Reports of the External Examiners for Part II & Part III Chemistry for 2010/11

Response from the Department

These reports have been redacted to remove any matters which refer to particular students

University of Glasgow | School of Chemistry

11 AUG 2011

The Vice-Chancellor
University of Cambridge
The Old Schools
Cambridge
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29th July 2011

Dear Vice-Chancellor,

External Examiners Report – Part II and Part III Chemistry (Organic Chemistry)

This was my first year as External Examiner with expertise in the area the organic chemistry. In general, the examination process ran smoothly right from the point of receipt of the examination papers until the conclusion of the examination process and preparation of the final class lists. Dr Keeler and his examinations team did a first class job in terms of preparation of the examination papers and compiling the mark lists. It was particularly helpful to be provided with very detailed information concerning averages, mark ranges and standard deviations for each question along with the number of candidates attempting each question.

Examination Papers and Model Answers

The draft examination papers were sent to me in good time. Even though this was my first year as an external examiner, the detailed instructions and formatting of the papers and model answers meant that it was a relatively easy task to navigate my way around the papers.

The papers covered a broad range of topics in chemistry and there was sufficient choice to allow candidates to play to their strengths. The balance between questions based on core knowledge and those testing problem-solving skills was entirely appropriate.

The inclusion of a cover sheet giving details of who set and checked the question plus and indication of whether the question is addressing basic core material or requires either additional knowledge or an ability to extrapolate what has been learned to solve an unfamiliar problem, was very helpful. The provision of complete and detailed model answers plus a marking scheme was also extremely helpful and much appreciated.

Suggestions for improvements

- More consistent marking schemes to go along with model answers – there are considerable discrepancies in what individual examiners expect the candidates to write for a given number of marks.
- Typed rather than hand written model answers would be helpful.
- With longer essay-style questions a checklist of key points would be helpful with the relative marks given for each key fact, calculation or reaction scheme.

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University of Glasgow | School of Chemistry

Part II Examination

The averages for the four Part II papers were very consistent with Papers 1–3 being in the 64-66% range and that for Paper 4 being 60%. All four papers generated marks with sufficient variation to indicate that exceptional students were being differentiated from the less able candidates. The practical mean practical mark was 68.59% which is about 5% higher than the corresponding averaged theory mark, but this is usually the case with chemistry courses.

Part III Examination

The examination questions were of a very high standard and covered a broad swathe of contemporary chemistry. The degree of choice given to the candidates is considerable and there seems to be a gravitation of candidates towards questions dealing with organic chemistry and away from physical chemistry in particular. While I am in favour of candidates being able to play to their strengths, I think there is probably a good case for structuring the examination papers in such a way that candidates are forced to answer at least some questions in all three major branches of chemistry. In many other universities it is considered undesirable for students to be able to effectively deselect large areas of chemistry. However, this is something that should be discussed in detail by members of the department at their Teaching Committee.

Research Project

The research project contributes 25% to the degree classification. This is a relatively high proportion of the total but is not out of line with the weighting given to projects in other chemistry departments in the UK. The challenge with final year projects is one of objective assessment and consistency and I am glad that a clearly defined set of criteria is being used in the project assessment.

University of Glasgow | School of Chemistry

General Observations and Suggestions

There were some issues of concern regarding the examination scripts and project marks:

- At least one examiner did not write anything on the examination booklets when marking them. This appears to have been an oversight and I trust that in future examination scripts will be fully annotated by the person marking them.
- In some cases the sum of the assigned marks in the booklet did not match the overall total mark give for the question. This is confusing for an External Examiner because it suggests that an arithmetic error may have occurred. I gather that this problem has arisen due to the policy of marking to an average; in future years markers should be careful to remark scripts properly and then adjust the final mark accordingly.
- One examiner had attempted to elevate marks to achieve an acceptable average by simply adding a fixed number of marks to each candidate. This is clearly unacceptable and scripts should be remarked properly if marking to an average is to be implemented – there is already sufficient discretion in the marking schemes to alter weightings in order to achieve the required result without resorting to a crude arithmetic fix.
- Some project marks were very high and in at least one case we did not feel that the report was of sufficient quality to merit such a high mark. Under the current arrangements, the supervisor has a disproportionate influence on the mark awarded for the project. Serious consideration should be given to having all aspects of the project, with the exception of laboratory performance, marked by members of academic staff who have not been involved with supervision of the student during the project.
- The marks given for the short questions in Paper 4 seemed to be rather inconsistent and there was evidence of slight grade inflation. This was particularly evident where students were being given more than half marks for questions where less that 50% of the question was correct or had been attempted. Although the perturbation for each

