A Level Chemistry

Required Practical Endorsement

Recording Practical Work in Your Lab Book

Why Keep a Lab Book?

You will need a record of your achievements as you progress through the two-year course; your lab book will highlight your development as a practical and methodical chemist.

Lab books also can be an opportunity to develop a skill used both by scientists and in business. They allow you to accurately and clearly record information, ideas and thoughts for future reference; this is a very useful life skill.

Plagiarism and Copying

You should know what plagiarism is. If you are unsure, look it up. Even better, see if someone else has looked it up and copy their answer!

The use of acknowledged sources is an encouraged and acceptable practice. Trying to pass off other people's work as your own is not an acceptable practice and definitely not cool! It will not help you learn.

You should use 'Harvard referencing' to cite all the research sources you use.

Criteria for Success

You will be given clearly defined criteria in each practical, against which you will be able to measure your progress. It is up to you to ensure you meet the success criteria; own the process and have the responsibility for collecting appropriate evidence of success.

Practical Focus

Most practical sessions will have a focus, e.g. the correct use of a piece of laboratory apparatus or a specific practical technique. You need to develop your skills in these areas and master them. Practical sessions that follow will invariably rely on your understanding of key skills.

Feedback and Assessment

The vast majority (if not all) of your feedback will be verbal feedback that occurs during the practical sessions. You will be observed by Andy and your other chemistry tutors as you carry out the different stages of each practical. You should engage fully with this process by listening to the feedback given and acting on it; you should also discuss your practical work with your tutors, lab partner and other students in other groups.

Having a full understanding of what you are doing and why you are doing it, coupled with an understanding of the methods and processes your peers are employing, will allow you to develop many skills that are critical for success in future education and employment.

Practical Marking and Grades

You will not be awarded any marks for your practical work. Focus on mastering the various practical techniques throughout the two-year course. Andy will provide resources that will help link the practical work to the assessments in the exams; make sure you complete any additional work set.

Group Work

Group work is a very powerful way of learning. When instructed to work in pairs or join a class discussion for example, you should fully commit to these activities; listen to your classmates; share ideas; critique others' plans etc. in a constructive and productive manner – **be nice!**

You need to share your results with other groups. Collect results from at least two other groups and discuss the procedure and the outcome. This is a good way to validate your work to some degree or maybe to find out why your practical isn't going well. You don't have to copy their results, just take a quick photo. Smart students organise this aspect of their studies by using social media or the college platform (Teams etc.) Again, **be nice!**

Use of Lab Books

You do not need to write up every practical you do in detail. However, it is good practice to have a record of all you do; your lab book could contain this. It is your personal book and may contain a range of notes, tables, jottings, reminders of what went wrong, errors identified and other findings. You may decide to keep a physical lab book, an electronic lab book or a mixture of the two. The benefit of the electronic lab nook is that you shouldn't lose it and you can add in photos, videos, IT processed data etc.

One of the most important reasons for keeping a lab book is that it should support your success in the exams when answering questions regarding the required practical tasks. It is important you complete the additional resources Andy gives you and that you keep them in your lab book along with the associated practical.

The Lab Book

A lab book is often a hard-backed book with bound pages; your lab book should have a cover that won't disintegrate the moment it gets slightly wet. *(Spiral bound notebooks are not recommended as it is too easy to rip a page out and start again.)*

A lab book is:

- A source of data that can be used later by the experimenter or others
- A complete record of what has been done so that experiments could be understood or repeated by a competent scientist at some point in the future
- A tool that supports sound thinking and helps experimenters to question their results to ensure that their interpretation is the same one that others would come to
- A record of why experiments were done.

Tips for Using Your Lab Book

- **Keep the first two pages of the lab notebook are reserved for the table of contents. These pages should be updated regularly with the title, page and date of each experiment; the table of contents will come in handy when you want to find details of past experiments.**

Each Practical Should Include the Following

- Title of experiment
- **Each page should be dated, and a page number added**
- Notes on the objectives of the experiment (e.g., apparatus and techniques covered or CPAC assessed)
- Notes on the method, including all details (e.g., temperatures, volumes, settings of pieces of Equipment) with justification where necessary
- Estimates of the uncertainty of measurements
- Sketches of how equipment has been set up can be helpful. Photographs are also acceptable
- Data and observations input to tables (or similar) while carrying out the experiment
- **Calculations – annotated to show thinking**
- Summary, discussions and conclusions
- Cross-references to earlier data and references to external information.

