THE UNIVERSITY OF EDINBURGH

PROGRAMME SPECIFICATION FOR BSc(Hons) in Chemistry (UTCHMTBBSCH)

1) Awarding Institution: The University of Edinburgh
2) Teaching Institution: The University of Edinburgh
3) Programme accredited by: The Royal Society of Chemistry
4) Final Award: BSc(Hons)
5) Programme Title: Chemistry
6) UCAS Code: F100

Relevant QAA Subject Benchmarking Group(s): Chemistry

7) Postholder with overall responsibility for QA: Dr. S. Daff
8) Date of production/revision: October 2016

9) External Summary
Chemistry is the science of molecules – their structures, properties, synthesis, and how they interact with each other to create new molecules. Its range and compass are enormous, from the simplest compounds like methane and sodium chloride up to huge and complex biological molecules such as DNA and proteins which form the basis of life itself. An understanding of every facet of science, technology and engineering is therefore informed by knowledge of chemistry. Furthermore a 21st century chemist can make significant contributions to a sustainable, secure and healthy future for the coming generations through the development of efficient renewable energy sources, smart materials and devices, and targeted medicinal therapies.

A chemistry degree at Edinburgh provides the intellectual framework for understanding the properties of molecules from fundamentals to the frontiers of current research. It also focuses strongly on the wide range of analytical and experimental skills necessary to practice the subject and provides insight into research via final-year research projects in research groups working at the cutting edge of the subject. The majority of chemistry graduates find careers in chemical or pharmaceutical companies, or utilise their broadly-based numerical, problem-solving and analytical skills in other areas such as business, banking, accountancy, marketing, advertising, or the IT sector. All the degrees include training and practice in communication skills, team working, and in the technology of scientific information retrieval and organisation.

10) Educational aims of programme:
The BSc degree programme covers topics in all branches of the discipline from their fundamentals to the frontiers of modern chemical knowledge. In the early years, in addition to the core chemistry and courses in mathematics, there is a flexible curriculum to suit personal interests, allowing courses in other sciences, arts or humanities to be combined with the core chemistry content. This flexibility also enables students to maintain options to transfer to an alternative degree programme within science or engineering at the end of the first year. There is scope for specialisation, in materials or environmental chemistry for example, through appropriate choice of optional courses in Years 2 and 4 and research project topic. Throughout emphasis is placed on
providing a broad and varied syllabus that not only reflects the multi-faceted nature of this science but also prepares students for future careers in industry, teaching or research. In the final year, direct experience of research is engendered by an in-depth individual research assignment. Alternatively, a final-year science education project and placement may be undertaken.

The aims of the degree programme are:

- To kindle in students a sense of enthusiasm for chemistry in all its aspects.
- To provide students with a skills base from which they can proceed to graduate employment or to further study.
- To produce well-rounded graduates with a thorough overall theoretical and practical understanding of chemistry, and with a sense of moral and social responsibility in relation to its potential impact on society and the environment.
- To instil an understanding and knowledge of chemistry, leading from the fundamentals, in the first two years, to the limits of existing knowledge in selected topics by the final year.
- To provide experience of the practical skills appropriate at each level of the curriculum together with a thorough knowledge of safe laboratory practice and an appreciation of the crucial importance of safety in experimental work.
- To develop transferable skills that maximise students’ prospects for future employment, including writing and oral presentation skills, information technology skills, team-working, and numerical and logical problem-solving.
- To develop mature and determined attitudes, including the capacity for self-organisation and time management, via independent project work.

11) Programme outcomes:

11a) Knowledge and understanding

- The characteristics of the different states of matter and the theories used to describe them.
- The principles of quantum mechanics and their application to the description of the structure and properties of atoms and molecules.
- The principles of thermodynamics and their applications to chemistry.
- The characteristic properties of elements and their compounds, including group relationships and trends within the Periodic Table.
- The structural features of chemical elements and their compounds, including stereochemistry.
- The synthesis, properties and applications of inorganic compounds, inorganic complexes and organometallic compounds.
- The nature and behaviour of functional groups in organic molecules and the properties of natural and synthetic aliphatic, aromatic and heterocyclic compounds.
- The mechanistic interpretation of chemical reactions; catalysis (both biological and synthetic); the kinetics of chemical change.
- The properties of natural and synthetic compounds that are important in the biological chemistry of living systems and in medicinal chemistry.
- The chemistry of materials and the relation between bulk properties and the properties of individual atoms and molecules, including macromolecules.
- The principles and techniques used in chemical analysis and the characterisation of chemical compounds, including structural characterisation by spectroscopy and X-ray crystallography.
- Major aspects of chemical terminology, nomenclature and conventions, as well as error analysis and the correct use of units.
11b) Skills and abilities in research and enquiry

By engaging with and completing the BSc degree in Chemistry the graduate is exposed to an internationally-renowned research school and undertakes an individual research project within a dynamic research group. In so doing, they develop:

- The application of knowledge and understanding gained throughout the curriculum to the solution of qualitative and quantitative problems of a familiar and unfamiliar nature, both in science and in a wider context.
- The ability to implement their scientific training to exercise rational enquiry and to compose pertinent research aims.
- The capacity to execute practical investigations and evaluate and appraise results and findings (including the ability to select appropriate analytical techniques and procedures).
- Skills in the synthesis, interpretation and evaluation of chemical information and data in terms of their significance and in their theoretical context.
- The ability to conduct comprehensive literature reviews (using online journals, archives, etc) in order to contextualise their own research findings.

