FORMULA SHEET

A Level chemistry data booklet and equations: what is given

The AQA booklet prints only the periodic table, IR and NMR tables and biochemistry structures; every calculation equation, such as pV = nRT and ΔG, you must learn.

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

What the AQA data booklet provides

The AQA 7405 booklet is only four pages and contains data tables, not equations or constants; all of it is printed for the exam.

The Periodic Table of the Elements Page 2. Gives atomic number, symbol, name and relative atomic mass, so use these Ar values in Mr and mole calculations.	A_r for every element	IN THE BOOKLET
Table A: infrared absorption data Page 3. Also lists N-H 3300 to 3500, O-H (alcohols) 3230 to 3550, O-H (acids) 2500 to 3000, C-H 2850 to 3300, C≡N 2220 to 2260, C=C 1620 to 1680, C-O 1000 to 1300 and C-C 750 to 1100 cm^{-1}.	C=O: 1680 to 1750 cm^{-1}	IN THE BOOKLET
Table B: 1H NMR chemical shift data Page 3. Covers ROH, RNH2, CH2, CH, protons next to C=O, O or halogens, alkene H, aldehyde H (9.0 to 10.0) and acid H (10.0 to 12.0).	δ for RCH_3 = 0.7 to 1.2 ppm	IN THE BOOKLET
Table C: 13C NMR chemical shift data Page 3. Also gives alkane C, C-halogen, C-N, C-O, C=C and arene, nitrile and ester or acid C=O ranges.	δ for C=O (aldehyde or ketone) = 190 to 220 ppm	IN THE BOOKLET
Phosphate, glucose and 2-deoxyribose Page 4. Skeletal structures for the DNA backbone and sugars (3.3.13 amino acids, proteins and DNA).	structures	IN THE BOOKLET
The four DNA bases Page 4. Structures only, so you still need to know which bases pair and how.	adenine, guanine, cytosine, thymine	IN THE BOOKLET
Six amino acids Page 4. Structures only; other amino acids will be drawn in the question if needed.	alanine, aspartic acid, cysteine, lysine, phenylalanine, serine	IN THE BOOKLET
Haem B Page 4. Printed with the biochemistry structures.	structure	IN THE BOOKLET

Constants and data AQA does not print

AQA states that you are not expected to recall these values; the question supplies them when they are needed.

Avogadro constant Not in the AQA booklet. The spec says you will not be expected to recall it; check the value printed in the question.	$L \approx 6.02 \times 10^{23}\ \text{mol}^{-1}$	LEARN IT
Gas constant Not in the AQA booklet. The spec says R will be given when required. Use it with pressure in Pa, volume in m^3 and temperature in K.	$R = 8.31\ \text{J K}^{-1}\ \text{mol}^{-1}$	LEARN IT
Specific heat capacity of water Not in the AQA booklet. The spec says you will not be expected to recall c; the question gives the value and units to use.	$c = 4.18\ \text{J g}^{-1}\ \text{K}^{-1}$	LEARN IT
Ionic product of water Not in the AQA booklet. Kw changes with temperature, so use the value in the question for any other temperature.	$K_w = 1.00 \times 10^{-14}\ \text{mol}^2\ \text{dm}^{-6}$ at 298 K	LEARN IT
Standard electrode potentials and bond enthalpies Not in the AQA booklet. Values are supplied in the question when a calculation needs them; the spec only expects you to use them.	$E^{\ominus}$ (V), bond enthalpy (kJ mol^{-1})	LEARN IT

Amount of substance and concentration

None of these equations is printed in the AQA booklet. Learn them and the units.

