# University of Huddersfield

# Programme Specification

|  |  |  |
| --- | --- | --- |
| 1 | Awarding Institution | University of Huddersfield |
| 2 | **Teaching Institution** | University of Huddersfield |
| 3 | **School and Department** | Applied Sciences, Chemical Sciences |
| 4 | **Course Accredited by** | Royal Society of Chemistry (2018) |
| 5 | Mode of Delivery | Full time |
| 6 | Final Award | MChem |
| 7 | Course Title | MChem Chemistry with Industrial Experience  MChem Chemistry |
| 8 | UCAS Code | F101 MChem/Chem |
| 9 | **Subject Benchmark Statement** | QAA Chemistry Benchmark Jan 2007 |
| 10 | Date of Programme Approval | Mar 2019  Revised March 2023 |

**11 Educational Aims of Course**

The chemical industry is one of the most important industrial sectors in the UK. There has always been a high demand for qualified chemistry graduates to work in the major petroleum and pharmaceutical companies. Increasing awareness of the environment and increasing legislation to control the degree of pollution has also lead to a greater demand for analytical chemists. Chemistry graduates are also employed as Forensic Scientists. Chemistry graduates, as well as being knowledgeable about their own subject have also been trained in other transferable skills permitting them to proceed into other careers, including teaching, accountancy, sales, etc.

A BSc (Hons) degree has been offered at the University of Huddersfield for over 40 years and an MChem for over 10 years. The MChem is an integrated master’s degree and provides both additional breadth of study and is designed to equip graduates with the knowledge and skills necessary for a career in Research and Development within the chemical industry. Since the Department recognises the importance of and places a high emphasis on work experience in industry, the MChem Chemistry with Industrial Experience was developed in 2007/2008 and includes a compulsory third year in industry. Recently, a number of students have spent their third year working in a university research lab rather than in industry, and the standalone MChem, introduced in 2013, recognises these students. The Department of Chemical and Biological Sciences has staff expertise in the four main branches of chemistry (inorganic, organic, physical and analytical) as well as other related areas such as biochemistry, medicinal chemistry, chemical engineering and forensic science. There are several large research groups within the Department in topical areas, including catalysis, organic and inorganic synthesis, medicinal chemistry and analytical chemistry. Students are able to study one option as this allows them to have specialised knowledge in particular related topics which will ultimately improve their employment prospects.

*The main aims of the programme are to:*

(1) instil in students a sense of enthusiasm for chemistry and an appreciation of the importance and sustainability of chemistry in the twenty first century;

(2) provide a knowledge in the main branches of chemistry (inorganic, organic, physical and analytical);

(3) provide training in the safe and competent use of laboratory equipment;

(4) develop in students an ability to apply their chemical knowledge and skills to the solution of new and varied theoretical and practical problems in chemistry;

(5) develop, through an education in chemistry, a range of transferable skills, including mathematical and IT skills, of value in chemical and non-chemical employment;

(6) provide specialised knowledge in chosen optional subjects;

(7) prepare students for a career as a research chemist.

###### 12 Intended learning outcomes

|  |
| --- |
| ***Knowledge and Understanding*** |
| Students will:  (8) have a basic knowledge of the four main branches of chemistry (inorganic, organic, physical and analytical)  (9) have a basic understanding of the mathematical principles and computing skills related to their application in chemistry  (10) have a deeper knowledge and understanding of certain aspects of chemistry  (11) have a knowledge of chosen optional areas  (12) be aware of the most recent developments at the forefront of chemistry  (13) have acquired sufficient knowledge and personal awareness to be able to make an informed choice of future career |

