A GUIDE TO WRITING PRACTICAL REPORTS

The main purpose of scientific report writing is to communicate the results of your experiment so that other people can reproduce your results if necessary. The process of writing a scientific report gives you valuable practice in clearly explaining the theoretical concepts and interpreting and manipulating data. Since these skills are also vital for performing well in the written examination, mastering the art of writing practical reports is essential!

This document gives a general description of the sections of a scientific report; however, you should check with your teacher about their specific requirements as there may be differences in approach, style and presentation.

WRITING STYLE

A scientific report should be written in a straight forward and precise manner so that it is easy for other people to read and understand.

- You should write in complete, grammatically correct sentences.
- Avoid elaborate vocabulary.
- Use chemical terms and conventions correctly, including chemical equation and units of measurement.
- Be concise. If you can use one word instead of a phrase with two or more words, then choose the one word (get around = avoid).
- Avoid long sentences. If most of your sentences are long (4 or more 'clauses' or parts) you will confuse the reader.
- Write in the third person (‘it’ rather than I or we).
- Write in past tense.
- Avoid definitive words (proves, definitely, will cause).

  Useful words to use are: Possibly, inference, presumably, probably, apparently, not likely, seemingly, appear, suggest, seem, maybe.

- Write objectively: present facts and figures only, do not include your beliefs or feelings. Avoid colloquialisms such as ‘the results dramatically showed...”.

Avoid	Instead use
I observed the angle to be	
I suggest	
I found	
In this report I will show	
The loss in mass was due to	
The results prove that	

GENERAL FORMAT OF PRACTICAL REPORTS

While different schools will vary in the sections required in a practical report, generally all reports follow a similar format as follows.

Experimental details:

- Practical title
- Your name
- Laboratory partners
- Date

Introduction

Some teachers may like you to include relevant background information. For example:

> Colorimetry is an analytical chemistry technique used to determine the concentration of coloured solutions. A white light source is passed through a colour filter or alternative wavelength selection device. The coloured light then passes through a cuvette containing a chemical compound in solution. The intensity of the light leaving the sample will be less than the light entering the cuvette. The loss of light or absorption is proportional to the concentration of the compound. To quantitatively analyse a sample, the absorbance of standard solutions containing the substance being analysed are measured. This data is converted into a calibration curve so that the concentration of the unknown sample can be determined.

Aim:

Writing an aim involves concisely describing the purpose of the experiment. There may be one aim or several. For instrumentation-based practicals it is customary to mention the apparatus to be used.

The aim for a chemistry practical which uses a colorimeter to determine the concentration of iron in spinach might be written as:

> To use a colorimeter to measure the absorbance of five standard solutions containing iron and use the data to construct a calibration curve. Transfer the iron from spinach into solution and measure its absorbance under identical conditions. Use the calibration curve to determine the iron content of the spinach and compare this to the manufacturer's value.

Equipment:

Provide a list of the equipment that was used. Be specific. Clearly indicate the size of the glassware needed (50 mL beaker) and the concentrations of any solutions used. A list of equipment is usually included on the practical sheet and you may not be required to rewrite it. If this is the case, reference the practical sheet in this section and make sure you include it with your report. Any changes to the equipment used must be annotated on the practical sheet.

Method:

Provide progressive, step by step instructions of how to conduct the experiment from beginning to end so that it can be easily and accurately duplicated by others. Be explicit and accurate and quantify the steps as much as possible.

This section should start with a list of safety precautions. Safety information may be found on the practical sheet or your teacher may provide you with MSDS (Material Safety Data Sheets) information. You may be required to find this information yourself and in this case you will probably need to do an internet search.

Normally, the method is given out as part of the practical notes and very rarely would you be required to rewrite it. Some teachers will be happy with a reference to the method. If any changes have been made, ensure that they are clearly annotated on the sheet.

Example: Refer to attached sheet titled “Determination of HCl concentration in brick cleaner”.

If you have taken a photograph of your experimental set up, you would include it here. Make sure it is given a descriptive heading.

Results:

Any data collected or observations made during the experiment should be accurately recorded in this section. Your teacher may require you to include the rough copy of your results from the experiment in order to verify your work. The results section is divided into sub sections as described below.

Observations (qualitative results):

Observations include things like colour changes, the appearance of a gas, sounds that were made (popping, hissing) and also anything that could influence the outcome of the experiment. Do not analyse or comment on the relevance of the observations. This will be done in the discussion section.

Examples

- Some of the precipitate stuck to the bottom of the flask and could not be removed.
- Even after thorough mixing, some of the fertiliser did not dissolve.
- The red solution became darker as time passed.

Numerical Data

Numerical data should be presented in tables, figures or graphs.

