOOKLET
Resistors in series	$R_\mathrm{T} = R_1 + R_2 + R_3 + \ldots$	IN THE BOOKLET
Resistors in parallel	$\dfrac{1}{R_\mathrm{T}} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3} + \ldots$	IN THE BOOKLET
Power	$P = VI = I^2R = \dfrac{V^2}{R}$	IN THE BOOKLET
emf	$\varepsilon = \dfrac{E}{Q}$	IN THE BOOKLET
emf and internal resistance	$\varepsilon = I(R + r)$	IN THE BOOKLET
Charge A rearrangement of I = ΔQ / Δt, but only the second form is printed.	$Q = It$	LEARN IT
Potential divider In the specification (3.5.1.5) but not in the booklet.	$V_\mathrm{out} = \dfrac{R_2}{R_1 + R_2}V_\mathrm{in}$	LEARN IT

Circular motion

Angular speed	$\omega = \dfrac{v}{r}$	IN THE BOOKLET
Angular speed and frequency	$\omega = 2\pi f$	IN THE BOOKLET
Centripetal acceleration	$a = \dfrac{v^2}{r} = \omega^2 r$	IN THE BOOKLET
Centripetal force	$F = \dfrac{mv^2}{r} = m\omega^2 r$	IN THE BOOKLET

Simple harmonic motion

Acceleration	$a = -\omega^2 x$	IN THE BOOKLET
Displacement	$x = A\cos(\omega t)$	IN THE BOOKLET
Speed	$v = \pm\omega\sqrt{A^2 - x^2}$	IN THE BOOKLET
Maximum speed	$v_\mathrm{max} = \omega A$	IN THE BOOKLET
Maximum acceleration	$a_\mathrm{max} = \omega^2 A$	IN THE BOOKLET
Mass on a spring	$T = 2\pi\sqrt{\dfrac{m}{k}}$	IN THE BOOKLET

Simple pendulum	$T = 2\pi\sqrt{\dfrac{l}{g}}$	IN THE BOOKLET
Displacement starting from equilibrium Only the cosine form is printed.	$x = A\sin(\omega t)$	LEARN IT

Thermal physics

Energy to change temperature	$Q = mc\Delta\theta$	IN THE BOOKLET
Energy to change state	$Q = ml$	IN THE BOOKLET
Ideal gas law (moles)	$pV = nRT$	IN THE BOOKLET
Ideal gas law (molecules)	$pV = NkT$	IN THE BOOKLET
Kinetic theory model	$pV = \frac{1}{3}Nm(c_{\text{rms}})^2$	IN THE BOOKLET
Kinetic energy of a gas molecule	$\frac{1}{2}m(c_{\text{rms}})^2 = \frac{3}{2}kT = \dfrac{3RT}{2N_{\text{A}}}$	IN THE BOOKLET
Celsius to kelvin Not printed in the booklet.	$T/\text{K} = \theta/^\circ\text{C} + 273$	LEARN IT

Gravitational fields

Force between two masses	$F = \dfrac{Gm_1m_2}{r^2}$	IN THE BOOKLET
Gravitational field strength	$g = \dfrac{F}{m}$	IN THE BOOKLET
Radial field strength	$g = \dfrac{GM}{r^2}$	IN THE BOOKLET
Work done	$\Delta W = m\Delta V$	IN THE BOOKLET
Gravitational potential	$V = -\dfrac{GM}{r}$	IN THE BOOKLET
Field strength from potential	$g = -\dfrac{\Delta V}{\Delta r}$	IN THE BOOKLET
Orbital period (circular orbit) Not printed. Derive it by equating gravitational force to centripetal force.	$T^2 = \dfrac{4\pi^2r^3}{GM}$	LEARN IT