Moles from mass n in mol, m in g, Mr in g mol^{-1}. Use Ar from the periodic table.	$n = \frac{m}{M_r}$	LEARN IT
Moles in solution c in mol dm^{-3}, V in dm^3. Convert cm^3 to dm^3 by dividing by 1000.	$n = c \times V$	LEARN IT
Concentration Mass concentration in g dm^{-3} = c x Mr.	$c = \frac{n}{V}$	LEARN IT
Number of particles L is the Avogadro constant. Use it for atoms, molecules, ions or electrons.	$N = n \times L$	LEARN IT
Dilution A rearrangement of n = cV with n unchanged. Keep both volumes in the same unit.	$c_1V_1 = c_2V_2$	LEARN IT
Empirical formula Divide by the smallest number of moles, then scale up if you get halves or thirds.	$\text{moles of each element} = \frac{\text{mass}}{A_r} \Rightarrow \text{simplest whole-number ratio}$	LEARN IT

Ideal gas equation

Ideal gas equation p in Pa, V in m^3, n in mol, T in K. 1 dm^3 = 1 × 10^{-3} m^3; 1 kPa = 1000 Pa. R is given in the question.	$pV = nRT$	LEARN IT

Relative molecular mass of a volatile liquid Rearranged from pV = nRT with n = m/Mr. Mass in g gives Mr in g mol^{-1}.	$M_\mathrm{r} = \dfrac{mRT}{pV}$	LEARN IT

Percentage yield and atom economy

Percentage yield Compare moles with moles or mass with mass, not one of each.	$\%\ \text{yield} = \dfrac{\text{actual amount of product}}{\text{theoretical amount of product}} \times 100$	LEARN IT
Percentage atom economy Use the balanced equation and include the coefficients. This is the AQA definition.	$\%\ \text{atom economy} = \dfrac{M_\mathrm{r}\ \text{of desired product}}{\text{sum of } M_\mathrm{r}\ \text{of all reactants}} \times 100$	LEARN IT

Energetics: calorimetry, Hess and bond enthalpies

Heat change in calorimetry m in g (mass of the substance heated, usually the water or solution), c in J g^{-1} K^{-1}, q in J. c is given in the question.	$q = mc\Delta T$	LEARN IT
Molar enthalpy change Convert q to kJ first (divide by 1000) so that the answer is in kJ mol^{-1}. Negative for a temperature rise (exothermic).	$\Delta H = -\dfrac{q}{n}$	LEARN IT
Hess's law with formation data Multiply each value by its coefficient. Elements in their standard states have Delta_f H = 0.	$\Delta_\mathrm{r}H = \sum \Delta_\mathrm{f}H^\ominus(\text{products}) - \sum \Delta_\mathrm{f}H^\ominus(\text{reactants})$	LEARN IT
Hess's law with combustion data Note the reversed order compared with formation data.	$\Delta_\mathrm{r}H = \sum \Delta_\mathrm{c}H^\ominus(\text{reactants}) - \sum \Delta_\mathrm{c}H^\ominus(\text{products})$	LEARN IT
Mean bond enthalpies Gives an approximate value because the bond enthalpies are averages and the species are gases.	$\Delta H = \sum(\text{bonds broken}) - \sum(\text{bonds formed})$	LEARN IT
Enthalpy of solution from a cycle A-level only. Lattice dissociation enthalpy is the negative of lattice formation enthalpy.	$\Delta_\mathrm{sol}H = \Delta H_{\text{lattice dissociation}} + \sum \Delta_\mathrm{hyd}H$	LEARN IT
Born-Haber cycle A-level only. Draw the cycle and apply Hess's law to find any one missing step, usually the lattice enthalpy.	$\Delta_\mathrm{f}H = \text{atomisation} + \text{ionisation energies} + \text{bond enthalpy terms} + \text{electron affinities} + \text{lattice formation}$	LEARN IT

Equilibrium: Kc and Kp

For the reaction aA + bB ⇌ cC + dD at a fixed temperature.