Tables

- Require a descriptive title.
- Each column of data should be clearly labelled. Units should be included with the title of the column NOT in the body of the table where the numerical data is recorded. The associated uncertainty should also be stated.
- The number of significant digits should reflect the precision of the measurements.
- There should be no variation in the precision of raw data. For example, the same number of decimal places should be used if the measuring device is consistent.

Example:

Table 1: Change in temperature of water when heated.

Time (sec) ±1 sec	Temperature (°C) ± 0.5°C	Temperature (°C) ± 0.5°C
	Trial 1	Trial 2
0	21.0	21.5
30	23.5	22.5
60	26.5	26.0
90	30.0	30.5

Subsequent calculations are usually clearer if data is arranged in columns instead of rows (as above). The table below is harder to interpret for most people.

Time (sec) ±1 sec		0	30	60	90
Temperature (°C) ± 0.5°C	Trial 1	21.0	23.5	26.5	30.0
Temperature (°C) ± 0.5°C	Trial 2	21.5	22.5	26.0	30.5

Figures

Figures can include graphs, scatterplots, drawings or even photographs. Essentially, figures are pictures of things.

Example:

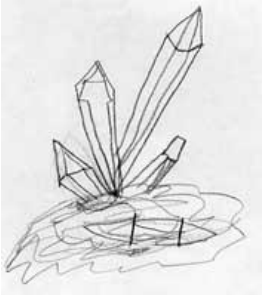


Figure 1: Drawing of NaCl crystals.

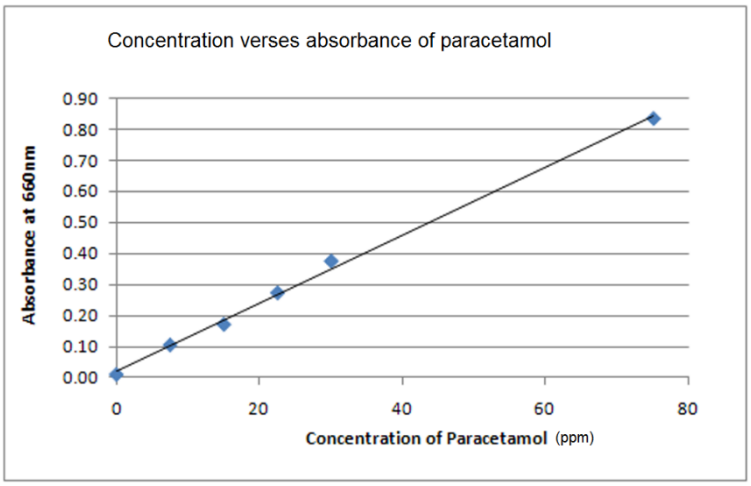
Graphs:

The type of graph required depends on the type of data collected. In chemistry, the most common type of graph will be one that shows a relationship between two variables. This type of data is best represented using a line graph.

Line graphs require:

- A descriptive title.
- Labelled axes with units.
- A line of best fit.
- The independent variable (the variable you are in control of changing) goes on the x axis.
- The dependant variable (the thing that you are recording) goes on the y axis.

Example:



Calculations:

Calculations will only apply to particular experiments. All steps should be shown in a logical order and be clearly set out.

Remember to:

- Show all calculations including averages, additions and subtractions.
- Use the correct number of significant figures.
- Use SI units.
- If a calculation is repeated a number of times, the full working out can be shown once as an example and the others can be recorded in a table.
- Error and uncertainty calculations should also be included here.

  Your teacher may require you to propagate uncertainties through a calculation by using the absolute and/or percent uncertainties from measurements to determine the overall uncertainty in calculated results. Usually only a simple treatment is required.
  For example, functions such as addition and subtraction, absolute uncertainties can be added. For multiplication, division and powers, percentage uncertainties can be added. You will need to discuss how to address errors with your teacher as it may be different to the method used in this document.
- Include a calculation of overall error if your result can be compared to a known value.
- Relevant, balanced equations with states can be included here.

Discussion:

The discussion section is used to identify the significance and meaning of the results that were collected and to identify any flaws or errors that occurred.

The discussion should cover the following questions and is usually written in an essay style (i.e. not as a question and answer section). The general topics found in a discussion are:

Discussion of results

- What do the results show? How do they relate to known theory?
- Do the results answer the aim?
- Are the results consistent with those reported by other groups?
- For quantitative experiments, compare your value to the expected value.

Errors and uncertainties

- If the results were not as expected, what are some possible explanations?
- What errors occurred and how did they affect the results?
- Comment on the overall error or % uncertainty in your quantitative results if possible.

Evaluation

- How could the experiment be improved?
- Were there any variables that should have been controlled but were not?
- Should more data have been collected in order to draw clearer conclusions?
- Could any of the errors and uncertainties be reduced or eliminated?
- Could the data have been measured more accurately?

Focus questions

Sometimes there will be questions included on the practical sheet for you to answer. These questions should be answered in the discussion.