The University Of Sheffield.

Programme Specification

A statement of the knowledge, understanding and skills that underpin a taught programme of study leading to an award from The University of Sheffield

1	**Programme Title**	Chemistry
2	**Programme Code**	MPSU002 / CHMU02
3	**HECoS Code**	100417
4	**Level of Study**	Undergraduate
5a	**Final Qualification**	Master of Chemistry (MChem)
5b	**QAA FHEQ Level**	Masters – Level 7
6a	**Intermediate Qualification(s)**	BSc with Honours
6b	**QAA FHEQ Level**	Level 6
7	**Teaching Institution** (if not Sheffield)	Not applicable
8	**Faculty**	Science
9	**School**	School of Mathematical and Physical Sciences
10	**Other Schools providing credit bearing modules for the programme**	None
11	**Mode(s) of Attendance**	Full-time
12	**Duration of the Programme**	4 years
13	**Accrediting Professional or Statutory Body**	Royal Society of Chemistry
14	**Date of production/revision**	December 2018, September 2022

15. Background to the programme and subject area

Chemistry occupies a central position in modern science because almost all the phenomena we observe and experience in the world around us are underpinned by the behaviour of atoms and molecules. Chemistry provides us with the insights to understand and predict this behaviour, and the skills to create the materials that control and change our environment. The applications of Chemistry in modern technology include medicine, forensic science, art restoration, solar energy, environmental control, agriculture, novel materials and many others. This enables Chemistry graduates to command a diverse range of career opportunities, both within chemistry and more broadly as scientists. In addition to professional careers closely related to the discipline, Chemistry graduates are able to pursue careers in areas such as management, sales, accounting, computing, patent law, insurance, banking, and teaching – well equipped for success due to their rigorous education in a challenging discipline.

The diversity of Chemistry and its place at the continually changing forefront of science requires contemporary expertise across the breadth of the subject from Schools delivering a chemical education. This encompasses the familiar sub-disciplines of inorganic, organic, physical and analytical chemistry which exemplify different methodologies, and extends into multidisciplinary areas such as sustainability, materials and biological chemistry, which are at the interface of important new technologies and challenges. The School at the University of Sheffield delivers research-led teaching in an inspirational and collaborative environment to meet the challenge of providing students with the excellent educational experience they need to emerge as adaptable, flexible and resilient professionals. With a deep understanding of their subject discipline and the skills, knowledge and values to be creative and effective problem solvers, they are independent learners able to communicate their ideas clearly to a range of audiences and work effectively, both individually and as part of a team. A major fourth year research project allows our MChem students to utilise and demonstrate these attributes generating new Chemical knowledge. Our graduates are able to take their place in society as well-informed, highly employable and responsible citizens who are motivated and equipped for the challenges of their chosen career.

The MChem Chemistry degree is primarily designed for students who foresee careers as professional chemists, and who will seek the professional status of Chartered Chemist in due course. The BSc degree can act as an exit degree for MChem students who either do not wish to continue into a fourth year of study, or who do not

perform strongly enough to meet the criteria for achieving an MChem. The BSc and MChem degrees share a common curriculum until the end of level 3 so that transfer is possible in either direction.

The MChem has been accredited by the Royal Society of Chemistry (RSC), which provides access to Associate Membership of the RSC and fully satisfies the academic requirements for the RSC's award of Chartered Chemist (CChem).

16. Programme aims

The School aims to provide high quality education which is stimulating, useful and enjoyable to students from a range of educational and social backgrounds and which is informed and invigorated by the research and scholarship of the staff. This contributes to the University's mission to maintain the highest standards of excellence as a research-led institution, whose staff work at the frontiers of academic enquiry and educate students in a research environment.

The programme aims to:

1. provide a wide understanding of Chemistry and its role in industry, the economy, the environment and society;

2. provide high quality teaching, informed and invigorated by the research and scholarship of the staff, and which is stimulating, and useful;

3. give to students a range of interpersonal and transferable skills;

4. engender attitudes which will promote lifelong learning;

5. promote the free pursuit of knowledge and to develop an ability to find, understand, and analyse information;

6. develop skills in the solution of theoretical and practical chemical problems;

7. foster safe and good laboratory practice;

8. develop students' analytical and deductive skills;

9. prepare students for a professional career;

10. to develop specialist knowledge and understanding of contemporary chemical problems and insights through exposure to material at the frontiers of the discipline;

11. enhance competence in practical chemistry and chemistry research methods, and develop the communication skills required to present material at research level;

12. provide the opportunity for students to acquire research skills and generate new knowledge in chemistry through an original research project.

