STUDY FORMULA BOOKLET

OxfordAQA International AS and A Level Physics 9630 data and formula booklet

The OxfordAQA 9630 booklet prints the constants and the equations for Units 1 to 4; 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 **OxfordAQA International AS and A-level Physics (9630) Data and formula booklet, version 1.2 (Insert)**, with what to learn and exam tips added by CuratedPrep.

Data: fundamental constants and values

Values are copied exactly as printed. This booklet has no Stefan constant or Wien constant.

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}
electron rest mass (equivalent to 5.5×10^{-4} u)	m_e	9.11×10^{-31}	kg
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

Astronomical data and geometric equations

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

Surface area of a cylinder Printed as surface area of cylinder: it is the curved surface only.	$A = 2\pi rh$	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
Quadratic equation Not printed in this booklet.	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	LEARN IT
Straight line graph Gradient m and intercept c.	$y = mx + c$	LEARN IT
Resolving a vector Trigonometry is not printed.	$F_x = F\cos\theta, \quad F_y = F\sin\theta$	LEARN IT

Astronomical data

The Earth mass here is 5.98, not the 5.97 printed in the AQA 7408 booklet.

Body	Mass / kg	Mean radius / m
Sun	1.99×10^{30}	6.96×10^{8}
Earth	5.98×10^{24}	6.37×10^{6}

Unit 1: mechanics and materials

Moments	$\text{moment} = Fd$	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	$v^2 = u^2 + 2as$	IN THE BOOKLET
Equations of motion	$s = \dfrac{(u+v)}{2}\,t$	IN THE BOOKLET
Equations of motion	$s = ut + \frac{1}{2}at^2$	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	$P = \dfrac{\Delta W}{\Delta t}, \quad P = Fv$	IN THE BOOKLET
Efficiency	$\text{efficiency} = \dfrac{\text{useful output power}}{\text{input power}}$	IN THE BOOKLET
Density	$\rho = \dfrac{m}{V}$	IN THE BOOKLET

Hooke's law	$F = k\Delta L$	IN THE BOOKLET
Young modulus	$E = \dfrac{\text{tensile stress}}{\text{tensile strain}}$	IN THE BOOKLET
Tensile stress	$\text{tensile stress} = \dfrac{F}{A}$	IN THE BOOKLET
Tensile strain	$\text{tensile strain} = \dfrac{\Delta L}{L}$	IN THE BOOKLET
Energy stored	$E = \frac{1}{2}F\Delta L$	IN THE BOOKLET
Weight Not printed.	$W = mg$	LEARN IT
Momentum Not printed.	$p = mv$	LEARN IT
Pressure Not printed.	$p = \dfrac{F}{A}$	LEARN IT

Unit 1: particles, radiation and radioactivity

Inverse square law for gamma radiation I falls with the square of the distance r from the source.	$I = \dfrac{I_0}{r^2}$	IN THE BOOKLET
Specific charge Not printed. Units C kg^{-1}.	$\text{specific charge} = \dfrac{Q}{m}$	LEARN IT
Amount of substance Not printed.	$n = \dfrac{N}{N_\text{A}}$	LEARN IT

Unit 2: 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	$R_\text{T} = R_1 + R_2 + R_3 + \ldots$	IN THE BOOKLET
Resistors in parallel	$\dfrac{1}{R_\text{T}} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3} + \ldots$	IN THE BOOKLET
Energy transferred	$E = IVt$	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 Not printed.	$Q = It$	LEARN IT

Potential divider Not printed.	$V_{\text{out}} = \dfrac{R_2}{R_1 + R_2} V_{\text{in}}$	LEARN IT

Unit 2: oscillations and waves

Mass-spring system	$T = 2\pi\sqrt{\dfrac{m}{k}}$	IN THE BOOKLET
Simple pendulum	$T = 2\pi\sqrt{\dfrac{l}{g}}$	IN THE BOOKLET
Wave speed	$c = f\lambda$	IN THE BOOKLET
Period	$f = \dfrac{1}{T}$	IN THE BOOKLET
First harmonic on a string T is tension and μ is mass per unit length.	$f = \dfrac{1}{2l}\sqrt{\dfrac{T}{\mu}}$	IN THE BOOKLET
Fringe spacing	$w = \dfrac{\lambda D}{s}$	IN THE BOOKLET
Diffraction grating	$d\sin\theta = n\lambda$	IN THE BOOKLET
Refractive index of a substance	$n = \dfrac{c}{c_{\text{s}}}$	IN THE BOOKLET
Law of refraction	$n_1 \sin\theta_1 = n_2 \sin\theta_2$	IN THE BOOKLET
Critical angle	$\sin\theta_{\text{c}} = \dfrac{n_2}{n_1} \quad (n_1 > n_2)$	IN THE BOOKLET
Photon energy	$E = hf = \dfrac{hc}{\lambda}$	IN THE BOOKLET
Photoelectricity	$hf = \phi + E_{\text{k(max)}}$	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
Harmonics on a string Not printed.	$f_n = nf_1$	LEARN IT
Intensity of a wave Not printed.	$I = \dfrac{P}{A}$	LEARN IT
Threshold frequency Not printed.	$\phi = hf_0$	LEARN IT
Stopping potential Not printed.	$eV_{\text{s}} = E_{\text{k(max)}}$	LEARN IT
Interference path difference Not printed.	$n\lambda$ (constructive), $\left(n + \frac{1}{2}\right)\lambda$ (destructive)	LEARN IT

