Guidance for Part II

Part II is widely agreed to be one of the highlights of the MChem course. It is purely a research project, and its nature can vary widely, reflecting the very wide range of the subject. However, the structure of the year is common across the department.

The aim of the year is to train you to be a professional chemist. You already have the basic chemical knowledge you need, that is what the first three years were all about. The key skills that we want you to develop in Part II are

- critical awareness of developments in the field, which requires thorough scholarship
- the ability to plan and organise your own work, i.e. develop your independence
- to analyse your results critically
- to use your initiative and originality.

As with all chemistry, this has to be done within a strict framework of safety regulations.

Induction process

At the start of the year there is an induction programme, which you must attend, as it contains vital information, for example about safety in the laboratories. In addition there will be more specialized sessions designed to tell you how your laboratory works. The timetable for the induction lectures may be found on the departmental web page at http://www.chem.ox.ac.uk/teaching/PartIIandOrgDPhilinductionprogramme_ver6.doc.

Before induction you need to download and read the safety manual, which is at http://www.chem.ox.ac.uk/safety/InductionPack/ChemistrySafetyManual.pdf.

There is also an induction pack, which contains the departmental registration form and a safety code of conduct document. You can download the induction pack from http://www.chem.ox.ac.uk/safety/InductionPack/ChemistryInductionPack.pdf.

The Code of Conduct document is particularly important. You, your supervisor, the Chemistry Safety Officer and the Buildings and Facilities Manager are required to sign it to confirm that you have:

- attended the induction sessions
- read and are in accord with the safety directions described in the safety manual
- read the Safety Code of Conduct document and accept the obligations set out in it

Your university card will not be activated for access to the laboratory, and you will not be permitted to start experimental work until this has been done.

Literature survey

Before starting a research project you must understand its context. This means that you must understand the aims of the project, in particular its relationship with other work already published. Your supervisor can get you started, but you need to make a thorough survey of the published scientific literature in the field. The department runs courses that teach you how to use some of the very powerful software available for this purpose, such as SciFinder, and there is a professional information scientist in the department, Lindsay Battle, who can help you when you can't find something.

You must also understand how your project fits in with the rest of your research group and/or work that has been carried out in the past in your group. You should discuss this with your supervisor at the start of the project, and you will find that your understanding develops through laboratory seminars and group meetings.

Lab work

You will almost certainly need to be flexible in the time you spend in the laboratory. Sometimes you may need to spend long hours at the bench, and sometimes you may have to wait for results. It may be difficult to fit research into a rigid daily schedule, although working as much as possible within normal lab working hours is best from a safety point of view. Whatever the situation, you must not work on your own. You will be making or discovering something new, and your research will not always go according to plan. However, you should have a clear set of objectives at the start of the project, and you should keep these in mind, modifying them if necessary in consultation with your supervisor as the project proceeds. You are not going to be judged on whether the project has worked – it may take more than nine months to make it work – but you may be judged on your reaction when things do not work as expected, the way you analyse and resolve the problems. It is *your* project, so use your initiative: try to find out the reasons when things go wrong: you may discover something interesting.

However, initiative must have limits: for obvious safety reasons **before trying a new procedure** you must consult your supervisor, make a proper risk assessment, write up the protocol in your lab book and have it countersigned by your supervisor, or some other person authorised by the supervisor before starting the experiment.

Be aware that if other people are hurt as a result of your negligence, you could be subject to civil claims for damages. Advice on the legal responsibilities for safety may be obtained from the Area Safety Officer and / or the University Safety Office.

Transferable skills

The Part II gives you the opportunity to develop different skills from the previous three years, in addition to the knowledge and understanding that you develop in your project area.

1. Critical faculty. Critical evaluation and logical analysis of results.

2. Problem solving. Troubleshooting problems with experiments / computations / theory.
3. Initiative. Finding inventive and imaginative solutions to problems.
4. Lateral and global thinking. Understanding the context of the project.
5. Information handling. Literature survey.
6. Written communication. Thesis.
7. Oral communication. Group talks.

Your intellectual engagement in a Part II project should go well beyond simply following a set of instructions provided by a supervisor or other members of the group.