Equilibrium constant Kc Concentrations in mol dm^{-3} at equilibrium. Work out the units from the expression. Only temperature changes Kc.	$K_c = \dfrac{[\mathrm{C}]^c[\mathrm{D}]^d}{[\mathrm{A}]^a[\mathrm{B}]^b}$	LEARN IT
Equilibrium constant Kp A-level only. Gases only, partial pressures at equilibrium. Units follow from the pressure unit used.	$K_p = \dfrac{p_\mathrm{C}^c\, p_\mathrm{D}^d}{p_\mathrm{A}^a\, p_\mathrm{B}^b}$	LEARN IT

Mole fraction Moles of the gas at equilibrium divided by the total moles of gas.	$x_{\mathrm{A}} = \dfrac{n_{\mathrm{A}}}{n_{\mathrm{total}}}$	LEARN IT
Partial pressure The partial pressures add up to the total pressure, which is a quick check.	$p_{\mathrm{A}} = x_{\mathrm{A}} \times P_{\mathrm{total}}$	LEARN IT

Rate equations and the Arrhenius equation

A-level only. The AQA spec says the Arrhenius equations and R will be given when required, but they are not in the booklet, so the question supplies them.

Rate equation m and n are orders (0, 1 or 2) found from experiment, not from the balanced equation. k is the rate constant.	$\mathrm{rate} = k[\mathrm{A}]^m[\mathrm{B}]^n$	LEARN IT
Overall order Use it to work out the units of k, for example $\mathrm{mol}^{-1}\ \mathrm{dm}^3\ \mathrm{s}^{-1}$ for second order.	$\mathrm{overall\ order} = m + n$	LEARN IT
Arrhenius equation Supplied in the question when required. Ea in J mol^{-1}, T in K, A is the Arrhenius constant. Raising T increases k.	$k = Ae^{-E_a/RT}$	LEARN IT
Arrhenius, logarithmic form Supplied when required. Plot ln k (y) against 1/T (x): gradient = -Ea/R and intercept = ln A. Convert Ea to kJ mol^{-1} at the end.	$\ln k = -\dfrac{E_a}{RT} + \ln A$	LEARN IT

Acids, bases, pH and buffers

A-level only. Use the units and approximations the AQA spec describes.

pH Convert back with [H+] = 10^-pH. For a strong monoprotic acid, [H+] equals the acid concentration.	$\mathrm{pH} = -\log_{10}[\mathrm{H}^+]$	LEARN IT
Ionic product of water Use it to find the pH of a strong base: [H+] = Kw / [OH-], then take -log.	$K_w = [\mathrm{H}^+][\mathrm{OH}^-]$	LEARN IT
Acid dissociation constant Units mol dm^{-3}. Written for HA ⇌ H+ + A-.	$K_a = \dfrac{[\mathrm{H}^+][\mathrm{A}^-]}{[\mathrm{HA}]}$	LEARN IT
pKa Convert back with Ka = 10^-pKa. pKa has no units.	$\mathrm{p}K_a = -\log_{10} K_a$	LEARN IT
pH of a weak acid (approximation) Assumes [H+] = [A-] and that [HA] at equilibrium equals the starting concentration. State both assumptions.	$[\mathrm{H}^+] = \sqrt{K_a\,[\mathrm{HA}]}$	LEARN IT
Acidic buffer Rearranged from Ka with [HA] and [A-] taken as the amounts of weak acid and its salt. Take -log to get pH.	$[\mathrm{H}^+] = K_a \times \dfrac{[\mathrm{HA}]}{[\mathrm{A}^-]}$	LEARN IT
Acidic buffer, Henderson form Equivalent to the line above. Check what your teacher accepts, but the previous form follows the AQA wording.	$\mathrm{pH} = \mathrm{p}K_a + \log_{10}\dfrac{[\mathrm{A}^-]}{[\mathrm{HA}]}$	LEARN IT

Titration calculation Find moles from c x V of the known solution, then use the equation ratio.	$n(\text{acid}) = \dfrac{\text{coefficient of acid}}{\text{coefficient of base}} \times n(\text{base})$	LEARN IT

Entropy and Gibbs free-energy change

A-level only.