Electric fields and capacitors

Coulomb's law	$F = \dfrac{1}{4\pi\varepsilon_0}\dfrac{Q_1Q_2}{r^2}$	IN THE BOOKLET
Force on a charge	$F = EQ$	IN THE BOOKLET
Uniform field	$E = \dfrac{V}{d}$	IN THE BOOKLET
Work done	$\Delta W = Q\Delta V$	IN THE BOOKLET
Radial field strength	$E = \dfrac{1}{4\pi\varepsilon_0}\dfrac{Q}{r^2}$	IN THE BOOKLET
Electric potential	$V = \dfrac{1}{4\pi\varepsilon_0}\dfrac{Q}{r}$	IN THE BOOKLET

Field strength from potential	$E = \dfrac{\Delta V}{\Delta r}$	IN THE BOOKLET
Capacitance	$C = \dfrac{Q}{V}$	IN THE BOOKLET
Parallel plate capacitor	$C = \dfrac{A\varepsilon_0\varepsilon_\mathrm{r}}{d}$	IN THE BOOKLET
Energy stored	$E = \frac{1}{2}QV = \frac{1}{2}CV^2 = \frac{1}{2}\dfrac{Q^2}{C}$	IN THE BOOKLET
Charging	$Q = Q_0\left(1 - e^{-t/RC}\right)$	IN THE BOOKLET
Discharging	$Q = Q_0\, e^{-t/RC}$	IN THE BOOKLET
Time constant Printed as RC, with no symbol. Often written as tau = RC.	RC	IN THE BOOKLET
Time for charge to halve Not printed. Follows from the discharge equation.	$t_{1/2} = RC\ln 2$	LEARN IT

Magnetic fields

Force on a current The booklet prints no sin θ. Use F = BIl sin θ if the field is not at right angles to the current.	$F = BIl$	IN THE BOOKLET
Force on a moving charge Use F = BQv sin θ if the velocity is not at right angles to the field.	$F = BQv$	IN THE BOOKLET
Magnetic flux	$\Phi = BA$	IN THE BOOKLET
Magnetic flux linkage The booklet prints this twice, also beside the induced emf.	$N\Phi = BAN\cos\theta$	IN THE BOOKLET
Magnitude of induced emf	$\varepsilon = N\dfrac{\Delta\Phi}{\Delta t}$	IN THE BOOKLET
emf in a rotating coil	$\varepsilon = BAN\omega\sin\omega t$	IN THE BOOKLET
Alternating current (rms)	$I_\mathrm{rms} = \dfrac{I_0}{\sqrt{2}},\ V_\mathrm{rms} = \dfrac{V_0}{\sqrt{2}}$	IN THE BOOKLET
Transformer	$\dfrac{N_\mathrm{s}}{N_\mathrm{p}} = \dfrac{V_\mathrm{s}}{V_\mathrm{p}}$	IN THE BOOKLET
Transformer efficiency	$\text{efficiency} = \dfrac{I_\mathrm{s}V_\mathrm{s}}{I_\mathrm{p}V_\mathrm{p}}$	IN THE BOOKLET

Nuclear physics

Inverse square law for gamma radiation	$I = \dfrac{k}{x^2}$	IN THE BOOKLET
Radioactive decay	$\dfrac{\Delta N}{\Delta t} = -\lambda N,\ \ N = N_0\, e^{-\lambda t}$	IN THE BOOKLET
Activity	$A = \lambda N$	IN THE BOOKLET
Half-life	$T_{1/2} = \dfrac{\ln 2}{\lambda}$	IN THE BOOKLET

Nuclear radius	$R = R_0 A^{1/3}$	IN THE BOOKLET
Energy-mass equation	$E = mc^2$	IN THE BOOKLET
Activity against time Not printed. It follows from A = λ N and the decay equation.	$A = A_0\, e^{-\lambda t}$	LEARN IT

Options: astrophysics

Paper 3 Section B asks about one option only (35 marks). The booklet prints the equations for all five options, so learn only the one your school teaches.

