

BSc Chemistry with Education
For students entering Part 1 in 2011/2

UCAS code: F1X3

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|---------------------------------------------|--------------------------------|
| Awarding Institution: | University of Reading |
| Teaching Institution: | University of Reading |
| Relevant QAA subject Benchmarking group(s): | Chemistry |
| Faculty: | Life Sciences Faculty |
| Programme length: | 3 years |
| Date of specification: | 27/Jun/2013 |
| Programme Director: | Dr Elizabeth Page |
| Programme Advisor: | Dr Elizabeth Page |
| Board of Studies: | Chemistry |
| Accreditation: | The Royal Society of Chemistry |

Summary of programme aims

The programme is designed to provide a broad and rigorous study of modern chemistry and to introduce students to the theory, procedures and practices of science education to help them to apply for a PGCE in order to pursue a career in teaching.

The aims of the programme are to:

- Train students in the theory and practice of all branches of modern chemistry according to the subject benchmarks for the discipline.
- Train students in a range of laboratory based skills and modern instrumental techniques.
- Ensure students respect and practise correct health and safety procedures and understand the importance of these to themselves and the wider community.
- Enable students to acquire first hand experience of science education at both primary and secondary level in order to achieve an initial understanding of a range of educational issues and are in a position to make an informed decision about their future careers.
- Provide students with a broad science knowledge base which they will be able to draw on in their further studies and teaching practice.
- Provide students with opportunities to develop their inter-personal and communication skills and specifically understand the educational needs of others.

Transferable skills

During the course of their studies at Reading, all students will be expected to enhance their academic and personal transferable skills. In following this programme, students will have had the opportunity to develop such skills, in particular relating to career management, communication (both written and oral), information handling, numeracy, problem-solving, team working and use of information technology and will have been encouraged to further develop and enhance the full set of skills through a variety of opportunities available outside their curriculum.

Throughout the programme, students will have the opportunity to develop skills such as initiative and creativity, organisation and self-management, and understanding the educational needs of others.

Programme content

The BSc Chemistry with Education degree programme is divided into three Parts, each of 120 credits. The degree profile outlined below lists the compulsory modules and gives some indication of the optional modules from which the student must make a selection. Students choose such optional modules in consultation with the Programme Adviser or the Programme Director. The number of credits for each module is given after its title.

Part 1 (three terms)

Compulsory modules

| <i>Code</i> | <i>Module title</i> | <i>Credits</i> | <i>Level</i> |
|-------------|---------------------------------------------------------|----------------|--------------|
| CH1CC1 | Chemical Concepts in Context | 10 | 4 |
| CH1IN1 | Fundamentals of Atomic Structure and the Periodic Table | 20 | 4 |
| CH1OR1 | Shape, Structure and Reactivity in Organic Chemistry | 20 | 4 |
| CH1PH1 | Physical Processes and Molecular Organisation | 20 | 4 |
| CH1PRA | Laboratory Skills for Chemists | 20 | 4 |

The following module is **compulsory** for students who do not have an A-level pass in Mathematics:

| | | | |
|------|-------------|----|---|
| CH1M | Chemistry M | 20 | 4 |
|------|-------------|----|---|

The following module is **compulsory** for students who have an A-level pass at grade C-E in Mathematics, and **optional** for those with a grade A-B:

| | | | |
|-------|-----------------------------|----|---|
| CH1M2 | Mathematics for Chemistry 2 | 10 | 4 |
|-------|-----------------------------|----|---|

Students will select science modules amounting to 10 credits (if they take CH1M), 20 credits (if they take CH1M2) or 30 credits (if they take neither) from outside the Department of Chemistry. These modules may be Biological or Plant Sciences, Geology or Environmental Sciences, Physics or Maths.

