

On this exam a justification is a chain of particles: what species is present, what it does, and why that produces the observation. A restatement of the observation never scores. Everything below is a rule the readers apply. “ ” : , ,

Justifying, calculating, communicating

✗ Justifying an answer by restating what the question observed.

✓ **Name the particles and the interaction: ‘the solution conducts, so mobile ions must be present, so the compound is ionic’.**

The guidelines print exactly this chain as the justification that earns the point.

SG 3 years

✗ Giving an enthalpy change with no sign.

✓ **The sign IS the answer: negative for exothermic, positive for endothermic.**

Mark schemes state the sign must be included; a magnitude alone does not earn the point.

MS

✗ Answering a calculation with the number only.

✓ **Show the set-up – the balanced equation, the moles, the substitution – then the value with its units.**

Points are awarded for the set-up separately from the arithmetic, so working survives a slip.

SG 3 years

✗ Rounding a molar quantity partway through.

✓ **Carry the full value and round once, matching the data’s significant figures.**

The precision of the data given sets the precision of the answer, and premature rounding moves it out of range.

CED Skill 5

✗ Drawing a Lewis structure with the lone pairs left off.

✓ **Show ALL bonding pairs and ALL non-bonding pairs explicitly.**

Mark schemes state this requirement in those words; implied electrons earn nothing.

MS

■ Where a question asks for a particulate diagram, draw the right NUMBER of particles as well as the right kinds – the ratio is part of the answer.

CED Skill 1

1 · Atomic Structure and Properties

✗ Explaining an ionisation-energy trend by ‘more protons’.

✓ **Finish the chain: greater effective nuclear charge, so the outer electron is held more strongly.**

The readers award the point for the attraction, not for the count of protons.

CED 1.6

✗ Reading a photoelectron spectrum peak height as energy.

✓ **Height gives the NUMBER of electrons in that subshell; position gives the binding energy.**

The two axes carry different information, and swapping them makes every deduction wrong.

CED 1.4

2 · Compound Structure and Properties

✗ Assigning an oxidation number by guessing.

✓ **Work from the rules: Na is +1 and O is -2, so in NaOCl the chlorine must be +1 for neutrality.**

Mark schemes print this exact reasoning for the point.

MS

✗ Explaining a boiling-point difference by ‘stronger bonds’.

✓ **Name the intermolecular force – hydrogen bonding, dipole-dipole, London dispersion – and say why it is stronger here.**

Covalent bonds are not what breaks on boiling; the wrong force makes the explanation wrong.

CED 2.5

3 · Properties of Substances and Mixtures

✗ Explaining a gas-law change without saying which quantities were held constant.

✓ **Name them: at constant temperature and amount, halving the volume doubles the pressure.**

The reasoning point depends on the conditions, not on the arithmetic.

CED 3.4

✗ Describing a solution’s concentration as ‘strong’.

✓ **Concentrated and dilute describe amount; strong and weak describe dissociation.**

The two words are not interchangeable, and the substitution makes an acid-base answer wrong.

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CED 3.9

4 · Chemical Reactions

✗ Writing a net ionic equation with the spectator ions still in it.

✓ **Cancel every species that appears unchanged on both sides, and balance charge.**

The spectators are what the question is asking you to remove.

CED 4.2

✗ Using the reagent in excess for a limiting-reactant calculation.

✓ **Compare mole ratios first, then work from the limiting one.**

Both moles are computable, so the wrong choice gives a plausible answer with no warning.

CED 4.5

5 · Kinetics

✗ Deducing a rate law from the balanced equation's coefficients.

✓ **Read it from the data: compare experiments where one concentration changes.**

The rate law is experimental; only for an elementary step do the coefficients give the orders.

CED 5.3

✗ Saying a catalyst 'speeds up the reaction'.

✓ **It provides an alternative pathway with a lower activation energy, and is not consumed.**

The mechanism is the explanation point; the effect is already in the question.

CED 5.10

✗ Naming the rate-determining step as the fastest one.

✓ **It is the SLOWEST step, and the rate law follows from it.**

The mechanism question hinges on this, and reversing it inverts the whole answer.

CED 5.8

6 · Thermochemistry

✗ Concluding a reaction is exothermic because the flask feels cool.

✓ **A flask that COOLS means the reaction absorbed energy: it is endothermic.**

Mark schemes print this reasoning directly, and the sign follows from it.

MS

✗ Using only the mass of the solute in $q = mc\Delta T$.

✓ **Use the total mass of the SOLUTION, and state the assumptions you made about c .**

The calorimetry point depends on the mass being the thing that changed temperature.

CED 6.5

7 · Equilibrium

✗ Saying an equilibrium ‘stops’ when it is reached.

✓ **Both reactions continue at equal rates, so the concentrations stay constant.**

The dynamic nature is the content being tested, and ‘stops’ contradicts it.

CED 7.2

✗ Applying Le Chatelier without saying which side has more moles of gas.

✓ **Compare the two sides first, then state the shift.**

The direction depends on that comparison, and the reasoning is the scored part.

SG2022 Q1

✗ Concluding that no solid remains when a solubility equilibrium is established.

✓ **If the system is at equilibrium, some solid must still be present.**

The guidelines print this reasoning: an equilibrium condition requires the solid phase.

SG2022 Q1

8 · Acids and Bases

✗ Assuming equal pH means equal concentration.

✓ **A weak acid needs a HIGHER concentration to reach the same pH as a strong one.**

The guidelines set out this comparison for hydrochloric and propanoic acid.

pH

SG2023 Q2

✗ Running a reaction that needs the deprotonated form in pure water.

✓ **Use a buffered solution at a pH that keeps the species in the form the reaction needs.**

The guidelines require the buffer to be named for the point.

SG2022 Q3

✗ Choosing an indicator by colour preference.

✓ **Choose one whose range spans the pH at the equivalence point.**

The equivalence pH depends on the salt formed, which is what the question is testing.

CED 8.8

9 · Thermodynamics and Electrochemistry

✗ Saying a reaction is ‘favourable’ because it is exothermic.

✓ **For $\Delta G < 0$ at ALL temperatures the reaction must be exothermic AND have a positive entropy change.**

Mark schemes state both conditions explicitly; one alone is not sufficient.

MS

✗ Predicting the sign of ΔS without counting the gas moles.

✓ **No gaseous reactants and gaseous products means ΔS is positive.**

Mark schemes print this reasoning as the justification that earns the point.

MS

✗ Deciding which species is oxidised by guessing.

✓ **Use the cell's behaviour or the standard potentials: a working cell means E° is positive, which fixes the direction.**

The guidelines print both routes as accepted justifications.

SG 2 years

✗ Choosing a titrant without checking the thermodynamics.

✓ **Pick the one for which E° is positive, or ΔG° negative.**

The guidelines award the point for choosing the correct titrant AND understanding why.

SG2021 Q4

■ Where you calculate an entropy or enthalpy from tabulated values, write the subtraction out – products minus reactants – before the arithmetic. The set-up is a separate point.

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SG2023 Q1