Angular magnification θi: angle subtended by the image at the eye. θo: angle subtended by the object at the unaided eye. The booklet writes it in words.	$M = \dfrac{\theta_i}{\theta_o}$	IN THE BOOKLET
Telescope in normal adjustment	$M = \dfrac{f_0}{f_\mathrm{e}}$	IN THE BOOKLET
Rayleigh criterion	$\theta \approx \dfrac{\lambda}{D}$	IN THE BOOKLET
Magnitude equation	$m - M = 5 \log \dfrac{d}{10}$	IN THE BOOKLET
Wien's law	$\lambda_\mathrm{max} T = 2.9 \times 10^{-3}\ \mathrm{m\ K}$	IN THE BOOKLET
Stefan's law	$P = \sigma A T^4$	IN THE BOOKLET
Schwarzschild radius	$R_\mathrm{s} \approx \dfrac{2GM}{c^2}$	IN THE BOOKLET
Doppler shift for v much less than c	$\dfrac{\Delta f}{f} = -\dfrac{\Delta \lambda}{\lambda} = \dfrac{v}{c}$	IN THE BOOKLET
Red shift	$z = -\dfrac{v}{c}$	IN THE BOOKLET
Hubble's law	$v = Hd$	IN THE BOOKLET

Astrophysics: distances and the Hubble constant

Quantity	Value
1 astronomical unit	1.50×10^{11} m
1 light year	9.46×10^{15} m
1 parsec	2.06×10^{5} AU = 3.08×10^{16} m = 3.26 ly
Hubble constant, H	65 km s^{-1} Mpc^{-1}

Options: medical physics

Lens power	$P = \dfrac{1}{f}$	IN THE BOOKLET
Lens magnification	$m = \dfrac{v}{u}$	IN THE BOOKLET
Lens equation	$\dfrac{1}{f} = \dfrac{1}{u} + \dfrac{1}{v}$	IN THE BOOKLET
Threshold of hearing	$I_0 = 1.0 \times 10^{-12}\ \mathrm{W\ m^{-2}}$	IN THE BOOKLET

Intensity level	$\text{intensity level} = 10 \log \frac{I}{I_0}$	IN THE BOOKLET
Absorption of X-rays	$I = I_0 e^{-\mu x}$	IN THE BOOKLET
Mass attenuation coefficient	$\mu_\text{m} = \frac{\mu}{\rho}$	IN THE BOOKLET
Acoustic impedance	$Z = \rho c$	IN THE BOOKLET
Ultrasound reflection	$\frac{I_\text{r}}{I_\text{i}} = \left(\frac{Z_2 - Z_1}{Z_2 + Z_1}\right)^2$	IN THE BOOKLET
Effective half-life	$\frac{1}{T_\text{E}} = \frac{1}{T_\text{B}} + \frac{1}{T_\text{P}}$	IN THE BOOKLET