Part 2 (three terms)

Compulsory modules

| <i>Code</i> | <i>Module title</i> | <i>Credits</i> | <i>Level</i> |
|-------------|-----------------------------------------|----------------|--------------|
| CH2IN1 | Further Inorganic Chemistry | 20 | 5 |
| CH2OR1 | Further Organic Chemistry | 20 | 5 |
| CH2PH1 | Further Physical Chemistry | 20 | 5 |
| CH2PRAC | Extended Laboratory Skills for Chemists | 30 | 5 |
| ED2UPS2 | Understanding Primary Science 2 | 10 | 5 |
| CH2CC1 | Chemical Concepts and Skills | 10 | 5 |
| CH2AN3 | Analytical Chemistry | 10 | 5 |

Part 3 (three terms)

Compulsory modules

| <i>Code</i> | <i>Module title</i> | <i>Credits</i> | <i>Level</i> |
|-------------|----------------------------------------------------------------------|----------------|--------------|
| CH3AN1 | X-Ray Techniques and Databases in Analytical Chemistry | 10 | 6 |
| CH3AN2 | Advanced Analytical Techniques for Inorganic Structure Determination | 10 | 6 |
| CH3PRE | BSc Chemistry Education Project | 40 | 6 |
| BI2EH4 | Introduction to the History and Philosophy of Science | 10 | 5 |
| ED3UPS | Understanding Primary Science 3 | 10 | 6 |

Optional modules

Four optional modules to be chosen from the following, to include at least 10 credits from each branch of inorganic, physical and organic chemistry.

| | | | |
|-------|-----------------------------------------------------------------|----|---|
| CH3I1 | d-and f- Block Chemistry | 10 | 6 |
| CH3I2 | Clusters, Extended Arrays and Solid-State Chemistry | 10 | 6 |
| CH3O1 | Advanced Organic Chemistry - Synthesis of Complex Targets | 10 | 6 |
| CH3O2 | Advanced Organic Chemistry - Contemporary Synthetic Methodology | 10 | 6 |
| CH3P1 | Advanced Topics in Physical Chemistry 1 | 10 | 6 |
| CH3P2 | Advanced Topics in Physical Chemistry 2 | 10 | 6 |

Progression requirements

To gain a threshold performance at Part 1 a student shall normally be required to achieve an overall average of 40% over 120 credits taken in Part 1, and a mark of at least 30% in individual modules amounting to not less than 100 credits. In order to progress from Part 1 to Part 2, a student shall normally be required to achieve a threshold performance at Part 1 and achieve an overall average of 40% over 120 credits taken in Part 1.

To gain a threshold performance at Part 2 a student shall normally be required to achieve: an overall average of 40% over 120 credits taken in Part 2, and a mark of at least 30% in individual modules amounting to not less than 100 credits. In order to progress from Part 2 to Part 3, a student shall normally be required to achieve a threshold performance at Part 2 and a pass of 40% in CH2PRAC and 40% in ED2UPS2. Students who achieve a threshold performance and a mark of 40% in CH2PRAC, but who achieve less than 40% in module ED2UPS2, will be permitted to transfer to the BSc Chemistry.

A pass of at least 40% in module CH3PRE is required to qualify for an Honours degree.

Assessment and classification

The University's honours classification scheme is:

| <i>Mark</i> | <i>Interpretation</i> |
|-------------|------------------------|
| 70% - 100% | First class |
| 60% - 69% | Upper Second class |
| 50% - 59% | Lower Second class |
| 40% - 49% | Third class |
| 35% - 39% | Below Honours Standard |
| 0% - 34% | Fail |

For the University-wide framework for classification, which includes details of the classification method, please see: www.reading.ac.uk/internal/exams/Policies/exa-class.aspx.

The weighting of the Parts/Years in the calculation of the degree classification is

Three-year programmes

Part 2 one-third

Part 3 two-thirds

Teaching is organised in modules that involve a combination of lectures, tutorials, workshops and practical sessions. In addition there are two modules which involve placements in local schools in which students learn through observation and practice about the education system. Several modules will also have self-study components through the electronic learning platform, Blackboard. Modules are assessed by a mixture of coursework and formal examinations. At least 50% of the assessment will normally be by formal examination except for the Part 3 project.

Admission requirements

Entrants to this programme are normally required to have obtained:

Grade C or better in Mathematics and English in GCSE; and to have achieved

UCAS tariff: 260 from 3 A levels including C in Chemistry and preferably one other science (two AS grades are acceptable in place of one A-level), or

International Baccalaureate: 30 points including 5 in chemistry, or

Scottish Highers: BBBB including C in Chemistry, or

Irish Leaving Certificate: BBBBC including C in Chemistry.