Remember

- Notes should be recorded as experiments are taking place. They should not be a "neat" record written at a later date.
- Notes should be written clearly, in legible writing and in language which can be understood by others.
- Lab books are used in industry as a source of data, and so should be written in indelible ink.
- There should be no blank spaces.
- **If you need to correct any information never erase or write over text, and never use correction fluid. Simply draw a single line through the error and add your initials/date to the corrected data.**
- It is also useful to note down a valid reason for the corrections made within the notebook as it allows others to understand the thought processes behind your correction/amendment.
- Numbers should not be overwritten, erased, or covered over.
- Pencil should not be used for anything other than graphs and diagrams.
- Worksheets, graphs, printed information, photographs and even flat "data" such as chromatograms or TLC plates can all be stuck into a lab book. (They should not cover up any information.)
- Anything glued in should lie flat and not be folded.

This list and its order are not prescriptive. Many experiments change as they are set up and trials run.

Don't be afraid to make mistakes. Your lab book is not expected to be perfect. In fact, If I see a perfectly turned-out lab book, with no mistakes and super neat, flawless work, ***I smell a rat!***

Methods of data collection and analysis

You should be able to

- describe with the aid of a clearly labelled diagram, the arrangement of apparatus for the experiment and the procedures to be followed
- describe how the data should be used in order to solve a problem or reach a conclusion
- set up apparatus correctly without assistance and follow instructions given
- undertake and record trial readings to determine the suitability of ranges and intervals where appropriate
- take repeat readings where appropriate
- make and record accurate measurements

Risk assessment

You should be able to assess the risks of your experiment.

Hazard	Risk	Control Measure

- Hazard – an object or chemical + the nature of the hazard
- Risk – an 'action' in the method that can create a risk from a hazard
- Control measure – must be practicable in the context of the practical You will be required to produce your own risk assessment for some exercises.

Table of results

You should be able to

- present numerical data and values in a single clear table of results
- use columns headings for both quantity and unit e.g. Volume HCl / cm3
- include columns for all the primary data and values calculated from them
- record primary data to the same number of decimal places as the apparatus resolution e.g. if volume is measured to the nearest 0.05 cm3 then all volumes in the column should be recorded to the nearest 0.05 cm3

Recording readings and significant figures

All primary data should be recorded to the resolution of the apparatus used. Any data calculated from the primary data should be given to the same number of significant figures (or a maximum of one extra) as the primary data. The number of significant figures should be consistent within a column of data.

Graphs

You must

- include a title and axes which are labelled with scales and units
- make sure the scales are convenient to use, so that readings may easily be taken from the graph – avoid scales which use factors of 3 – and that the plotted points occupy at least half of both the vertical and horizontal extent of the graph grid
- consider carefully whether your plotted points suggest a straight line or a curve, then draw in your best fit line either with the aid of a ruler or (if a curve) by a freehand sketch
- determine the gradient of a graph, clearly showing the readings you use by drawing a right-angled triangle (this should be large so that accuracy is preserved)

Estimating uncertainties

You should be able to

- identify the measurement which involves the greatest uncertainty (based on apparatus resolution), likely to be a volume or temperature
- express the uncertainty (single value and difference between two readings) as a percentage of the measured value
- express the result to a sensible number of significant figures (4 sig figs for 0.1%; 3 sig figs for 1% and 2 sig figs for 10%)

Conclusions and evaluations

You should be able to

- use data to solve a problem or reach a conclusion
- evaluate experimental methods and suggest improvements

Paper vs Electronic

There are several very strong arguments for using an electronic lab book. They are difficult to lose, and IT generated graphs, tables and photos can be added easily. Sharing results etc. is also easier to facilitate online. The downside is the lab book really needs to be a live version of events, written in real-time in the lab if possible.

References

I've just pulled this booklet together from various sources, mainly the AQA Required Practical Handbook. Anyway, here's a list of the websites I used.

https://www.technologynetworks.com/tn/how-to-guides/how-to-keep-a-lab-notebook-312713

https://libguides.mq.edu.au/referencing/Harvard

https://filestore.aqa.org.uk/resources/chemistry/AQA-7404-7405-PHBK.PDF