Entropy change of a reaction Absolute entropies are supplied in the question. Units J K^{-1} mol^{-1}.	$\Delta S^{\ominus} = \sum S^{\ominus}(\text{products}) - \sum S^{\ominus}(\text{reactants})$	LEARN IT
Gibbs free-energy change The spec gives this as the relationship to learn. Convert ΔS to kJ K^{-1} mol^{-1} (divide by 1000) so all terms are in kJ mol^{-1}.	$\Delta G = \Delta H - T\Delta S$	LEARN IT
Feasibility condition A reaction is feasible when the free-energy change is zero or negative.	$\Delta G \leq 0$	LEARN IT
Temperature at which a reaction becomes feasible Set ΔG = 0 and rearrange. Check the units of ΔS first.	$T = \dfrac{\Delta H}{\Delta S}$	LEARN IT
ΔG against T graph Plot ΔG (y) against T (x) in kelvin.	$\text{gradient} = -\Delta S, \quad \text{intercept} = \Delta H$	LEARN IT

Electrode potentials and cells

A-level only. AQA does not require the Nernst equation.

EMF of a cell The more positive half-cell is the positive electrode. The E° values are supplied in the question.	$E^{\ominus}_{\text{cell}} = E^{\ominus}_{\text{positive}} - E^{\ominus}_{\text{negative}}$	LEARN IT
Conventional cell representation Negative electrode on the left, positive on the right. A double line is the salt bridge.	$\text{Pt} \mid \text{Fe}^{2+}, \text{Fe}^{3+} \mid\mid \text{Ag}^{+} \mid \text{Ag}$	LEARN IT
Feasibility from E° The direction is predicted only; the rate may still be too slow, and non-standard conditions change E.	$E^{\ominus}_{\text{cell}} > 0 \Rightarrow \text{reaction predicted to go}$	LEARN IT

Comparison with other boards

The given column refers to AQA 7405. The notes say what Pearson Edexcel International A Level (YCH11), Pearson Edexcel A Level (9CH0) and Cambridge 9701 (2025 to 2027) print.

Gas constant R Printed in Edexcel IAL, Edexcel 9CH0 and Cambridge booklets. AQA supplies it in the question.	$R = 8.31\ \text{J K}^{-1}\ \text{mol}^{-1}$	LEARN IT
Avogadro constant Edexcel IAL and 9CH0 print 6.02 × 10^{23}. Cambridge prints 6.022 × 10^{23}. AQA supplies it in the question.	$L = 6.02 \times 10^{23}\ \text{mol}^{-1}$	LEARN IT
Molar volume of a gas Edexcel IAL and 9CH0 print 24 dm^3 mol^{-1} at r.t.p. Cambridge prints 22.4 dm^3 mol^{-1} at s.t.p. (101 kPa, 273 K) and 24.0 dm^3 mol^{-1} at room conditions. AQA does not print a molar volume.	$V_m = 24\ \text{dm}^3\ \text{mol}^{-1}\ \text{at r.t.p.}$	LEARN IT

