Chemistry Paper 1 Mark Scheme

Sample assessment 2026–27

Time allowed: 2 hours Total marks: 70

STAFF ONLY

Credit valid equivalent scientific responses where they meet the approved set-specific marking criteria. Reconcile every maximum mark to the candidate paper and answer booklet.

Section A · Multiple-choice questions

Award 1 mark for each correct answer.

Question	Correct answer
A1	D · 0.100 mol. n = 4.00/40.0 = 0.100 mol.
A2	B · 6.00 dm³. V = 0.250 × 24.0 = 6.00 dm³.
A3	A · 0.40%. The titre uses two readings: 100 × 0.10/25.00 = 0.40%.
A4	C · Closeness of a measured value to the accepted or true value. Accuracy concerns agreement with the value being measured.
A5	A · Proton number and electron number. Isotopes differ in neutron number; neutral atoms have electrons equal to protons.
A6	C · 24.3. The weighted mean is 24×0.80 + 25×0.10 + 26×0.10 = 24.3.
A7	D · $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$. The 13 electrons occupy the subshells in this order.
A8	B · The electron removed from aluminium is in a higher-energy 3p subshell. The 3p electron is easier to remove than the magnesium 3s electron.
A9	B · Both electrons from nitrogen. Nitrogen donates its lone pair to the proton.
A10	A · Octahedral. Six bonding pairs around sulfur give an octahedral arrangement.
A11	D · Hydrogen bonding between water molecules. Water molecules form intermolecular hydrogen bonds.
A12	C · Its equal bond dipoles cancel in a linear molecule. The symmetry makes the resultant molecular dipole zero.
A13	C · +6. x + 4(−2) = −2, so x = +6.
A14	D · Increased distance and shielding make the outer electron easier to remove. The attraction for the outer electron decreases despite increased nuclear charge.

Question	Correct answer
A15	A · Magnesium oxide and hydrogen. $Mg + H_2O(g) \rightarrow MgO + H_2$.
A16	B · Br^-. Bromide ions lose electrons to form bromine.
A17	D · The solution temperature falls. The reaction takes in energy from the surrounding solution.
A18	A · 2090 J. $q = mc\Delta T = 100 \times 4.18 \times 5.0 = 2090$ J.
A19	B · The enthalpy change depends only on initial and final states, not the route. Enthalpy is a state function.
A20	C · An average enthalpy needed to break one mole of a specified bond in gaseous species. The value is averaged over chemical environments.

Section B · Extended-response marking map

Question B1 · 10 marks

(a) 2 marks
1 mark: Correct products NaCl, CO_2 and H_2O.
1 mark: Correct coefficients: $Na_2CO_3 + 2HCl \rightarrow 2NaCl + CO_2 + H_2O$.
Mapping: LO1; AO1 2

(b) 3 marks
1 mark: n = 2.65/106.0 = 0.0250 mol.
1 mark: V = 0.2500 dm^3; uses c = n/V.
1 mark: c = 0.100 mol dm^{-3}.
Mapping: LO1; AO2 3

(c) 3 marks
1 mark: The aliquot contains 0.100 × 0.02500 = 0.00250 mol Na_2CO_3.
1 mark: n(HCl) = 2 × 0.00250 = 0.00500 mol.
1 mark: c(HCl) = 0.00500/0.02000 = 0.250 mol dm^{-3}.
Mapping: LO1; AO2 3

(d) 2 marks
1 mark: Close agreement supports precision but a systematic error could affect all titres similarly.
1 mark: A relevant check such as testing a certified reference/independently prepared standard, or checking calibration of volumetric apparatus against an independent reference.
Mapping: LO2; AO3 2

Alternative valid responses / allocation: (a) One mark for correct products; second requires the complete balanced equation. State symbols are not required.(b) Award one mark for the mole calculation, one mark for the concentration setup and one mark for the correct answer with units. A correct final answer without sufficient relevant working earns the accuracy mark only.(c) Award one mark for the aliquot amount, one mark for the stoichiometric ratio and one mark for the concentration calculation and answer with units. Allow follow-through from part (b) where the method remains valid; an unsupported final answer earns the accuracy mark only.(d) Credit another check that addresses accuracy; simply repeating the same titration is insufficient for the second mark.

Question B2 · 10 marks

(a) 2 marks
1 mark: 17 protons.
1 mark: 20 neutrons.
Mapping: LO3; AO1 2

(b) 2 marks
1 mark: Uses weighted mean (35×75.0 + 37×25.0)/100.
1 mark: 35.5, with no unit.
Mapping: LO3; AO2 2

(c) 2 marks
1 mark: Two outer-shell electrons.
1 mark: The large jump between the second and third ionisations indicates removal from an inner shell after the two outer electrons.
Mapping: LO4; AO2 2

(d) 4 marks
1 mark: Electrons occupy discrete/quantised energy levels.
1 mark: An excited electron can move from a higher to a lower level.
1 mark: A photon is emitted with energy equal to the difference between the levels.
1 mark: Only particular energy differences and therefore particular frequencies/wavelengths occur.
Mapping: LO4; AO1 4

Alternative valid responses / allocation: (b) Award one mark for a stated weighted-mean method and one mark for 35.5. An unsupported correct answer earns the accuracy mark only.(d) Credit an equivalent clear account; do not require a numerical spectral calculation.