17. Programme learning outcomes

1	Apply chemistry concepts and knowledge to evaluate and interpret chemical phenomena.
2	Design, execute, evaluate, and report a scientific investigation applying the appropriate knowledge within and up to the frontiers of the discipline.
3	Use chemical concepts and methods to interpret phenomena in society, technology, and the natural world, and articulate ethical implications of chemical activity in and on society.
4	Solve a range of problem types by applying a broad range of chemistry principles and knowledge, using logical methodology, and demonstrating creative and analytical thinking.
5	Design, conduct and accurately record the results of experiments using appropriate technical skills and following safe laboratory practice.
6	Analyse and represent chemical data using appropriate information technology.
7	Find and communicate information to a range of audiences through a variety of written and oral media using discipline-specific conventions where appropriate.
8	Work independently and as part of a team deploying effective organisation, personal responsibility, and planning skills.
9	Describe skills, attributes and experience, and critically reflect on professional development to foster lifelong learning skills.
10	Acquire a detailed knowledge and demonstrate a critical awareness of specialised areas at the forefront of contemporary chemistry.

11	Be able to conduct a substantial original research project, analysing and communicating the results independently.

18. Teaching, learning and assessment

Development of the learning outcomes is promoted through the following teaching and learning methods:

Lectures

Lectures are used to explain concepts and theories, to provide and interpret complex information (supported by our VLE), and to exemplify approaches to problem solving.

Tutorials

Small group tutorials in levels 1 and 2 provide the opportunity for students to work together, supported by their tutor. These are formative sessions, and the key element is that the students engage in carrying out the work rather than simply receiving instruction. As well as providing the opportunity to learn problem solving and clarify their understanding of chemical concepts, honing their analytical thought processes, these sessions provide the opportunity to develop their skills in working with peers and communicating complex ideas. The students have to be active participants, with the tutor providing a supportive environment to provide feedback and guidance based on their efforts.

The individual interaction between students and tutors is maintained throughout the degree, and regular individual meetings form part of the reflective skills audit and careers guidance, as well as the usual pastoral support. The relationship between student and tutor is reinforced from the beginning of the course through the regular academic tutorials described above.

Group work and workshops

Students work in groups to tackle some aspects of the laboratory course, culminating in a group project in the level 3 laboratory based projects where they have to cooperate to tackle the open ended problems effectively. Further opportunities for group work occur in supporting the lecture courses at level 3, where students are expected to be independent learners and use their earlier experience to work together effectively.

Research seminars

Students are exposed to the cutting edge of chemistry through invited seminar speakers, with compulsory attendance in level 4.

Laboratory work

Technical skills, safety assessments, time management and experimental design are developed through the laboratory programme.

Project work

Open ended project work provides the opportunity for students to tackle larger tasks and demonstrate their independent study skills, as exemplified through a substantial literature review and laboratory project in level 3.

Research Project

In level 4, students are exposed to the research environment and given the opportunity to carry out original research under the supervision of an academic member of staff. A principal requirement of the project is that it has the potential to generate publishable work, and gives the student the opportunity to apply the skills that they have accumulated over levels 1 to 3 in independent scientific investigations.

Opportunities to demonstrate achievement of the learning outcomes are provided through the following assessment methods:

Formal examinations

Unseen examinations which test chemistry knowledge and its application to solving short answer unseen problems. Unseen examinations which test chemistry knowledge and technical problem solving skills using online quizzes.

Coursework

This is assessed through a variety of methods to test both knowledge and communication skills, including written submissions and oral presentations. In the laboratory, the recording of experimental outputs and data

submission demonstrates effective laboratory skills, alongside the intellectual skills demonstrated by the analysis of these data. During the final year project, the supervisor assesses the performance of the student in the project using well defined criteria.

