

Guidance for Practical 2 – Chapter 1

Determination of the empirical formula of magnesium oxide

This practical exercise has been designed as a simple task to illustrate some of the points required to meet the IB internal assessment criteria. This practical could not be used for assessment of DCP as the students have been told how to record their data and been given a data table to fill in.

The practical can be used to introduce the ideas of uncertainties in measurements and in recording data to the appropriate number of significant figures. For example, for measuring masses using a 2 d.p. balance, the mass of magnesium should be recorded as 0.10 ± 0.01 g.

The results of this experiment could also be compared with another experiment, such as one using a much smaller mass of Mg, so that the uncertainty in the mass recorded by the balance becomes much more significant.

Students should be encouraged to make detailed observations during practical work and to record qualitative as well as quantitative data.

Possible observations that could be made during this practical include the following:

- the crucible was dirty
- the magnesium ribbon was dull grey (indicating oxidation)
- the ribbon glowed bright white as it burned
- some white powder escaped from the crucible as the lid was lifted
- the final product was a white powder.

Possible sources of error in this practical include:

- formation of magnesium nitride by reaction with nitrogen in the air
- some of the magnesium oxide escaped so the final mass was lower than expected
- some of the magnesium had already been oxidised
- random errors due to the measuring apparatus
- if the crucible was dirty the substance inside it could have decomposed or reacted with the air.

For the systematic errors, students should consider whether they would cause the ratio to be too high or too low (too much Mg or too much O) and link this to their results.

Students should suggest improvements to the procedure to reduce the errors. These should be both specific and possible to carry out in a school laboratory, e.g. clean the magnesium with sand paper prior to weighing.

The formation of magnesium nitride is a significant source of error. An alternative procedure involves adding a few drops of water after the magnesium has completely reacted. This converts the magnesium nitride to magnesium hydroxide and ammonia. Heating the mixture strongly will then decompose the magnesium hydroxide to magnesium oxide and will drive off any excess water.