Options: engineering physics

Moment of inertia	$I = \Sigma m r^2$	IN THE BOOKLET
Angular kinetic energy	$E_k = \frac{1}{2} I \omega^2$	IN THE BOOKLET
Equations of angular motion	$\omega_2 = \omega_1 + \alpha t, \;\; \omega_2^2 = \omega_1^2 + 2\alpha\theta$	IN THE BOOKLET
Equations of angular motion (angle)	$\theta = \omega_1 t + \frac{\alpha t^2}{2}, \;\; \theta = \frac{(\omega_1 + \omega_2)t}{2}$	IN THE BOOKLET
Torque	$T = I\alpha, \;\; T = Fr$	IN THE BOOKLET
Angular momentum and impulse	$\text{angular momentum} = I\omega, \;\; T\Delta t = \Delta(I\omega)$	IN THE BOOKLET
Rotational work and power	$W = T\theta, \;\; P = T\omega$	IN THE BOOKLET
First law of thermodynamics	$Q = \Delta U + W, \;\; W = p\Delta V$	IN THE BOOKLET
Adiabatic and isothermal change Adiabatic, then isothermal.	$pV^\gamma = \text{constant}, \;\; pV = \text{constant}$	IN THE BOOKLET
Heat engine efficiency	$\text{efficiency} = \frac{W}{Q_\text{H}} = \frac{Q_\text{H} - Q_\text{C}}{Q_\text{H}}$	IN THE BOOKLET
Maximum theoretical efficiency	$\frac{T_\text{H} - T_\text{C}}{T_\text{H}}$	IN THE BOOKLET
Work done per cycle	$W_\text{cycle} = \text{area of } p\text{-}V \text{ loop}$	IN THE BOOKLET
Input power	$\text{input power} = \text{calorific value} \times \text{fuel flow rate}$	IN THE BOOKLET
Indicated power	$\text{indicated power} = (\text{area of } p\text{-}V \text{ loop}) \times (\text{cycles per second}) \times (\text{number of cylinders})$	IN THE BOOKLET
Output or brake power	$P = T\omega$	IN THE BOOKLET
Friction power	$\text{friction power} = \text{indicated power} - \text{brake power}$	IN THE BOOKLET
Refrigerator	$\text{COP}_\text{ref} = \frac{Q_\text{C}}{W} = \frac{Q_\text{C}}{Q_\text{H} - Q_\text{C}}$	IN THE BOOKLET
Heat pump	$\text{COP}_\text{hp} = \frac{Q_\text{H}}{W} = \frac{Q_\text{H}}{Q_\text{H} - Q_\text{C}}$	IN THE BOOKLET

Options: turning points in physics

Electron in an electric field	$F = \frac{eV}{d}$	IN THE BOOKLET

Electron in a magnetic field	$F = Bev, \;\; r = \dfrac{mv}{Be}$	IN THE BOOKLET
Electron accelerated through a pd	$\frac{1}{2}mv^2 = eV$	IN THE BOOKLET
Millikan's experiment	$\dfrac{QV}{d} = mg, \;\; F = 6\pi\eta r v$	IN THE BOOKLET
Maxwell's formula	$c = \dfrac{1}{\sqrt{\mu_0 \varepsilon_0}}$	IN THE BOOKLET
de Broglie wavelength of an accelerated electron	$\lambda = \dfrac{h}{p} = \dfrac{h}{\sqrt{2meV}}$	IN THE BOOKLET
Time dilation	$t = \dfrac{t_0}{\sqrt{1 - \dfrac{v^2}{c^2}}}$	IN THE BOOKLET
Length contraction	$l = l_0\sqrt{1 - \dfrac{v^2}{c^2}}$	IN THE BOOKLET
Relativistic energy	$E = mc^2 = \dfrac{m_0 c^2}{\sqrt{1 - \dfrac{v^2}{c^2}}}$	IN THE BOOKLET

Options: electronics

Resonant frequency	$f_0 = \dfrac{1}{2\pi\sqrt{LC}}$	IN THE BOOKLET
Q-factor	$Q = \dfrac{f_0}{f_\mathrm{B}}$	IN THE BOOKLET
Op-amp, open loop	$V_\mathrm{out} = A_\mathrm{OL}(V_+ - V_-)$	IN THE BOOKLET
Inverting amplifier	$\dfrac{V_\mathrm{out}}{V_\mathrm{in}} = -\dfrac{R_\mathrm{f}}{R_\mathrm{in}}$	IN THE BOOKLET
Non-inverting amplifier	$\dfrac{V_\mathrm{out}}{V_\mathrm{in}} = 1 + \dfrac{R_\mathrm{f}}{R_1}$	IN THE BOOKLET
Summing amplifier	$V_\mathrm{out} = -R_\mathrm{f}\left(\dfrac{V_1}{R_1} + \dfrac{V_2}{R_2} + \dfrac{V_3}{R_3} + \ldots\right)$	IN THE BOOKLET
Difference amplifier	$V_\mathrm{out} = (V_+ - V_-)\dfrac{R_\mathrm{f}}{R_1}$	IN THE BOOKLET
Bandwidth for AM	$\mathrm{bandwidth} = 2f_\mathrm{M}$	IN THE BOOKLET
Bandwidth for FM	$\mathrm{bandwidth} = 2(\Delta f + f_\mathrm{M})$	IN THE BOOKLET