individual question was small, the cumulative effect over several short questions could be significant.

- Currently, there is no final check with regard to the addition of marks in individual scripts. It would be sensible to have someone double check the scripts for arithmetical errors prior to entry of marks in the appropriate spreadsheets. This could be done by teaching support staff and would not constitute double marking.

In summary, I can confirm that the examinations were of a high standard and are indicative of the high quality of the chemistry courses offered at Cambridge. I can also confirm that the examinations were conducted in a fair and impartial manner.
I would also like pay tribute Dr Keeler and his colleagues for their excellent level of organisation and also thank them for the helpfulness and kind hospitality. I very much look forward to returning to Cambridge next summer in my capacity as External Examiner.

Yours sincerely,

J. Stephen Clark

UCL DEPARTMENT OF CHEMISTRY
PROFESSOR HELEN FIELDING

01 JUL 2011

The Vice-Chancellor
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28 June 2011

Dear Vice-Chancellor

External Examiner's Report for Part II and Part III Chemistry 2010 (Physical and Theoretical)

This was my second year as moderating external examiner in Chemistry Part II and III with particular responsibility for Physical and Theoretical Chemistry.

General procedures

As last year, the examination process was organised extremely efficiently by the Senior Examiner, Dr Keeler. The examination questions and model answers were sent in March and we were given plenty of time to read them and prepare comments. We were also sent copies of the instructions that had been provided for the internal examiners and question setters, as well as minutes of examination meetings, all of which were useful.

The model answers were accompanied by a sheet indicating whether the different parts of the question were based on lecture notes or whether they were new, unseen problems. This was particularly helpful. Generally, the model answers were sufficiently detailed that they were useful in determining whether or not a question was appropriate.

I received a copy of the responses to my comments on the examination questions, and those of the other external examiners, in May. The internal examiners and question setters had considered all the comments carefully and responded in detail.

Post-examination meeting in Cambridge

The external examiners' meeting commenced at 11 am on the day prior to the final examiners' meeting. The senior examiner provided us with detailed written reports and a very clear oral summary of the examinations. The scripts were all laid out carefully so it was easy to find those belonging to candidates whose marks we chose to look at more carefully.

We paid particular attention to the candidates at the borderlines, both in terms of their written papers and, where appropriate, their practical work or project dissertations.

