STUDY FORMULA BOOKLET

AQA GCSE Combined Science Trilogy 8464 physics equations and periodic table

The 8464 physics sheet for June 2027 prints all 28 equations, three Higher Tier only, and the insert gives the periodic table. Chemistry calculations are yours to recall.

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

Based on the official **Physics Equations Sheet, GCSE Combined Science: Trilogy (8464) and Synergy (8465), AQA insert, for use in June 2027 only (28 equations; HT = Higher Tier only equations); The Periodic Table of Elements, insert for GCSE Chemistry (8462), Trilogy (8464) and Synergy (8465) papers v1**, with what to learn and exam tips added by CuratedPrep.

Energy and power

The sheet has no headings. CuratedPrep groups the 28 equations by topic and keeps the sheet's own order. Notes say whether the specification puts each on the recall list (Appendix B, recall and apply) or the select and apply list, and mark Higher Tier only (HT).

Kinetic energy

Spec recall list. Ek in joules (J), m in kg, v in m/s.

$$E_k = \frac{1}{2}mv^2$$

IN THE BOOKLET

Elastic potential energy

Spec select and apply list. Ee in J, k spring constant in N/m, e extension in m. Valid up to the limit of proportionality.

$$E_e = \frac{1}{2}ke^2$$

IN THE BOOKLET

Gravitational potential energy

Spec recall list. Ep in J, m in kg, g gravitational field strength in N/kg, h height in m.

$$E_p = mgh$$

IN THE BOOKLET

Change in thermal energy

Spec select and apply list. ΔE in J, m in kg, c specific heat capacity in J/kg °C, Δtheta temperature change in °C.

$$\Delta E = mc\Delta\theta$$

IN THE BOOKLET

Power (energy transferred)

Spec recall list. P in watts (W), E energy transferred in J, t in seconds (s).

$$P = \frac{E}{t}$$

IN THE BOOKLET

Power (work done)

Spec recall list. W work done in J, t in s. One watt is one joule per second.

$$P = \frac{W}{t}$$

IN THE BOOKLET

Efficiency (energy)

Spec recall list. A ratio with no unit. Multiply by 100 for a percentage.

$$\text{efficiency} = \frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$$

IN THE BOOKLET

Efficiency (power)

Spec recall list. Same idea using power in W.

$$\text{efficiency} = \frac{\text{useful power output}}{\text{total power input}}$$

IN THE BOOKLET

Electricity

Charge flow

Spec recall list. Q in coulombs (C), I in amperes (A), t in s.

$$Q = It$$

IN THE BOOKLET

Potential difference

Spec recall list. V in volts (V), I in A, R resistance in ohms (Ω).

$$V = IR$$

IN THE BOOKLET

Electrical power

Spec recall list. P in W, V in V, I in A.

$$P = VI$$

IN THE BOOKLET

Power in a resistor Spec recall list. P in W, I in A, R in Ω.	$P = I^2R$	IN THE BOOKLET
Energy transferred (power and time) Spec recall list. E in J, P in W, t in s.	$E = Pt$	IN THE BOOKLET
Energy transferred (charge and potential difference) Spec recall list. E in J, Q in C, V in V.	$E = QV$	IN THE BOOKLET

Transformers

Higher Tier only.

Transformer: power in equals power out Spec select and apply list. HT only. For a 100 per cent efficient transformer: p is primary, s is secondary, V in volts, I in amperes.	$V_pI_p = V_sI_s$	IN THE BOOKLET

Density and change of state

Density Spec recall list. ρ in kg/m^3, m in kg, V in m^3.	$\rho = \frac{m}{V}$	IN THE BOOKLET
Thermal energy for a change of state Spec select and apply list. E in J, m in kg, L specific latent heat in J/kg.	$E = mL$	IN THE BOOKLET

Forces and work

Weight Spec recall list. W in newtons (N), m in kg, g in N/kg.	$W = mg$	IN THE BOOKLET
Work done Spec recall list. W in J, F in N, s distance moved along the line of action of the force in m.	$W = Fs$	IN THE BOOKLET
Force on a spring Spec recall list. F in N, k in N/m, e extension in m. Up to the limit of proportionality.	$F = ke$	IN THE BOOKLET

Motion and momentum

Distance travelled Spec recall list. s in m, v speed in m/s, t in s.	$s = vt$	IN THE BOOKLET
Acceleration Spec recall list. a in m/s^2, Δv change in velocity in m/s, t time taken in s.	$a = \frac{\Delta v}{t}$	IN THE BOOKLET
Uniform acceleration Spec select and apply list. v final and u initial velocity in m/s, a in m/s^2, s distance in m.	$v^2 - u^2 = 2as$	IN THE BOOKLET
Resultant force Spec recall list. F resultant force in N, m in kg, a in m/s^2.	$F = ma$	IN THE BOOKLET

Momentum

Spec recall list. HT only. p in kg m/s, m in kg, v in m/s.

$$p = mv$$

IN THE BOOKLET

Waves

Period

Spec select and apply list. T in s, f frequency in hertz (Hz).