Oral presentations

These form an important part of communicating the facts and interpretations of laboratory and project work.

Oral exams

The final year project involves a viva exam on the subject of the project report, allowing a detailed assessment of the student's knowledge and insights into the work carried out.

Project reports

These become more detailed and extensive as students' progress through the course, culminating in the report of the final year research project.

Reflective skills audit

Academic staff ensure that students engage with the requirements to reflect on their skills development through the course.

19. Reference points

The learning outcomes have been developed to reflect the following points of reference:

Subject Benchmark Statements (2014)
https://www.qaa.ac.uk/docs/qaa/subject-benchmark-statements/sbs-chemistry-14.pdf?sfvrsn=99e1f781_14

Framework for Higher Education Qualifications (2014)
https://www.qaa.ac.uk/docs/qaa/quality-code/qualifications-frameworks.pdf

University Strategic Plan
http://www.sheffield.ac.uk/strategicplan

Learning and Teaching Strategy (2016-21)
https://www.sheffield.ac.uk/staff/learning-teaching/our-approach/strategy2016-21

RSC Accreditation of Degree Programmes (2017)
http://www.rsc.org/images/Accreditation%20criteria%202017-%20update%20july%2017_tcm18-151306.pdf

20. Programme structure and regulations

The first two years of all the chemistry degree programmes share a common set of core modules. This structure enables students to transfer between any of the degree programmes that the School offers, so that they can respond to potential changes in their specific interests as they progress through their education.

In level 1, a core 80 credit Fundamentals of Chemistry module establishes the fundamental principles that underpin the whole breadth of Chemistry, then focuses on themes to inculcate the different knowledge and methodologies employed across the subject. This ensures that all students experience a rigorous introduction to basic chemical principles with an emphasis upon Chemistry as a unified subject. The place of chemistry in the wider world is emphasised through the 10 credit Chemistry in a Sustainable Future module which is also compulsory for all students: it is essential that all our graduates understand the impact and influence that Chemistry wields. A 20 credit Essential Skills for Chemists module lays the foundation for the quantitative, communication and professional skills needed for Chemistry at University level and beyond. This level also allows students to extend their studies with 10 approved credits selected from modules covering the broader application of chemistry or a language module.

The themes established in level 1 are developed through five modules in level 2, which are Inorganic Chemistry: Structure, Bonding and Reactivity; Synthetic, Mechanistic and Biological Aspects of Organic Chemistry; Physical Chemistry and Polymer Science; Environmental, Analytical and Sustainable Chemistry; and Enterprise and Employability. At the end of level 2, students need to obtain a weighted average mark of 60 to remain on the MChem course.

In level 3, students develop their capacity for open ended, independent work through the 30 credit Chemistry Employability Skills and Projects modules. A key feature of this module is a skills for success component, which aims to ensure that students identify and develop skills that will be of use to them in life, future study and employment. The remaining core syllabus is completed by three 20 credit compulsory modules, preparing

students to take an informed choice of a wide range of optional modules that provide the opportunity for students to sample the frontiers of the subject and how it is applied in the wider world. Students take three 10 credit modules, led solely by their preferred specialisation. At the end of level 3, students need to obtain a weighted average mark of 54.5 to remain on the MChem course. Should they not achieve this, they are transferred onto the BSc Chemistry course.

Level 4 provides a wide range of topics at the cutting edge of the subject where students are again free to pursue their specialist interests. Each student selects three 15 credit modules to study from an extensive list which captures the breadth of research expertise in the School. A major feature of the final year is the major project, where students work alongside research active Chemists in the research laboratories. These projects are designed to yield potentially publishable results, and provide the opportunity to apply the skills developed over the course of the previous three years in independent original research.

Detailed information about the structure of programmes, regulations concerning assessment and progression and descriptions of individual modules are published in the University Calendar available on-line at http://www.sheffield.ac.uk/calendar/.