Admissions Tutor: Dr JM Elliott (email: j.m.elliott@reading.ac.uk)

Support for students and their learning

University support for students and their learning falls into two categories. Learning support is provided by a wide array of services across the University, including: the University Library, the Careers, Placement and Experience Centre (CPEC), In-session English Support Programme, the Study Advice and Mathematics Support Centre teams, IT Services and the Student Access to Independent Learning (S@il) computer-based teaching and learning facilities. There are language laboratory facilities both for those students studying on a language degree and for those taking modules offered by the Institution-wide Language Programme. Student guidance and welfare support is provided by Personal Tutors, School Senior Tutors, the Students' Union, the Medical Practice and advisers in the Student Services Centre. The Student Services Centre is housed in the Carrington Building and offers advice on accommodation, careers, disability, finance, and wellbeing, academic issues (eg problems with module selection) and exam related queries. Students can get key information and guidance from the team of Helpdesk Advisers, or make an appointment with a specialist adviser; Student Services also offer drop-in sessions and runs workshops and seminars on a range of topics. For more information see www.reading.ac.uk/student

Within the Department of Chemistry additional support is given through practical classes and tutorials in every Part of the degree programme. There are Course Advisers for every Part of the programme and the Director of Undergraduate Studies is also available for consultation and advice on academic and personal matters.

Throughout the course students will have support and guidance from staff in the Institute of Education who will advise on aspects of current educational practice, school placements and application for postgraduate teacher training.

Career prospects

A BSc in Chemistry with Education will provide graduates with an ideal platform from which to apply for postgraduate teacher training in either primary education or secondary science. Delivery of the programme by the Department of Chemistry, in conjunction with the Institute of Education, will ensure that graduates are given guidance in making effective applications for PGCE courses and will have the necessary background to make informed decisions about career choice as well as first hand experience of both primary and secondary education. Graduates from this programme will be familiar with the attributes required for a career in teaching and, after suitable postgraduate study, will be well-qualified to embark upon a career in science education.

Alternatively graduates will be able to undertake a whole range of other careers either within the chemical community or outside. Having a core (over 50%) training in the chemical sciences, graduates will have acquired technical, numerical and problem solving skills valuable in employment as technical assistants, sales or marketing personnel, accountancy, computing, the environment, local government and health and safety.

Opportunities for study abroad or for placements

Students will spend approximately half a day a week for one term in a local primary school during the second year of their course. This will give students the opportunity to observe primary education at first hand and to assist with the delivery of science lessons where appropriate. During their final year students will spend one day a week in a local secondary school as part of their final year project. The experiences gained during both placements will assist in informing career choice and will provide the necessary background to support students in their applications for PGCE courses.

For students without a second language besides English there are limited opportunities within this programme for a student to study abroad because of the requirement to study another language. However the Department of Chemistry has strong links with several European universities through the Erasmus scheme and a year abroad would be possible for students with proficiency in a second European language through this scheme. It is not anticipated that students on this programme would wish to spend a year in industry because of the vocational nature of the programme which is intended to prepare students for a career in teaching. However, if specifically desired a year in industry could be intercalated between Years 2 and 3.

Programme Outcomes

Knowledge and Understanding

A. Knowledge and understanding of:

1. The fundamental concepts and techniques in chemistry

Teaching/learning methods and strategies

The knowledge required for basic topics is provided in formal lectures supported by problem solving

2. A selection of more specialist topics in the three main branches of chemistry and in analytical chemistry
3. The main techniques involved in laboratory work
4. The spectroscopic methods used to identify molecules and to determine their structure and the basics of the underlying theory
5. Science education at primary and secondary levels
6. One other science subject at undergraduate level
7. Basic mathematical manipulations required for all the above

sessions and small group tutorials throughout all 3 years of the course. Practical classes are an important component of Part 1 and Part 2 chemistry. An understanding of the theory of spectroscopic techniques is taught in lectures, a familiarity with the instrumentation acquired in practical sessions, and application of the results practised in workshops. School placements and associated reading and reflection will introduce students to science education. The mathematics required for chemists is taught through lectures and problem sessions. All the above are supported by e-learning where appropriate.

Assessment

Most knowledge is assessed through a combination of coursework and unseen examinations. 3, 4 and 5 are assessed mainly by coursework, to include personal observations and records, dissertations and oral presentations.