11c) Graduate Attributes: Skills and abilities in Personal and Intellectual Autonomy

The knowledge and understanding gained during the BSc degree, along with the emphasis that is placed on practical laboratory-based learning, results in a graduate that can demonstrate the ability to:

- Adopt a flexible approach to reflect on different aspects of this broad science and the knowledge and skills that underpin all of them.
- Understand and analyse critically different sets of data to reach well-considered, evidence-based conclusions, drawing on their own knowledge and experience.
- Harness numerical, computational and experimental skills, which can be applied to problem-solving exercises relating to qualitative and quantitative information.
- Display the confidence to work independently, taking responsibility for their own learning and committing to continual professional and personal development.
- Transfer the knowledge and skills gained during their studies of chemistry to other fields of science and beyond.

11d) Graduate Attributes: Skills and abilities in Communication

By engaging and participating in the wide-ranging programme of study that includes small-group and individual research investigations, presentation skills and report writing, a graduate of the BSc degree:

- Is able to communicate effectively, demonstrating knowledge and understanding of essential concepts and theories, in writing and orally, to fellow students, researchers and academic staff.
- Develops IT skills such as word-processing and structure drawing, data-logging and storage and analysis in order to illustrate their arguments most effectively.
- Creates experimental reports, scientific posters and dissertations in accordance with current conventions.
- Demonstrates mature team-working skills, in order to produce well-balanced and well-substantiated solutions to scientific problems.
• Seeks and values constructive feedback to further personal and professional development.

11e) Graduate Attributes: Skills and abilities in Personal Effectiveness

In addition to the knowledge and understanding of the immediate degree discipline, the range of transferable skills developed during a BSc degree allows a graduate to:

• Take responsibility for their own learning and prioritise effectively to complete tasks efficiently and safely.
• Have the confidence to draw conclusions based on their knowledge and sound analysis.
• Engage effectively with the vibrant and multi-national teaching and research environment to enhance their academic experience.
• Develop an appreciation of the social, ethical and environmental implications of scientific research.
• Show flexibility in responding to their environments by adapting appropriately to change.

11f) Technical/practical skills

A core learning outcome of the BSc degree is to train a skilled and confident practical chemist. As such, a graduate is able to demonstrate:

• An appreciation for the safe handling of chemical materials, taking into account their physical and chemical properties, including any specific hazards associated with their use.
• The conduct of standard laboratory procedures involved in synthetic and analytical work.
• Skills in the monitoring, by observation and measurement, of chemical properties, events or changes, and the systematic and reliable recording and documentation thereof.
• The operation of standard chemical instrumentation such as that used for structural investigations and separation.
• The ability to conduct risk assessments concerning the use of chemical substances and laboratory procedures.

12 Programme structure and features

Acquisition of knowledge and understanding is achieved mainly through lectures, laboratory classes, tutorials/workshops and project work. Lectures are assessed via formal 'unseen' examinations. In all courses understanding is reinforced by small group tutorials and/or by problem solving workshops. Written communication, report writing and IT skills are developed via laboratory reports, posters, essays and project reports. Oral presentation skills are acquired via formal presentations. Practical skills and an awareness of the safety aspects of laboratory work and risk-assessment are developed progressively over the first three years of the course and through a research project in the final year.

The figures in parenthesis following the course names in the outline degree programme below are the Scottish Credit and Qualifications Framework (SCQF) credit level and credit points. Further information can be found at http://www.scqf.org.uk/. Normally courses totalling 120 credits are studied in each year with the level progressing year by year.
Year 1/2: A wide choice of 'other subjects' is available, limited only by timetable compatibility. Students with appropriate qualifications may enter directly into Year 2.

Year 3: Progression to BSc (Honours) in Year 4 requires an average Year 3 mark at Grade D (40%) or higher, including an average at Grade D (40%) or higher in the Year 3 written courses.

Year 4: In the final year of the BSc Honours degree in chemistry there is free choice of four 'elective' lecture courses in a range of aspects of chemistry in addition the project and transferable skills course.