Unit 3: circular motion and periodic motion

Magnitude of 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	$F = \frac{mv^2}{r} = m\omega^2 r$	IN THE BOOKLET
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	$v_{\max} = \omega A$	IN THE BOOKLET
Maximum acceleration	$a_{\max} = \omega^2 A$	IN THE BOOKLET
Mass-spring system	$T = 2\pi\sqrt{\frac{m}{k}}$	IN THE BOOKLET
Simple pendulum	$T = 2\pi\sqrt{\frac{l}{g}}$	IN THE BOOKLET
Total energy of an oscillator	$E = \frac{1}{2}m\omega^2 A^2$	IN THE BOOKLET
Displacement from equilibrium Only the cosine form is printed.	$x = A\sin(\omega t)$	LEARN IT

Unit 3: gravitational fields and satellites

Force between point masses	$F = \frac{Gm_1m_2}{r^2}$	IN THE BOOKLET
Gravitational field strength	$g = \frac{F}{m}$	IN THE BOOKLET
Field strength in a radial field	$g = \frac{GM}{r^2}$	IN THE BOOKLET
Work done	$\Delta W = m\Delta V$	IN THE BOOKLET
Gravitational potential	$V = -\frac{GM}{r}$	IN THE BOOKLET
Field strength from potential	$g = -\frac{\Delta V}{\Delta r}$	IN THE BOOKLET
Orbital period (circular orbit) Not printed. Derive it by equating gravitational force to centripetal force.	$T^2 = \frac{4\pi^2 r^3}{GM}$	LEARN IT
Orbital speed Not printed. From the same derivation.	$v = \sqrt{\frac{GM}{r}}$	LEARN IT

Unit 3: exponential change

Time constant Printed as RC, with no symbol. Often written as tau = RC.	RC	IN THE BOOKLET
Time to halve	$T_{1/2} = \ln 2\, RC$	IN THE BOOKLET
Capacitor charging	$Q = Q_0\left(1 - e^{-t/RC}\right)$	IN THE BOOKLET
Capacitor discharging	$Q = Q_0\, e^{-t/RC}$	IN THE BOOKLET
Radioactive decay	$\frac{\Delta N}{\Delta t} = -\lambda N$	IN THE BOOKLET
Radioactive decay	$N = N_0\, e^{-\lambda t}$	IN THE BOOKLET

Activity	$A = \lambda N$	IN THE BOOKLET
Activity	$A = A_0\, e^{-\lambda t}$	IN THE BOOKLET
Half-life	$T_{1/2} = \dfrac{\ln 2}{\lambda}$	IN THE BOOKLET

Unit 3: electric fields and capacitance

Force between point charges in a vacuum	$F = \dfrac{1}{4\pi\varepsilon_0}\dfrac{Q_1 Q_2}{r^2}$	IN THE BOOKLET
Force on a charge The printed equation gives the field strength.	$E = \dfrac{F}{Q}$	IN THE BOOKLET
Field strength for a uniform field	$E = \dfrac{V}{d}$	IN THE BOOKLET
Field strength for a radial field	$E = \dfrac{1}{4\pi\varepsilon_0}\dfrac{Q}{r^2}$	IN THE BOOKLET
Work done moving a charge Q	$\Delta W = Q\Delta V$	IN THE BOOKLET
Work done moving a charge Q	$Fd = Q\Delta V$	IN THE BOOKLET
Electric potential	$V = \dfrac{1}{4\pi\varepsilon_0}\dfrac{Q}{r}$	IN THE BOOKLET
Electric potential	$E = \dfrac{\Delta V}{\Delta r}$	IN THE BOOKLET
Capacitance	$C = \dfrac{Q}{V}$	IN THE BOOKLET
Capacitance	$C = \dfrac{A\varepsilon_0\varepsilon_\mathrm{r}}{d}$	IN THE BOOKLET
Capacitor energy stored	$E = \frac{1}{2}QV = \frac{1}{2}CV^2 = \frac{1}{2}\dfrac{Q^2}{C}$	IN THE BOOKLET

Unit 3: magnetic fields

Force on a current 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	$N\Phi = BAN\cos\theta$	IN THE BOOKLET
Magnitude of induced emf Printed without N. For a coil the rate of change is of the flux linkage N Phi.	$\varepsilon = \dfrac{\Delta\Phi}{\Delta t}$	IN THE BOOKLET
Emf induced in a rotating coil	$\varepsilon = BAN\omega\sin\omega t$	IN THE BOOKLET
Alternating current	$I_\mathrm{rms} = \dfrac{I_0}{\sqrt{2}},\ V_\mathrm{rms} = \dfrac{V_0}{\sqrt{2}}$	IN THE BOOKLET
Transformer equation	$\dfrac{N_\mathrm{s}}{N_\mathrm{p}} = \dfrac{V_\mathrm{s}}{V_\mathrm{p}}$	IN THE BOOKLET