Thesis

The major output of the year is a thesis. You can find detailed instructions about the required length, typeface, and structure of the thesis on the departmental web page, at http://www.chem.ox.ac.uk/teaching/partIIInstrtoCand.html. Since these are revised annually you will be told when this year's instructions are available. It should be a professionally produced research report, accurate, brief and clear, as far as possible free from spelling, grammatical and scientific errors, and properly presented.

Be aware that the submission deadline is very strict (to the minute), it is noon on the Friday of seventh week of Trinity term. Leave plenty of time for the preparation of the thesis, it always takes longer than you expect. It is not a bad idea to use the Easter vacation to write a first draft of the introductory section. Late submission attracts an automatic fine from the Proctors and the examiners may also apply a marks penalty.

Most theses will follow the structure below, although this may not be appropriate in your area of chemistry, take advice from your supervisor. The thesis should be written in a style that makes it accessible to examiners who may not be specialists in the specific area of your work.

1. Title page.
2. Short summary. This should be a maximum of 2 pages, and be independent of the main text.
3. List of contents.
4. Acknowledgements. This section must contain a signed and dated statement that the work reported is your own except where otherwise acknowledged. The required form of this statement may be found on the website. You can also acknowledge the help of your supervisor, research group, friends, cat etc. if appropriate.
5. Glossary of abbreviations, acronyms, and any special terms used (if appropriate).
6. Introductory section. This should describe the aims of the research, the specific objectives of the project, and put it in context. You might also need to outline any background theory you need later.
7. Descriptive section. This should be a description of what you did, making clear any logical argument, and the reasons for any decisions you took. You should describe the experiments (or computation or theory) you did, and analyse the

results, showing that you appreciate their significance. If you worked as part of a group you need to make very clear the nature of your personal contribution to the project. Suitable figures, equations and chemical structures should be included.

8. The thesis should end with a brief (e.g. half-page) formal conclusion on the results.

It is a good idea to use appropriate chapters and numbered sub-headings, because this makes it easier for the reader to understand the structure of the project. Scientific reports generally use the passive voice rather than the first person (e.g. "nitrobenzene was separated from the products by steam distillation" rather than "I separated the nitrobenzene from the products by steam distillation"). It may be necessary to use the first person occasionally when clarifying your own contributions. You should also avoid unnecessary abbreviations (e.g. don't), colloquialisms and jokes.

References should be given whenever you refer to other work: in particular all quotes must be attributed and the sources of any material (e.g. figures) you reproduce must be acknowledged. The format for referencing should conform to the norms of one of the major scientific journals.

Chemical structures and mathematical equations should be professionally drawn, e.g. using ChemDraw®, MathType® or LaTeX. Symbols for physical quantities should be italicized, units should not. Composite units should be separated by spaces, SI prefixes should not. For example, a conductivity G with the value 2.6 milliSiemens per metre should be written $G = 2.6\ \mathrm{mS\ m^{-1}}$ so that you do not confuse the prefix *milli* with the unit *metre*. The rules for this are an international standard, and can be found in the IUPAC green book http://old.iupac.org/publications/books/gbook/green_book_2ed.pdf page 5.

Assessment

The Part II contributes 25% of the marks available for your degree. Most of these marks are for the thesis. The thesis will be read by two examiners, one of whom may be external to the University. They do not assess you on whether the project worked or not, which may be entirely out of your control. They are trying to assess how you went about it, its logical development, your critical analysis of results, the ways you tried to understand and circumvent difficulties, the extent to which you can put your project in a wider scientific context, your appreciation of its significance, your scientific understanding of the project, the quality of your presentation, and the effort you put in. They do this on the basis of your thesis, a report from your supervisor and the viva. In particular you need to make sure that you have thought about your results, that you understand the relationship between your project and the material you studied in Part I, and that you have applied this material wherever appropriate.

The supervisor's report will, in particular, describe what has been your own contribution to the project, your technical ability, the extent to which you have made intellectual/academic input to the project and your level of effort.

Vivas take place in 10th and 11th weeks and are normally of 20 minutes duration. The purpose of the viva is to test whether you understand what you have written in the thesis and the background to your work, and to make sure that this has been your own work.

Troubleshooting

In the event of difficulties you should talk to your supervisor, your College tutor or the Director of Studies. If you need an extension of the submission deadline, this request must be made to the Proctors through your College Senior Tutor, accompanied by an appropriate medical certificate. Extensions are not granted for computer problems. You are strongly advised to keep adequate back-ups of your thesis and to print it in plenty of time.