A-Level Chemistry

Lab Report Guide · 实验报告指南

Chemistry practical work splits into two kinds that are marked quite differently: quantitative work, where the marks are in the table, the arithmetic and the uncertainty, and qualitative analysis, where they are in observation wording and inference. This guide gives the frame for both. 化学实验分定量与定性两类，评分标准不同，本册分别给出写作框架。

Quantitative work – the titration frame

The results table — Rows for rough and at least two accurate titres, columns for final reading, initial reading and titre, all to the same two decimal places – 0.05 cm^3 precision, so 24.50 cm^3, never 24.5.

Concordant titres — Identify titres within 0.10 cm^3 of each other, tick them, and average ONLY those. Averaging the rough titre in is a guaranteed lost mark and it is checked every session.

The calculation chain — Moles of the standard solution, then the equation ratio, then moles of the unknown, then its concentration. Set each step out on its own line; a bare final answer forfeits the method marks.

Uncertainty — A burette reading has an uncertainty of ± 0.05 cm^3 and a titre uses TWO readings, so its absolute uncertainty is ± 0.10 cm^3. Percentage uncertainty is that divided by the titre; a small titre therefore carries a large percentage uncertainty, which is the standard evaluation point.

Improving precision — A larger titre reduces the percentage uncertainty. Suggest a more dilute titrant or a larger aliquot, and say by how much the uncertainty would fall.

Quantitative work – enthalpy and rates

Enthalpy determinations — Use $q = mc\Delta T$ with the mass of the SOLUTION, then divide by moles and flip the sign. Extrapolate a cooling curve back to the mixing time to find the true temperature rise, and say why: heat is lost during the reaction.

Rate experiments — Record the time to a fixed extent of reaction, and plot $1/t$ as a measure of the initial rate. State what is kept constant, including total volume, which must be maintained with water so concentration is the only variable.

Judging the trend — Compare like with like: if doubling a concentration doubles $1/t$, the order in that reagent is one. Say so, and give the evidence from the table.

Qualitative analysis – the observation frame

Write what you saw, not what you concluded — "A white precipitate formed, which dissolved in excess sodium hydroxide" is an observation. "Aluminium ions are present" is an inference and belongs in the next column. Mixing them costs the observation mark.

Be complete about colour and state — Name the colour, the state, and whether there was effervescence, warming or a smell. "Precipitate" alone is not enough; "pale blue precipitate" is.

Test with excess — For hydroxide and ammonia tests, always record both the initial result and the result on adding excess – the pair is what identifies the ion, and half the pair identifies nothing.

Inference wording — Name the ion, with its charge: "Cu^{2+} present", not "copper". Where a test narrows to two possibilities, say which two and what further test would separate them.

Evaluation and planning

Name errors specifically — Heat loss to the surroundings, incomplete combustion, evaporation of a volatile reagent, a solution left in the pipette, an indicator changing over a range. Each must be tied to the specific step it affects.

Say which direction the error pushes the result — Heat loss makes the measured temperature rise too small, so the calculated enthalpy change is too small in magnitude. Stating the DIRECTION is a separate mark from naming the error.

Planning questions — A plan must state the independent variable and its range, the dependent variable and how it is measured, at least three controlled variables, the apparatus with the reason for each choice of precision, and a safety measure justified by a named hazard.

The write-up skeleton

Aim and the equation for the reaction, balanced, with state symbols.

Method: enough detail for another student to repeat it, including concentrations and volumes. Hazards named with the precaution each requires.

Results: one clearly headed table at the correct precision, with concordant titres identified.

Calculation: the chain, with units at every stage and the final answer to three significant figures.

Evaluation: the largest source of uncertainty identified by percentage, its direction of effect, and a specific improvement.