Question B3 · 10 marks

(a) 2 marks
1 mark: An electrostatic attraction.
1 mark: Between oppositely charged ions.
Mapping: LO5; AO1 2

(b) 4 marks
1 mark: A giant ionic lattice.
1 mark: Strong electrostatic attractions act between oppositely charged ions.
1 mark: Substantial energy is needed to overcome these attractions on melting.
1 mark: Ions are fixed in the solid but mobile and able to carry charge in the liquid.
Mapping: LO5, LO6; AO2 4

(c) 2 marks
1 mark: Hydrogen is covalently bonded to a strongly electronegative N, O or F atom.
1 mark: It is attracted to a lone pair on an N, O or F atom of another molecule.
Mapping: LO6; AO1 2

(d) 2 marks
1 mark: Many simple molecular substances share these broad physical properties, so they do not uniquely identify Q.
1 mark: A discriminating additional measurement such as an accurately measured boiling point compared with reference data, or a suitable independent spectrum/composition measurement.
Mapping: LO2, LO6; AO3 2

Alternative valid responses / allocation: (c) For this question credit the conventional intermolecular hydrogen-bonding account taught at this level.
(d) Accept a valid distinguishing test with its use clear; a full analytical method outside Paper 1 is not required.

Question B4 · 10 marks

(a) 4 marks
1 mark: Oxidation has $2Br^- \rightarrow Br_2$.
1 mark: Correct electron placement and balance: $2Br^- \rightarrow Br_2 + 2e^-$.
1 mark: Reduction has $Cl_2 \rightarrow 2Cl^-$.
1 mark: Correct electron placement and balance: $Cl_2 + 2e^- \rightarrow 2Cl^-$.
Mapping: LO7, LO8; AO1 4

(b) 2 marks
1 mark: Chlorine is a stronger oxidising agent/more readily gains electrons than bromine.
1 mark: It can oxidise bromide to bromine; bromine is insufficiently strong an oxidising agent to oxidise chloride under these conditions.
Mapping: LO8; AO2 2

(c) 2 marks
1 mark: Mg^{2+} is smaller and has greater charge density/polarising power than Ba^{2+}.
1 mark: It distorts the carbonate ion more strongly, making magnesium carbonate less thermally stable/easier to decompose.
Mapping: LO8; AO2 2

(d) 2 marks
1 mark: Identifies unequal masses, different vessels, uncontrolled heating/temperature, or unequal gas-detection conditions as a relevant weakness.
1 mark: Explains how that difference could change heating or gas-detection time independently of thermal stability.
Mapping: LO2, LO8; AO3 2

Alternative valid responses / allocation: (a) Award two marks per correctly balanced half-equation. One per correct species relationship without the correct electrons.
(d) A linked weakness and effect are required; do not credit unrelated generic statements.

Question B5 · 10 marks

(a) 2 marks
1 mark: The enthalpy change when one mole of a substance is completely burned in oxygen.
1 mark: With reactants and products in their standard states under standard conditions.
Mapping: LO9; AO1 2

(b) 3 marks
1 mark: n = 2.30/46.0 = 0.0500 mol.
1 mark: Energy released = 0.0500 × 1367 = 68.35 kJ.
1 mark: 68.4 kJ released, to three significant figures.
Mapping: LO1, LO9; AO2 3

(c) 3 marks
1 mark: Energy to break bonds = 436 + 243 = 679 kJ mol^{-1} of reaction.
1 mark: Energy released on formation = 2 × 432 = 864 kJ mol^{-1} of reaction.
1 mark: ΔH = 679 − 864 = −185 kJ mol^{-1}.
Mapping: LO10; AO2 3

(d) 2 marks
1 mark: A valid cause, such as heat lost to surroundings, heat absorbed by unaccounted apparatus, incomplete combustion, or fuel evaporation included as burned fuel.
1 mark: A linked explanation that less measured heat per assumed mole burned gives a smaller magnitude/less negative inferred enthalpy.
Mapping: LO2, LO9; AO3 2

Alternative valid responses / allocation: (b) Award one mark for the mole calculation, one mark for the energy calculation and one mark for 68.4 kJ released to three significant figures. Accept −68.4 kJ as the reaction enthalpy change if the sign convention is clear; an unsupported final answer earns the accuracy mark only.(c) Award one mark for energy to break bonds, one mark for energy released on formation and one mark for the signed answer with units. An unsupported correct answer earns the final accuracy mark only.(d) One linked cause and explanation, not two unconnected causes; accept another scientifically valid mechanism.

Marking principles

Award one mark for the single correct MCQ option; otherwise award zero. No negative marking. If an answer is clearly replaced, mark the final unambiguous choice.

For Section B, use the stated point allocations and specific calculation rules. Credit equivalent scientifically correct responses; do not double-credit a repeated point.

Where a later calculation uses an earlier incorrect value correctly, credit the independent subsequent method unless this makes the task trivial. Do not award the final accuracy mark for an incorrect result.

Do not penalise spelling unless meaning is unclear or a different scientific term is given. Credit correct chemical reasoning expressed in equivalent language.

All raw marks, marker identities, moderation decisions and release approvals must be recorded through the controlled pack processes.

Paper total: 70 marks. AO1, AO2 and AO3 are assessed.