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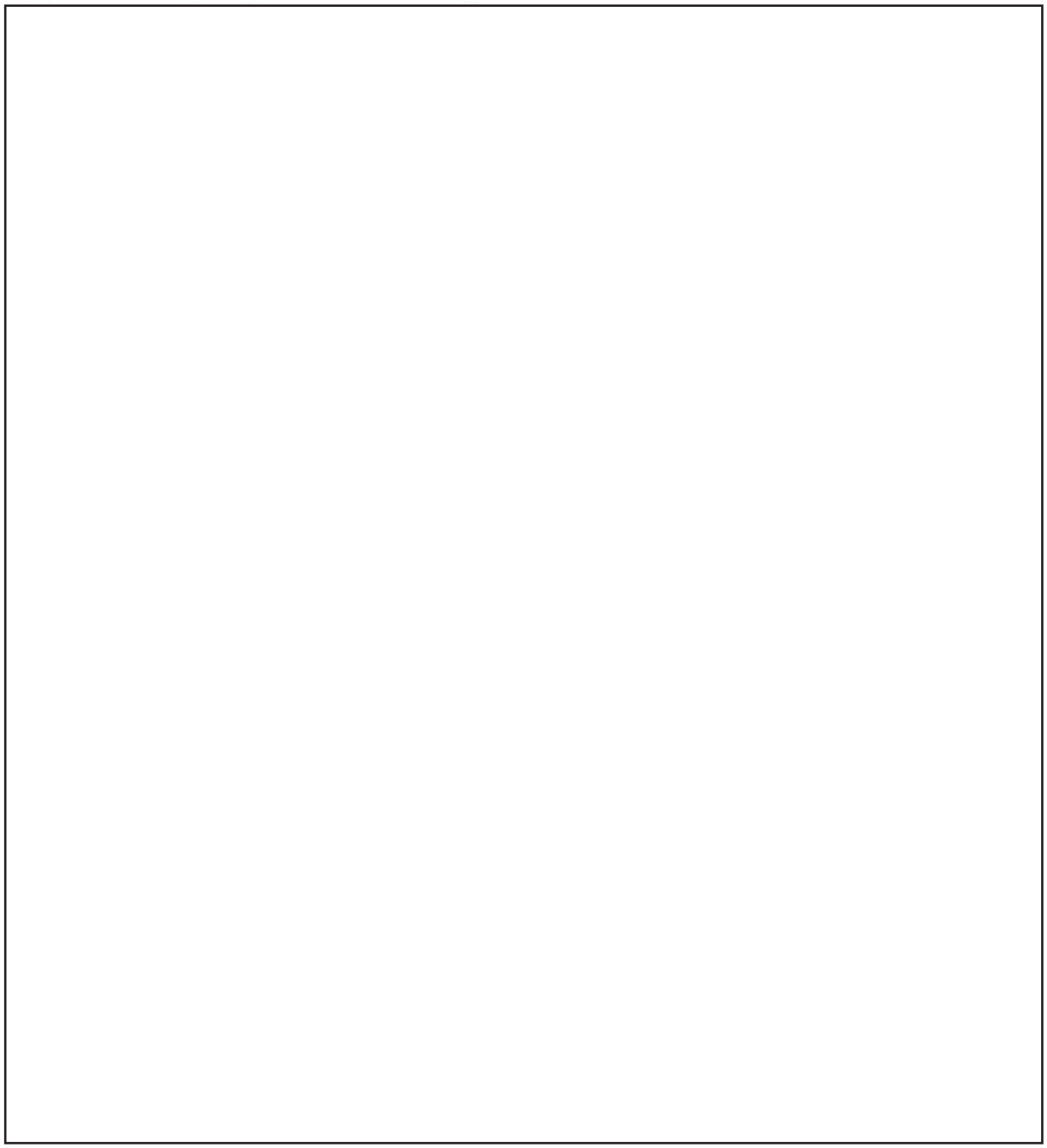
Decisions at borderlines

Part III



Part II

General comments

The examinations are of a high standard. There are a large number of 1st and 2.1 degrees; however, the marking seems generally fair and this distribution simply reflects the high quality of the Cambridge Chemistry students. The Part II exams cover a wide range of physical and theoretical chemistry. There is less breadth in Part III, but I appreciate that this reflects the research interests of the Physical Chemistry section. I was surprised at the low number of physical and theoretical chemistry questions that were attempted in the exams. This is not the case for physical chemistry at UCL, and is possibly something that the Chemistry Department in Cambridge might like to think about.

I was very impressed with the clear qualitative descriptors used in the marking scheme for the Part III reseach projects. Generally, the comments and the marks were very consistent and I noted that, in the projects I sampled, most of the examiners had also written helpful comments on the dissertations. However, there was a notable exception: candidate 8130T, as discussed above.

I was a little surprised that this extraordinary pattern of marks had been presented to us without any explanation. It suggests that there should be some sort of internal moderation of project assessment and marks. This could take the form of double-blind marking of the project report by two members of staff, who are not the supervisor, and an oral exam that is observed by members of staff who are present at a significant number of oral exams and can keep a check on the uniformity of marking. I would recommend that the supervisor input to the overall project mark is reduced.

