General Comments for Internal Assessment: Conclusion & Evaluation

Explanatory Note: Whilst correcting the IB-Lab: Mass Relationship in a Chemical Reaction for the Conclusion and Evaluation section, I have decided that it would be very beneficial to all of you to actually see the precise breakdown of where marks were awarded and where they were lost.
Thus I started out by making individual comments for each lab report. However, since the comments were practically the same or completely redundant as well as took enormous amount of time, I chose to compile a single comment package, (a sort of subject report), that would apply to the conclusion and evaluation section of all of the write-ups of your lab reports.

Below you will see all the things I noticed and noted down that were either very well done or need to be changed/edited. So, please do not be surprised or depressed right away, since not all of these comments apply to your particular lab report. However, please take a certain amount of time to read through carefully all of the comments below, as to avoid similar mistakes in future.

If you follow these notes and take the advice, I guarantee that in future you will score very high, if not perfect scores.
And most importantly treat this as a friendly offer of help. I am trying to give you as much guidance as possible!

Before we begin
Make sure that you know exactly what is required from you for the marking criteria (read the marking criteria carefully), —most of the time easy marks are lost due to the absence of a part of the criteria. To help you to ensure that you have covered each aspect of the marking criteria I have prepared a checklist for each of the Internal Assessment marking criteria. (See below)

Conclusion and Evaluation
Although, I was not marking the Procedure, however I needed to see it in order to correct the evaluations and weaknesses in the procedure that you stated as part of the modifications.

In the procedure, you should have stated the reasons for each step. (See Hadi Sukkar's report as an exemplar)
It was relevant to state that the copper should have been washed with copious amounts of water to dissolve the soluble aluminum chloride particles.

Always use formal tone for write-ups (avoid contractions and slang or simply loose language— I have encountered this a couple of times!).

If you are typing up the calculations, to give them a better look, use equation maker programs such as Equation Editor or Math Type.

Use the Symbol system to insert the ± .

There is always a space between the magnitude (i.e. the number) and the unit, i.e. 1.02 g not 1.02g.
Proper number of significant figures must be included with all measured values.
Recording 1.2 ± 0.01 g is incorrect as well as recording 1.200 ± 0.01 g. (why?)

The units are only placed once only in the header of the column of the data table and not repeated again in each of the cells of the column.

The quantitative data table should only include the data measurements made in the performance of the lab and not any calculations performed, (i.e. only DC and not DP).

If you used the mass of aluminium in your data table, you should have clearly stated whether this was the mass measured initially or after the reaction.

Note, that you were actually provided with copper (II) chloride dihydrate as the solid, and not copper (II) chloride, hence the main error in the calculation for molar mass, thus the mols and hence problems arising in the calculation of the mols ratio.

What is "odour of metal" as stated by most of you in the qualitative observations?

In qualitative observations, simply state what is being observed and not your inferences, example: a pink/bronze solid appeared in the colourless solution and not copper was seen and aluminium chloride solution formed.

Most of you stated that you observed a gas was evolved, however be observant and write the equation for the reaction to check if there should be any gas— this statement is illogical!

A good idea that I observed was to indicate footnotes on errors indicated in the evaluation. (See Callum Lurre's report as an exemplar)

There is a difference in stating mol ratio and *molar* ratio!

You should have calculated the theoretical mass of copper from the limiting reagent and the percentage error from your experimental data and hence stated it in the conclusion, since generally the experimental yield was much higher, this would have helped to explain the possible errors!

A percentage error should have been compared to the total estimated random error as derived from the propagation of uncertainties.

An explanation of how each of the errors encountered affected the results was not included. The direction of the error should have been indicated.

Do not write: "skewing the results" or "skewing the equation", this does not shed light on any aspect of the explanation or solution to the problem encountered.

Simply stating that it was difficult to observe if the reaction had gone to completion is insufficient— in the procedure mention the fact that when solution was colourless, this indicated that all the copper (II) ion, (Cu^{+2} ions are blue), had reacted.
To see the change in colour, the human eye is limited in its accuracy and perception is fallible, however then suggest a modification: since the reaction was exothermic, then why not wait until there is no further change in temperature; or keeping adding aluminium until no further reaction observed, or wait for a given time span to allow the reaction to complete.

Majority of the students did not record any qualitative observations for the dry copper, as these were relevant for the evaluation, especially if you started to mention the error of the copper turning green or the filter paper having a yellow ring around it.

If you mentioned that there was a green or black residue on the copper, it is then necessary to state the possible reasons: black due to oxidation of copper to copper (II) oxide whilst the green is due to the formation of copper (II) carbonate.

And the yellow ring is due to hydrated aluminium chloride remaining in the copper collected.

If the errors stated “the solution had a pink tinge upon filtration”, or”aluminium strip was crinkled”, or “the aluminium strip/scalpel contained pink residue”, all this resulted in the loss of fine copper particles as an error; then it is important and relevant that you should state this very clearly in the qualitative observation data table!

Do not state “if more time, copper may be removed from aluminium”, this is not an improvement.

Use of old aluminium strips is not an error, and the statement that O^{-2} bonds with Cl^{-1}, please read your work! (Some understanding of chemistry is necessary.)

Do not state “shine sandpaper”, what is that, I think you meant sandpaper the aluminium strip in order to remove the oxide layer!

Do not remove the oxide layer with iron wool, as the iron will react with the copper (II) chloride solution.

It is not sufficient to state that more precise equipment should be used!

Use of a ‘high speed jet of water’ to remove copper from the aluminium strip, or drying the aluminium strip and thus allowing the copper to ‘flake off easily’ as modifications were good. Or heating the aluminium with water and then collecting the detached copper via filtration.

A centrifuge may be used to prevent the loss of copper from the solution

A Buchner funnel (suction filtration) could have been used to speed up the filtration process.

Drying the copper using a desiccator may be used to dry the copper, (the desiccants are usually silica gel, calcium oxide) as a suggestion, instead of heating the copper as this will initiate the oxidation of copper to copper (II) oxide.

Using high grade chemicals to improve quality of chemicals for high school chemistry and not validated and is an unrealistic expense.

State that performing a single experiment so the data range is limited and does not offer the ability to determine means and averages for a more reliable experiment as an improvement and modification.