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

IN THE BOOKLET

Wave speed

Spec recall list. v in m/s, f in Hz, λ wavelength in m.

$$v = f\lambda$$

IN THE BOOKLET

Magnetic force on a conductor

Higher Tier only.

Force on a conductor in a magnetic field

Spec select and apply list. HT only. F in N, B magnetic flux density in tesla (T), I in A, l length in m. Conductor at right angles to the field.

$$F = BIl$$

IN THE BOOKLET

The periodic table of elements

Copied as printed on the AQA insert: groups 1 to 7 and 0, relative atomic masses as printed, square brackets kept. Relative atomic masses of Cu and Cl are not rounded to the nearest whole number. La and Ac sit in group 3 with an asterisk, and the lanthanides (atomic numbers 58 to 71) and actinides (90 to 103) are omitted, as on the insert, so 90 elements are shown.

1	2											3	4	5	6	7	0
1 H hydrogen 1																	2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 63.5	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium [98]	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 La lanthanum 139	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium [209]	85 At astatine [210]	86 Rn radon [222]
87 Fr francium [223]	88 Ra radium [226]	89 Ac actinium [227]	104 Rf rutherfordium [261]	105 Db dubnium [262]	106 Sg seaborgium [266]	107 Bh bohrium [264]	108 Hs hassium [277]	109 Mt meitnerium [268]	110 Ds darmstadtium [271]	111 Rg roentgenium [272]	112 Cn copernicium [285]	113 Nh nihonium [286]	114 Fl flerovium [289]	115 Mc moscovium [289]	116 Lv livermorium [293]	117 Ts tennessine [294]	118 Og oganesson [294]

Z Sym name A_r — atomic number · symbol · name · relative atomic mass

Physics rules the sheet does not print

Specification content you must know, with no matching line on the equation sheet.

Series circuit: total resistance

Same current through each component; the supply potential difference is shared between them. Spec 6.2.2.

$$R_{\text{total}} = R_1 + R_2$$

LEARN IT

Parallel circuit: total current

Same potential difference across each branch. Total resistance is less than the smallest single resistor. You do not calculate parallel resistance.

$$I_{\text{total}} = I_1 + I_2$$

LEARN IT

Conservation of momentum
HT only. In a closed system. Use p = mv for each object and treat direction with plus and minus signs.

$$\text{total momentum before} = \text{total momentum after}$$

LEARN IT

Stopping distance
Thinking distance depends on reaction time and speed; braking distance depends on speed, mass, road and brakes.

$$\text{stopping distance} = \text{thinking distance} + \text{braking distance}$$

LEARN IT

Free fall near the Earth's surface
Use g = 9.8 N/kg for weight and potential energy unless the question gives another value.

$$a \approx 9.8\ \text{m/s}^2$$

LEARN IT

Relative atomic mass and relative formula mass

All tiers. Use the relative atomic masses printed in the periodic table.

Relative atomic mass from isotopes
Weighted mean using the percentage abundance of each isotope. With percentages the bottom line is 100. All tiers.

$$A_r = \frac{\sum(\text{isotope mass} \times \text{abundance})}{\sum \text{abundance}}$$

LEARN IT

Relative formula mass
Add the relative atomic masses of every atom shown in the formula, using the numbers in the formula. For (OH)2 multiply the bracket contents. All tiers.

$$M_r = \sum A_r$$

LEARN IT

Percentage by mass of an element in a compound
Atoms is the number of atoms of that element in one formula. All tiers.

$$\%\ \text{by mass} = \frac{\text{atoms} \times A_r}{M_r} \times 100$$

LEARN IT

Moles and reacting masses

Higher Tier only throughout this section.

Amount of substance (moles)
n in mol, m in g, Mr relative formula mass (grams per mole). Rearrange for mass: m = n x Mr. Higher tier only.

$$n = \frac{m}{M_r}$$

LEARN IT

Avogadro constant
One mole of any substance contains 6.02 × 10^{23} atoms, molecules or ions, so the number of particles N = n x 6.02 × 10^{23}. Higher tier only.

$$6.02 \times 10^{23}\ \text{per mole}$$

LEARN IT

Moles in a balanced equation
Read the balancing numbers as mole ratios, for example Mg + 2HCl gives 1 mol Mg to 2 mol HCl. Convert to moles, use the ratio, then convert back to mass. Higher tier only.

$$\frac{n_A}{\text{coefficient of A}} = \frac{n_B}{\text{coefficient of B}}$$

LEARN IT

Balancing numbers from masses
Convert each mass to moles, then divide all by the smallest to get a simple whole number ratio. Higher tier only.