21. Student development over the course of study

The students' progress towards achieving the programme level learning outcomes is guided by a series of intermediate learning outcomes, allowing them to stage the development of their knowledge and skills over the course of the programme:

Level 1: Apply fundamental concepts (vocabulary, facts, theories, and models) to chemical phenomena and describe the place of models in chemistry. Demonstrate a working understanding of scientific method (methodology of chemistry research) through an investigation. Articulate in simple terms the role of chemistry in society and the philosophy and limitations of the scientific method. Follow a logical problem solving methodology to solve a problem. Safely conduct a basic investigation in the laboratory, demonstrate good organisation skills in lab work and accurately and concisely document experimental work in a lab notebook. Demonstrate mathematical skills in simple data analysis and use software to plot appropriate graphs. Demonstrate basic information literacy and correct terminology in a range of written work and oral presentation. Manage own work to meet deadlines, identify and find own resources, engage successfully in group activity with a familiar team, work independently. Identify skills and abilities through critical reflection on experiences of learning and wider context and describe development activities done.

Level 2: Apply chemical concepts to interpret chemical phenomena. Design an investigation into a problem in the world around us. Interpret phenomena in society, technology and the natural world in terms of chemical behaviour. List some ethical implications of chemical activity on society. Differentiate between and appraise contrasting solutions of a chemical problem. Design experiments, specifying the resources required and assessing the risks involved. Interpret results of experiments using appropriate software and by combining methods of analysis. Find information from different sources and use in written and oral presentation work that demonstrates use of vocabulary and communication styles appropriate to discipline-specific conventions. Organise own learning resources (information management - endnote/databases), set and meet deadlines, and engage successfully in group activity with an unfamiliar team. Critically reflect on skills in order to improve effectiveness in learning or work. Describe activities taken in a considered exploration of career options.

Level 3: Apply concepts and knowledge across the breadth of chemistry to evaluate and interpret chemical phenomena including aspects of the frontiers of the discipline. Design, execute and evaluate an investigation into a known problem based on research themes or an applied problem in the world around us. Assemble information from across chemistry to interpret phenomena in society, technology and the natural world, in terms of chemical behaviour. Apply knowledge of the ethical implications of chemical activity in and on society to own practice. Describe a complex problem in society, technology or the natural world and draw together knowledge to plan a solution using logical methodology, demonstrating creative and analytical thinking. Design, conduct, and accurately record the results of experiments and investigations using a range of practical skills demonstrating awareness of sustainability in chemistry through cost-effective use of resources. Choose and apply methods of data analysis and presentation appropriate to a specific investigation. Find appropriate sources in the literature and communicate information through a variety of written and oral media in accordance with discipline-specific conventions to a range of audiences. Work independently demonstrating self-direction, effective planning and organisation to achieve goals. Make best use of time, group abilities, and laboratory facilities to achieve goals, working together to plan and agree own and colleagues' contribution to group work in a team and demonstrate personal responsibility in performing tasks. Exercise initiative and take personal responsibility in continuing professional development through self-directed learning and reflective practice. Describe skills, attributes, and experience clearly: for example, through securing graduate job/summer internship/Master's degree relevant to career.

Level 4: Apply specialist concepts and knowledge to evaluate and interpret chemical phenomena and to create new knowledge at the frontiers of discipline. Execute, evaluate, and report a research project applying the appropriate knowledge at the frontiers of the discipline. Evaluate the societal impact and ethical implications of advances at the forefront of chemical knowledge. Solve a range of problem types relevant to questions at the frontiers of the discipline. Design, conduct and accurately record the results of experiments using appropriate practical skills and following safe laboratory practice for research at the frontiers of chemistry. Analyse and represent data using appropriate disciplinary-specific software and demonstrating critical thinking skills. Use current literature and an expert command of vocabulary to present a well-reasoned interpretation of experimental results and the outcomes of a research project using written and oral presentation. Take ownership of own research work through regular re-evaluation of progress, orderly management of data and acting as a member of a research team. Exercise initiative and take personal responsibility in continuing professional development as a researcher through self-directed learning and reflective practice; for example, through securing graduate job/further training/higher degree relevant to career.

22. Criteria for admission to the programme

Detailed information regarding admission to the programme is available at http://www.shef.ac.uk/prospective/

23. Additional information

This specification represents a concise statement about the main features of the programme and should be considered alongside other sources of information provided by the teaching School(s) and the University. In addition to programme specific information, further information about studying at The University of Sheffield can be accessed via our Student Services web site at http://www.shef.ac.uk/ssid.