The other slight surprise was the discovery that one examiner had added 2 marks to all answers to one exam question, to bring the question average up to the required 65%. This is a rather strange practice and rewards students who have scored lower marks with a higher percentage increase than those who scored a higher initial mark. It might be worth considering having some procedure for reporting issues with marks so that it is not the responsibility of a single person to make changes. Problems and solutions should then be reported to the external examiners so they are aware of them before they scrutinise the scripts.

Nonetheless, overall, the examination process runs smoothly and I was reassured that the two candidates we interviewed at the 1st/2.1 boundary were of a similar standard to those who would be found at this boundary at UCL.

Finally, I have enjoyed my second year as an External Examiner and would like to thank once again the senior examiner, Dr James Keeler, and his colleagues for their excellent organisation and administration of the examination process and the support and hospitality they offer to their external examiners.

Yours sincerely,

HFielding

Helen Fielding

School of Chemistry

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26 June 2011

Dear Vice-Chancellor,

External Examiner's report for Part II and Part III Chemistry 2010/11 (Inorganic Chemistry)

This was my third and final year as examiner for inorganic chemistry. Many thanks are due to the Senior Examiner, Dr. Keeler, and his team for the smooth organisation and the excellent administration of the examination process and the arrangements for the external examiners.

On arrival we were fully briefed on the results of the examination and the class list and were provided with very informative statistics and marks analyses. This introduction included a detailed review of the class list, with emphasis on those candidates near a borderline, and an indication where such borderlines might be drawn. This was very helpful for our subsequent discussions. We were able to scrutinise the examination scripts to carry out quality comparisons.

Pre-examination scrutiny of draft papers

The relevant information for examiners on the conduct of the examinations and the draft examination scripts were sent out in good time. The papers covered a broad range of topics and explored a wide cross-section of the subject in considerable depth. There was a good mix of problem solving and knowledge-based questions.

The practice of adding a front sheet for each question, which requires the question setter to indicate whether the materials is essentially recall, has been seen before or is new or problem solving in nature, is very helpful in judging the degree of difficulty of the questions.

Procedures for checking examination papers for errors worked well, and I am satisfied with the responses by the internal examiners to any comments I made on the draft papers.

Suggestions:

(1) One area that could still benefit from improvement concerns the model answers. While in the majority of cases these showed good detail of the marking

criteria, the quality was variable, and in some cases it could have been made clearer what was expected of the students.

(2) The practice of providing typed model answers should be strongly encouraged. Deciphering handwritten notes can be very time consuming.

(3) The model answers for descriptive, essay-type questions are rather variable – please provide more complete model answers for such questions which give a more precise indication as to what does and does not constitute an answer that would attract high marks.

Part II Examination

General comments.

The average marks for the four Part II papers were comparable to previous years, 60.1 – 65.6 %. The four papers produced well-balanced results. The mean marks had sufficiently high standard deviations to indicate good differentiation.

The mean Part II practical mark of 68.59% was marginally lower than last year (69.85%) but still runs ahead of the mean to the theory papers. The standard deviation of 9.77 was much broader than last year and is evidence of an attempt to introduce a more discriminating marking regime. This is both necessary and very welcome. The examiners are encouraged to ensure that this marking trend continues.

Looking through a cross-section of the practical reports left me with the impression that there was scope for raising the quality threshold for practical data acquisition and analysis.

Part III Examinations

General comments on examination papers.

The examination questions were generally of a high standard and covered a broad range of topics. We were provided with a very helpful marks analysis in histogram form which showed that, as in previous years, candidates chose to concentrate mainly on organic chemistry, with fewer answers in inorganic and even fewer in physical, theoretical and biological chemistry. This has the effect that final year students in Cambridge are tested on a narrower section of the subject than one would find in many other institutions, where compulsory and revision questions, or indeed synoptic papers, have been introduced in the final year. This is a topic of consideration by the Teaching Committee.