**Chemistry (BSc), F100**

<table>
<thead>
<tr>
<th>Year</th>
<th>Courses (credit points)</th>
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<tbody>
<tr>
<td>Entry point 1 1</td>
<td>Chemistry 1A (8,20), Chemistry1B (8,20), Maths (8,40), other subjects (7/8,40)</td>
</tr>
<tr>
<td>Entry point 2 2</td>
<td>Chemistry 2 (8,40), other subjects (7/8,40), other subjects (8,40)</td>
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<tr>
<td>3</td>
<td>Chemistry 3A (9,40), Chemistry 3B (9,40), Chemistry 3P (9,40)</td>
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<tr>
<td>4</td>
<td>Research Project and Transferable Skills (10,40)*, 80 credits chosen from: Properties and Reactions of Matter (10,20), Synthetic Organic Chemistry (10,20), Techniques and Concepts in Inorganic Chemistry (10,20), Analytical Chemistry (10, 20), Biophysical Chemistry (10,20), Chemistry of Functional Materials (10,20), Environmental Chemistry (10,20), Physical Techniques in Action (10,20), Sustainable Chemistry (10,20), Biomacromolecules (10,20), Chemical Medicine (10,20)</td>
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<tr>
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<td>*The Science Education Placement (10,40) course may be taken instead (subject to availability and selection by interview)</td>
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13 Teaching and Learning Methods and Strategies

Teaching and Learning strategies employed at the University of Edinburgh consist of a variety of different methods appropriate to the programme aims. The graduate attributes listed above are met through a teaching and learning framework (detailed below) which is appropriate to the level and content of the course.

Teaching and Learning Activities

*In Year 1*

- Lectures
- Laboratories
- Tutorials
- Seminars
- Problem based learning activities
- Peer group learning
- Examples Classes
- Feedback sessions
- Careers talks
- Skills sessions
- One to one meetings with personal tutors

**In Year 2**

- Lectures
- Laboratories
- Tutorials
- Seminars
- Problem based learning activities
- Peer group learning
- Examples Classes
- Feedback sessions
- Careers talks
- Skills sessions
- One to one meetings with personal tutors

**In Year 3**

- Lectures
- Laboratories
- Tutorials
- Seminars
- Problem based learning activities
- Peer group learning
- Examples Classes
- Feedback sessions
- Careers talks
- Skills sessions
- One to one meetings with personal tutors

**Year 4**

- Lectures
- Laboratories
- Tutorials
- Seminars
- Problem based learning activities
- Peer group learning
- Examples Classes
- Feedback sessions
- Careers talks
- Skills sessions
- One to one meetings with personal tutors/project supervisors

**Facilities**

The School of Chemistry is equipped with a wide range of state of the art facilities and instrumentation. The Universities of Edinburgh and St Andrews have formed EaStCHEM, the leading Chemistry research school in Scotland, and the largest in the UK. EaStCHEM researchers produced 75% of all world-leading outputs (4* maximum ranking) in Scotland. This level of excellence continues as indicated by recent awards for our researchers. EaStCHEM is also part of ScotCHEM, which strengthens links between the major Schools of Chemistry in Scottish Universities.
Courses can be assessed by a diverse range of methods and often takes the form of formative work which provides the student with on-going feedback as well as summative assessment which is submitted for credit.

In Year 1

- Class tests
- Online assignments
- Laboratory reports
- Multiple-choice tests
- Written examinations

In Year 2

- Class tests
- Laboratory reports
- Continual assessment
- Essays
- Mathematics for chemistry problem exercises
- Written examinations

In Year 3

- Class tests
- Online assignments
- Laboratory reports
- Multiple-choice tests
- Abstracting exercise
- Problem-based learning
- Oral presentations
- Poster presentations
- Written examinations

Year 4

- Written exercises
- Oral presentations
- Literature comprehension exercise
- Literature survey
- Literature précis
- Personal attributes
- Practical work
- Project reports
- Written examinations

15 Career Opportunities

Chemistry graduates from the University of Edinburgh are highly regarded by local and international employers. Many graduates move into careers in the oil, chemical or pharmaceutical industries, in sales and marketing or research and development roles. Some graduates choose further study, leading to an MSc, PhD or teaching qualification. The course also prepares you for a variety of other careers, including areas such as management, finance or IT.
Teaching in the School of Chemistry is carried out in a highly active research environment which has strong connections with the chemical and pharmaceutical industries. The chemistry courses include extensive experimental work carried out in modern laboratories (opened in 1999). The proportion of time spent at the bench increases as the course progresses and culminates in an extended research project in the final year. The high quality of research activity in the EaStCHEM research school (rated in the top 4 in the UK in the 2014 Research Assessment Exercise) enables us to offer project work at the cutting edge of the subject across virtually all major areas of chemistry. Excellent IT facilities for undergraduates are provided throughout the university.

The high quality of teaching within the School of Chemistry has been recognised by the University student body – in 2011 the School was the recipient of the EUSA Teaching Award for Best Department. Advice and support, both academic and in all areas of student life, is available via Personal Tutors (PTs). The latter are staff members in the School of Chemistry who each look after the interests of a group of students. Each student is attached to a particular PT, normally for the whole duration of their course, and will see him/her on a regular basis for advice about their course and as a first point of contact in relation to any problems which may arise.

Further information

View the prospectus entry for this programme