$$\text{ratio} = \frac{m_1}{M_{r1}} : \frac{m_2}{M_{r2}} : \cdots$$

LEARN IT

Limiting reactant
Work out the moles of each reactant, compare them with the equation ratio, and use the limiting one to find the amount of product. Higher tier only.

$$\text{limiting reactant} = \text{the reactant that runs out first}$$

LEARN IT

Concentration of solutions

Concentration in g/dm3

Rearrange to find the mass of solute in a given volume. Convert cm3 to dm3 by dividing by 1000. All tiers; explaining how mass and volume relate to concentration is Higher tier only.

$$c\ (\text{g/dm}^3) = \frac{\text{mass of solute (g)}}{\text{volume of solution (dm}^3)}$$

LEARN IT

Energy changes and rates

Overall energy change from bond energies

Bond energies in kJ/mol are given in the question. A negative answer means exothermic (more energy released making bonds than taken in breaking them). Higher tier only.

$$\text{energy change} = \Sigma(\text{bonds broken}) - \Sigma(\text{bonds formed})$$

LEARN IT

Mean rate of reaction (product formed)

Quantity measured as mass in g or volume in cm3, so units g/s or cm3/s. Higher tier also uses moles and mol/s.

$$\text{mean rate} = \frac{\text{quantity of product formed}}{\text{time taken}}$$

LEARN IT

Mean rate of reaction (reactant used)

Same method using the reactant used up. Units g/s, cm3/s, or mol/s at Higher tier.

$$\text{mean rate} = \frac{\text{quantity of reactant used}}{\text{time taken}}$$

LEARN IT

Rate at one moment from a tangent

Draw a tangent to the curve at the chosen time and calculate its gradient. Higher tier only. All tiers draw tangents and use the slope.

$$\text{rate} = \text{gradient of tangent} = \frac{\Delta y}{\Delta x}$$

LEARN IT

Chromatography and uncertainty

Rf value

Measure from the origin line to the centre of the spot, and to the solvent front. No unit, between 0 and 1.

$$R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$$

LEARN IT

Mean of repeat results

Ignore anomalous results before averaging.

$$\text{mean} = \frac{\text{sum of results}}{\text{number of results}}$$

LEARN IT

Uncertainty from the range

The spec asks you to use the range of a set of measurements about the mean as the uncertainty. Range is largest minus smallest.

$$\text{uncertainty} = \pm\frac{\text{range}}{2}$$

LEARN IT

Learn these: not in the booklet

The 21 equations on the specification recall list

Weight, work done, force on a spring, distance travelled, acceleration, resultant force, momentum (HT), kinetic energy, gravitational potential energy, both power equations, both efficiency equations, wave speed, charge flow, V = IR, P = VI, P = I squared R, E = Pt, E = QV and density. The June 2027 sheet prints them, but the specification still lists them as recall and apply.

The 7 select and apply equations

v squared minus u squared, elastic potential energy, change in thermal energy, period, E = mL, and the two HT ones F = BIl and Vp Ip = Vs Is. These are on the sheet and you choose and use them.

Typical speeds

Walking about 1.5 m/s, running about 3 m/s and cycling about 6 m/s. The speed of sound in air is about 330 m/s.

Moles from mass

$$n = \frac{m}{M_r}$$

Higher Tier only. The Avogadro constant is 6.02×10^{23} per mole.

Concentration

$$c\ (\text{g/dm}^3) = \frac{m}{V}$$

V in dm3. Divide cm3 by 1000. Trilogy uses g/dm3 only.

Mean rate and Rf

Mean rate is quantity of reactant used or product formed over time taken. Rf is distance moved by substance over distance moved by solvent.

Using the booklet in the exam

- Check the sheet for the quantity you are asked for, then check the unit in the question before you substitute.
- Convert units first: grams to kilograms, centimetres to metres, minutes to seconds, kilowatts to watts, cm^2 to m^2.
- Write the equation, then the substitution, then the answer with its unit. Marks are given for each stage.
- Pick the right power equation: P = E/t, P = W/t, P = VI or P = I squared R depending on the data you are given.
- On a chemistry paper the periodic table gives relative atomic masses but no formulas: write n = m/Mr and the equation ratio yourself.
- Foundation students can skip the three HT physics rows and the Higher Tier only chemistry rows.

Based on: AQA GCSE Combined Science Trilogy 8464, Physics Equations Sheet, for use in June 2027 only; AQA GCSE Combined Science Trilogy 8464 specification, Specification version 1.3, October 2026 (Appendix B: physics equations; 5.3 quantitative chemistry, 5.5 energy changes, 5.6 rates); AQA periodic table insert, The Periodic Table of Elements, insert for 8462, 8464 and 8465 papers (June 2022 version of the same insert); AQA news, GCSE Maths and Sciences formulae and equation sheets for 2027 and 2028 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.