The research project

The project contributes 25% to the overall mark. Its assessment has been the subject of a number of suggestions by previous external examiners. Most importantly, the length of the project has now been extended to 16 weeks, which is most welcome and brings these projects closer to the time investment required at most other institutions (20 weeks). The reports now include a concise summary and the projects are being assessed against a number of well-specified criteria.

Compared to previous years, the markers' annotations of the project reports were much clearer and more detailed, and there was more emphasis on using use publication-standard formats for references. This is a significant improvement from last year and represents an example of excellent practice.

The mean project mark of 72.8% was 1.3% higher than last year, with a narrow standard deviation of 6.9%.

While high project marks are not altogether unusual and may well reflect the considerable effort invested by most students, it was noted that 50% of the marks are awarded by the supervisor, who may a vested interest. Some other major institutions operate a marking scheme where the supervisor contributes no more than 25% and is not involved in marking the final report.

Recommendation:

All three examiners suggested reducing the influence of supervisor-generated marks and to set up a moderation panel that is charged with ensuring that overall project marks follow objective criteria and are comparable for all projects. There was one case this year, at a borderline, where such criteria did not seem to have been applied (see below).

Other comments

Scrutiny of the examination scripts this year highlighted a number of concerns:

(1) One examiner did not enter any annotations on the exam scripts. This seems to have been due to a misunderstanding of the recommended marking rules.

(2) Some marks in scripts were ticks only. It is recommended to identify more clearly how many marks are awarded for which element of the answer.

(3) One examiner addressed the recommendation to mark to a given average by adding two marks to each answer sheet. This had the consequence of favouring students with low marks compared to their high-scoring peers.

This style of marking would not be acceptable at most institutions but, fortunately, was an isolated case.

It is recommended that examiners be reminded that the marks awarded should be transparent enough for validation by the external examiners, i.e. marks should only be given for clear academic reasons.

This practice puts into question to what extent examiners should be asked to "mark to an average". Marking to the same average each year would appear to be incompatible with cohort tracking, which aims to establish quality differences between student cohorts.

(4) The marking practice for paper 4, which consists largely of short questions, proved somewhat uneven: some markers awarded 40% even though perhaps only 20% of the question had been answered, while others gave no marks for partial questions. While on average such practices balance out, some students may be favoured or disfavoured by their choice of questions, and there was some evidence for this in borderline cases. The internal examiners are encouraged to establish more even mark practices.

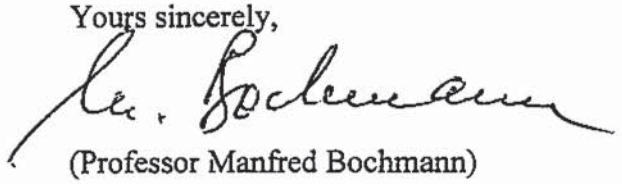
(5) While the external examiners accept that detailed second-marking is not required for Cambridge examination papers, it is recommended that the arithmetic correctness of the marks for each question be checked by an independent person, either the paper convenor or clerical staff.

I am happy to confirm that the examinations were conducted fairly and to a high standard and provide a testimony of the excellent student experience at Cambridge. A more even distribution in the subject questions attempted by candidates would seem

desirable, as would be the inclusion of synoptic elements; this would certainly have helped at borderline interviews this year.

Finally, I wish to thank once again James Keeler and colleagues for the excellent organisation and their kind hospitality.

Yours sincerely,



(Professor Manfred Bochmann)

Response to the reports of the External Examiners: Part II and Part III Chemistry 2011

We are grateful to the External Examiners for the care and professionalism with which they have undertaken their duties. Their commentary on, and suggestions concerning, our assessment process are key to maintaining high quality and accountability.