Learn these: not in the booklet

Prefixes

$\mathrm{p} = 10^{-12}$, $\mathrm{n} = 10^{-9}$, $\mu = 10^{-6}$, $\mathrm{m} = 10^{-3}$, $\mathrm{k} = 10^{3}$, $\mathrm{M} = 10^{6}$, $\mathrm{G} = 10^{9}$

The booklet gives constants in standard form but no prefix table.

Pressure

$$p = \frac{F}{A}$$

Amount of substance

$$n = \frac{m}{M} = \frac{N}{N_\mathrm{A}}$$

M is molar mass in kg mol^{-1} when you want SI units.

Gas laws at constant amount

$$pV = \text{constant}, \quad \frac{V}{T} = \text{constant}, \quad \frac{p}{T} = \text{constant}$$

Boyle's law needs constant T, Charles's law needs constant p, the pressure law needs constant V. T is in kelvin.

Intensity of radiation

$$I = \frac{P}{A}$$

Harmonics on a string

$$f_n = n f_1$$

Adjacent nodes are half a wavelength apart.

Kirchhoff's laws

First law: the sum of currents into a junction equals the sum out. Second law: in a closed loop the sum of emfs equals the sum of the potential differences.

Terminal pd and lost volts

$$\varepsilon = V + Ir$$

A rearrangement of the printed epsilon = I(R + r).

Moments

In equilibrium the sum of clockwise moments about any point equals the sum of anticlockwise moments, and the resultant force is zero.

Small angles

$$\sin\theta \approx \tan\theta \approx \theta, \quad \cos\theta \approx 1$$

θ in radians, for small θ only.

Logarithm rules

$$\ln(ab) = \ln a + \ln b, \quad \ln(a^n) = n \ln a, \quad \ln e^x = x$$

Percentage uncertainty

$$\frac{\Delta x}{x} \times 100\%$$

For a product or quotient add the percentage uncertainties; for a power n multiply the percentage uncertainty by n.

Mass defect and binding energy

$$\Delta E = \Delta m\, c^2$$

Binding energy per nucleon is the binding energy divided by the nucleon number A. Use the printed value of c and u = 931.5 MeV.

Pair production and annihilation

Pair production needs a photon of at least twice the rest energy of one particle (1.022 MeV for an electron and positron). Annihilation produces two photons, each of at least the rest energy of one particle.

Conservation in particle interactions

Charge, baryon number and lepton number are conserved in every interaction. Strangeness is conserved in strong interactions but can change by 0, +1 or -1 in weak interactions.

Fleming's left-hand rule

Gives the direction of the force on a current or moving charge. Lenz's law: the induced emf acts to oppose the change that causes it.

Kelvin and electronvolt

$$1\ \text{eV} = 1.60 \times 10^{-19}\ \text{J}, \quad T/\text{K} = \theta/^\circ\text{C} + 273$$

Using the booklet in the exam

- Learn the symbols and units. The booklet gives names and equations only, so you must know what each letter stands for.
- Many equations come in several forms, such as P = VI = I^2 R = V^2 / R. Pick the one that uses the numbers you are given.
- The booklet prints F = BIl and F = BQv without sin θ. If the field is not at right angles, include the sine.
- Use the printed constants, not the values stored in your calculator, and keep the full figures until the final line.
- The option equations are printed for all five options, so use the exam paper to see which one you answer and ignore the others.

Based on: AQA A Level Physics (7408), A-level Physics data and formulae (version 1.6, for exams from the June 2017 series onwards). 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.