Transformer efficiency	$\text{efficiency} = \dfrac{I_\text{s}V_\text{s}}{I_\text{p}V_\text{p}}$	IN THE BOOKLET

Unit 4: thermal physics

Energy to change temperature	$Q = mc\Delta\theta$	IN THE BOOKLET
Energy to change state	$Q = ml$	IN THE BOOKLET
Gas law	$pV = nRT$	IN THE BOOKLET
Gas law	$pV = NkT$	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
Thermodynamics W is the work done on the system.	$\Delta U = Q + W$	IN THE BOOKLET
Thermodynamics	$W = p\Delta V$	IN THE BOOKLET
Rate of energy transfer by conduction k is the thermal conductivity.	$\dfrac{kA\Delta\theta}{L}$	IN THE BOOKLET
Rate of energy transfer U is the U-value, equal to k / L.	$UA\Delta\theta$	IN THE BOOKLET
Gas laws at constant amount Not printed. Temperature in kelvin.	$pV = \text{constant},\ \dfrac{V}{T} = \text{constant},\ \dfrac{p}{T} = \text{constant}$	LEARN IT
Celsius to kelvin Not printed.	$T/\text{K} = \theta/^\circ\text{C} + 273$	LEARN IT

Unit 4: nuclear physics

Nuclear radius	$R = R_0A^{1/3}$	IN THE BOOKLET
Energy-mass equation	$E = mc^2$	IN THE BOOKLET
Binding energy Not printed. Δm is the mass defect.	$E_\text{b} = \Delta m\, c^2$	LEARN IT

Unit 4: energy sources

Moment of inertia	$I = mr^2$	IN THE BOOKLET
Moment of inertia	$I = \Sigma mr^2$	IN THE BOOKLET
Angular kinetic energy	$E_\text{k(rot)} = \frac{1}{2}I\omega^2$	IN THE BOOKLET
Equations of angular motion	$\omega = \omega_0 + \alpha t$	IN THE BOOKLET
Equations of angular motion	$\omega^2 = \omega_0^2 + 2\alpha\theta$	IN THE BOOKLET
Equations of angular motion	$\theta = \omega_0 t + \frac{1}{2}\alpha t^2$	IN THE BOOKLET
Equations of angular motion	$\theta = \dfrac{(\omega_0 + \omega)}{2}t$	IN THE BOOKLET
Torque	$T = I\alpha$	IN THE BOOKLET

Torque	$T = Fr$	IN THE BOOKLET
Angular momentum	$I\omega$	IN THE BOOKLET
Angular impulse	$T\Delta t = \Delta(I\omega)$	IN THE BOOKLET
Work done	$W = T\theta$	IN THE BOOKLET
Power	$P = T\omega$	IN THE BOOKLET
Maximum power available from a turbine	$P = \frac{1}{2}\pi r^2 \rho v^3$	IN THE BOOKLET
Solar intensity	$I = \dfrac{P}{4\pi r^2}$	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.

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.

Ohm's law

Current is proportional to potential difference for an ohmic conductor at constant temperature.

Terminal pd and lost volts

$\varepsilon = V + Ir$

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

Beta decays

$\mathrm{n} \to \mathrm{p} + \beta^- + \bar{\nu}_\mathrm{e}, \quad \mathrm{p} \to \mathrm{n} + \beta^+ + \nu_\mathrm{e}$

The specification expects equations for alpha, beta-minus and beta-plus decay, including neutrinos and antineutrinos, and the decay of a free neutron.

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.

Geostationary orbit

Period of 24 hours, above the equator, moving in the same direction as the Earth rotates.

Lenz's law

The induced emf acts in the direction that opposes the change that produces it.

Logarithm rules

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

Percentage uncertainty

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

For products and quotients add percentage uncertainties; for a power n multiply the percentage uncertainty by n.

Small angles

$\sin\theta \approx \tan\theta \approx \theta$

θ in radians, for small θ only.

Electronvolt

$1\ \mathrm{eV} = 1.60 \times 10^{-19}\ \mathrm{J}$

Using the booklet in the exam

- Find each equation under its unit heading in the booklet, then check the symbols and units yourself, because none are defined.
- Printed forms vary: P = VI = I^2 R = V^2 / R and E = (1/2)QV = (1/2)CV^2 are all one equation, so choose the form that fits your data.
- The induced emf is printed as epsilon = delta Phi / delta t. For a coil use the flux linkage N Phi to include the number of turns.
- The thermodynamics equation is ΔU = Q + W, where W is the work done on the system, so take care with the sign.
- This booklet has no Stefan or Wien constant, so check what is printed before you assume a value is given.

Based on: OxfordAQA International AS and A-level Physics (9630), Data and formula booklet insert, version 1.2. 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.