Ionic product of water Edexcel IAL, Edexcel 9CH0 and Cambridge (at 298 K) print it. AQA does not.	$K_w = 1.00 \times 10^{-14}\ \text{mol}^2\,\text{dm}^{-6}$	LEARN IT
Elementary charge Printed by Edexcel IAL, Edexcel 9CH0 and Cambridge (shown as -1.60 × 10^{-19} C). Not in the AQA booklet.	$e = 1.60 \times 10^{-19}\ \text{C}$	LEARN IT
Faraday constant Printed in the Cambridge booklet only. Not in the Edexcel or AQA booklets.	$F = 9.65 \times 10^{4}\ \text{C mol}^{-1}$	LEARN IT
Specific heat capacity of water Printed in the Cambridge booklet only. AQA and Edexcel supply it in the question.	$c = 4.18\ \text{J g}^{-1}\,\text{K}^{-1}$	LEARN IT
Standard electrode potentials Printed by Edexcel IAL and 9CH0 (31 half-equations, 298 K) and by Cambridge (alphabetical list, with other tables). Not in the AQA booklet.	$E^{\ominus}$ (V) table	LEARN IT
Bond energies Printed in the Cambridge booklet only (diatomic and polyatomic tables). Not in the AQA or Edexcel booklets.	bond energy (kJ mol^{-1})	LEARN IT
Ionisation energies Printed in the Cambridge booklet for selected elements. Not in the AQA or Edexcel booklets.	1st to 4th (kJ mol^{-1})	LEARN IT
Pauling electronegativities Printed by Edexcel IAL, Edexcel 9CH0 and Cambridge. Not in the AQA booklet.	χ for each element	LEARN IT
IR, 1H NMR and 13C NMR tables All four booklets print IR and NMR data. AQA and Cambridge use tables; Edexcel uses a chart for NMR. The values differ between boards, so use the booklet for your own board.	spectroscopy data	IN THE BOOKLET
Periodic Table Printed in all four booklets.	A_r	IN THE BOOKLET
Biochemistry structures Printed in the AQA booklet only (phosphate, glucose, 2-deoxyribose, four bases, six amino acids, haem B).	bases, sugars, amino acids	IN THE BOOKLET
Calculation equations None of the four booklets prints calculation equations. You must learn them for every board; only the values supplied differ.	$n = \dfrac{m}{M_\text{r}},\ pV = nRT,\ \Delta G = \Delta H - T\Delta S$	LEARN IT

Learn these: not in the booklet

Moles from mass

$$n = \frac{m}{M_\text{r}}$$

Moles in solution

$$n = cV$$

Ideal gas equation

$$pV = nRT$$

Percentage yield

$$\frac{\text{actual}}{\text{theoretical}} \times 100$$

Percentage atom economy

$$\frac{M_\text{r}\ \text{desired product}}{\sum M_\text{r}\ \text{reactants}} \times 100$$

Heat change

$$q = mc\Delta T$$

Hess's law

$$\Delta_r H = \sum \Delta_f H(\text{products}) - \sum \Delta_f H(\text{reactants})$$

Kc and Kp expressions

$$p = xP$$

Write Kc and Kp from the balanced equation; partial pressure is mole fraction times total pressure.

Rate equation

$$\text{rate} = k[\text{A}]^m[\text{B}]^n$$

pH

$$\text{pH} = -\log_{10}[\text{H}^+] and K_w = [\text{H}^+][\text{OH}^-]$$

Ka and pKa

$$K_a = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]},\ \text{p}K_a = -\log_{10} K_a$$

Gibbs free energy

$$\Delta G = \Delta H - T\Delta S$$

Cell EMF

$$E^{\ominus}_{\text{cell}} = E^{\ominus}_{\text{positive}} - E^{\ominus}_{\text{negative}}$$

Using the sheet in the exam

- Open the AQA booklet before the exam and find the periodic table on page 2 and the spectroscopy tables on page 3, so you do not search for them under time pressure.
- Do not look for equations in the booklet: none is printed. Learn every equation and the units, then check each answer has the right units.
- Convert before you substitute: cm^3 to dm^3 for concentrations, dm^3 to m^3 and kPa to Pa for pV = nRT, and J to kJ when combining Delta H and T Delta S.
- For spectra, match the question's compound to the ranges in the table; remember O-H in acids (2500 to 3000) is broader and lower than in alcohols.
- When a question gives R, Ka or Kw, use exactly the value in the question, and keep to the number of significant figures in the data.

Checked against the official documents: AQA A Level Chemistry (7405), A-level Chemistry 7405 Data Booklet (insert provided with the papers) and the AQA specification; Pearson Edexcel International A Level Chemistry (YCH11), IAL Chemistry data booklet (specification appendix, pages 100 to 105); Pearson Edexcel A Level Chemistry (9CH0), GCE Chemistry (9CH0) Data Booklet, Issue 2, Summer 2017; Cambridge International AS & A Level Chemistry (9701), Syllabus 2025, 2026 and 2027, Data section (pages 80 to 91). 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.