Model answers

We agree that there is still a way to go in the quality of the model answers which are provided. The instructions to colleagues are clear about what is required, but a minority simply fail to comply. For the coming year we will reiterate the key points:

1. *The answer should be sufficiently detailed that others can see both what is expected and where credit will be given.*
2. *Where the answer is an essay, the model answer should give a detailed summary of the points which are expected to be covered, and the marks to be awarded for each.*
3. *The model answers must be legible.*

In respect of the last point, we do not feel that we can insist on typed answers as especially in the case of questions requiring many structures to be drawn, this would be very time consuming.

Marking practices

Markers are instructed that they should annotate the script so that others can see where marks are being awarded. It is also a standing instruction that simply scaling a final mark is not an acceptable practice – rather, if the distribution of marks is not considered appropriate the question should be remarked. We regret that in a couple of cases these instructions were not followed and will endeavour to ensure that there is no repetition of this in future years.

Most examiners assign 'part marks' as they mark a question and then these are added up to give the final mark shown on the front cover. In a few cases it appeared that the sum of the part marks was not equal to the total shown on the front cover and, upon investigation, it turned out that this was not an error but that the examiner had derived the final mark by a process other than simply adding up the part marks. We agree that such a process lacks transparency and makes it difficult for others to check the assessment process. *For future years the instruction to markers will be that final mark must be equal to the sum of the part marks*.

To date it has not been our practice for there to be any check that the part marks add up to the final mark. It is suggested that such a check could be carried out by technical or secretarial staff, but we are concerned that this in the very busy examination period we simply would not have the resources to do this. *We will look into the possibility of making some spot checks on the set of answers for particular questions.*

Assessment of projects

Developing a fair and transparent method for assessing the Part III research projects has been the subject of many recommendations from successive External Examiners. The issue which has arisen this year is whether or not the project supervisor (a member of the academic staff) has too large an influence over the final mark awarded. This was brought to light by a particular case in which it was felt that a very high project mark was not justified by the evidence of the written account.

Presently, the supervisor assigns 50% of the marks for the student's commitment and achievement in the laboratory. The supervisor, in consultation with one of the Examiners, is also involved in assigning 30% of the marks for the written report and 20% of the marks for oral examination. It is true, therefore, that the supervisor can have a strong influence over the final mark. It is also true that it is really only the supervisor who can make a detailed judgement about quality and significance of the work.

We propose to change the system of assessment so that the supervisor only allocates the 50% of the marks for commitment and achievement. The remainder of the assessment will be carried out by one of the Examiners together with another member of staff who has a good knowledge of the research area. We believe that this will lead to a more objective assessment, as requested by the External Examiners.

Short questions on Part II Paper 4

Professor Bochmann and Professor Clark commented on what they saw as overly-generous marking of the five-minute questions on Paper 4. These questions are designed to test basic knowledge and understanding, and it is true that we have had some difficulty in pitching the questions at the right level so that they can be answered at a reasonable level and within the time allocated. The examiners are looking for the average mark for the four five-minute questions which relate to one course to be reasonably close to the 65%, and on the whole we have achieved this. It may be that a particular question has been more generously marked, but since everyone has to answer all of the questions this will not cause a systematic bias in the results.

It is interesting to note that Paper 4 invariably has a lower average than the other papers, reflecting the difficulty that the students have with completing these short-answer questions in the time allocated. *We will continue to review the level of difficulty and appropriateness of these questions so that the marking can be strict.*

Balance of the course

As has been noted before, the vast majority of the questions answered in both the Part II and Part III examinations are from inorganic, organic or biological chemistry. A much smaller number of candidates answer physical chemistry questions, and a very small number of people answer theoretical chemistry questions (beyond those which are compulsory on Part II Papers 1 and 4). This profile arises because of two factors. First, the students are given a free choice in the courses they study. Second, as a result of the structure of the Natural Sciences Tripos we tend to have rather few physically/theoretically oriented students studying with us, since such students gravitate towards physics. In addition, we tend to pick up quite a few biologically oriented students who are attracted by the options we offer in this area in Part II and Part III. Together these factors result in a cohort of students whole profile is rather different than you might expect for a major chemistry department.

Drafted by Teaching Committee 17/10/2011