Skills and other attributes

B. Intellectual skills - *able to*:

1. Think logically
2. Analyse and solve problems
3. Organise tasks into a structured form
4. Understand the evolving state of knowledge in a rapidly developing area
5. Transfer appropriate knowledge and methods from one topic within a subject to another
6. Critically appraise the literature and select and reject information as appropriate
7. Construct an argument and discuss a theory
8. Apply scientific method to an open question or problem

Teaching/learning methods and strategies

Logic is an essential component in the understanding and construction of synthetic methods in organic chemistry and in rationalising mechanisms and pathways in inorganic and organic chemistry. Analytical and spectroscopic problems teach applied logic whilst philosophy in a module in Part 3 introduces the fundamentals of logical argument. Problem solving plays a major role in both physical and analytical chemistry. Recent developments in the subject are introduced where appropriate but particularly in specialist topics in Part 3. Chemistry is a subject which is built upon fundamental principles and students are encouraged to make the connections between different areas in small group tutorials. Students are encouraged to refer to the scientific and educational literature to inform their knowledge and research in Parts 2 and 3. The core History and Philosophy of Science module at Part 3 teaches students to think logically and write persuasively. The scientific method is at the basis of all scientific discovery and is taught both in practical work and in the History and Philosophy of Science.

Assessment

1-4 are assessed both directly and indirectly throughout the course whilst 5 leads to higher level performance. 6, 7 and 8 are assessed in the education project and dissertation in Part 3.

C. Practical skills - able to:

1. Follow practical instructions safely and accurately
2. Carry out a variety of experimental procedures
3. Measure and interpret various spectroscopic techniques
4. Interpret quantitatively the results of their experiments
5. Understand the specific requirements of teaching laboratory based subjects
6. Formulate safety protocols and demonstrate a thorough understanding of health and safety requirements
7. Assist others in safe and efficient laboratory work

D. Transferable skills - able to:

1. use IT (word processing, spreadsheets, chemical databases, molecular modelling packages)
2. communicate scientific ideas
3. give oral presentations
4. use language at an appropriate level to express a scientific idea
5. work as part of a team
6. manage their time
7. use appropriate numerical algorithms and manipulate numbers and mathematical formulae.
8. prepare and plan for a career in science education
9. use their initiative and creativity in developing materials at an appropriate level

Teaching/learning methods and strategies

Detailed practical manuals are provided for all practical courses in Part 1 and 2, together with sources of additional reading and online laboratory manuals in some cases. An introductory laboratory techniques course is followed at the start of Part 1 so that no student is disadvantaged by any limitations of their prior experience. Staff and postgraduate demonstrators are present in ample numbers during every practical session and technical staff are encouraged to play an active role in educating students in good laboratory practice. Staff and postgraduate students assess and give feedback on practical reports.

Workshop sessions are held to assist students in analysing spectroscopic data.

Involvement in lab classes in school placements will help students with 5.

Assessment

1 to 4 are assessed by the practical work associated with Part 1 and 2 of the chemistry course.

3 is also assessed by problems in written examinations.

Increasing emphasis is placed upon the assessment of 6 throughout the course and specifically in the organic and analytical practical courses in Part 2.

Safe working is emphasised at every stage.

3 is specifically but not exclusively assessed through the core modules CH2PRAC, CH2AN3, CH3AN1 and CH3AN2.

Teaching/learning methods and strategies

The use of IT is embedded throughout the programme but is specifically addressed in module CH1PRA.

Oral and written presentation skills, problem-solving, team working, time management and extracting and summarising information are specifically addressed in CH1CC1 and throughout the remainder of the programme

2 and 3 are specifically addressed in the Part 2 primary visit and the project, CH3PRE and module CH2CC1.

2 - 6 are assessed in modules CH1CC1 and CH2CC1.

4 is addressed in the modules involving school visits and throughout the course in tutorial work

5 is addressed in practicals, group tutorial and workshops, and in collaborative teaching in the project in some cases

6 is specifically addressed in the school visits in Parts 2 and 3 and in practical work and is essential for the timely and effective completion of the project.

8 is addressed in the embedded module in CH2CC1

9 is generally an essential component of the

education project and ED2UP2

Assessment

1-7 are assessed mainly by coursework which forms a part of many modules, particularly at Part 2 and 3. 7 is assessed mainly in examinations in physical chemistry but also in inorganic and analytical chemistry. 9 is assessed by the final dissertation and 8 is assessed by coursework in module CH2PRAC.

Please note - This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each module can be found in the module description and in the programme handbook. The University reserves the right to modify this specification in unforeseen circumstances, or where the process of academic development and feedback from students, quality assurance process or external sources, such as professional bodies, requires a change to be made. In such circumstances, a revised specification will be issued.