| ***Skills and Other Attributes*** |
| --- |
| Students will be able to:  (14) demonstrate knowledge of essential facts, concepts, principles and theories in the main areas of chemistry;  (15) apply their knowledge to the solution of qualitative and quantitative problems of a familiar and unfamiliar nature;  (16) evaluate, interpret and generate chemical information and data;  (17) recognise and analyse problems and plan strategies for their solution;  (18) present scientific results and conclusions clearly and correctly, in writing and orally, to a variety of audiences;  (19) use information technology for data processing and retrieving chemical information;  (20) adapt and apply methodology to the solution of unfamiliar problems;  (21) evaluate and present research results objectively;  (22) carry out original research of sufficient quality for potential publication. |

| ***Professional Practical Skills*** |
| --- |
| Students will be able to:  (23) handle chemicals and carry out standard laboratory synthetic procedures safely;  (24) operate standard chemical instrumentation;  (25) monitor chemical properties, events or changes by the observation, measurement and systematic and reliable recording thereof;  (26) interpret and explain the limits of accuracy in their experimental results in terms of their significance and underlying theory;  (27) carry out risk assessments on chemical procedures and laboratory procedures;  (28) competently plan, design and execute practical investigations from the problem recognition stage through the selection of appropriate techniques and methodologies to the evaluation and appraisal of the results;  (29) work independently and be self-critical in the evaluation of risks, experimental procedures and outcomes and understand how the limits of accuracy of experimental data should be used in the planning of future work. |

| ***Transferrable/Key Skills*** |
| --- |
| Students will have:  (30) interpersonal skills, including the ability to work as part of a team;  (31) numeracy and information technology skills;  (32) verbal and written communication skills;  (33) time management and organisational skills;  (34) information retrieval skills, including on-line searches;  (35) study skills and independent learning ability for continuing personal development;  (36) problem solving skills;  (37) shown self-direction and originality in tackling and solving problems and be able to act  independently in planning and implementing tasks at a professional level;  (38) shown the ability to communicate and interact with professionals from other disciplines or within an industrial environment;  (39) shown initiative and personal responsibility;  (40) developed decision making skills in complex and unpredictable situations. |

###### 13 Course structures and requirements, levels, modules, credits and awards:

The Course is consistent with the University Credit Accumulation and Transfer Scheme (CATS) where modules are predominantly of 20 credits, delivered and assessed over one year. In the first year, modules are at foundation level (“F” level credits) and provide underpinning knowledge, competencies and skills for the later intermediate, honours and masters level modules (“I”, “H” and “M” level credits, respectively) taken in later years. Students are required to take 120 “F” level credits in the first year, 120 “I” level credits in the second year and 80 “H” level and 40 “M” level credits during the third year. In their final year they take 80 “M” level credits in core chemistry and a further 40 “H” level credits in their chosen specialisation.

Year 1 - The first year modules cover fundamental inorganic, organic, physical and analytical chemistry. The lectures and seminars are supplemented with relevant practical exercises. These modules are supported by data handling modules which are intended to aid the understanding, manipulation, analysis and presentation of chemical and other scientific data. Basic IT and communication skills are introduced.

Year 2 – The inorganic, organic, physical and analytical chemistry modules build on the concepts introduced in the first year. There is also the opportunity for students to study a module in an additional optional area (biology, chemical engineering, geography).

Year 3 – For MChem with Industrial Experience, Year 3 is a one year position in an industrial setting. For MChem, Year 3 may also be spent in a university research lab, governmental organisation, research establishment or hospital setting. During Year 3, students will carry out a research project and write this up as a scientific journal article. They will also carry out a survey of the sector related to their position, study aspects of business in science, and compile a portfolio of the skills they have acquired during Year 3. A chemistry module will be studied in addition.

Year 4 - The final year includes modules on more advanced aspects of chemistry. A substantial research project (40 credits) allows the student to work independently, but with guidance, on specific problems at the forefront of chemistry, which enables them to develop their own line of investigation. As well the core advanced modules in Physical, Organic and Inorganic, students will also study one module in their chosen option.

**Year 1**

|  |  |  |  |
| --- | --- | --- | --- |
| **Module Code** | **Module Title** | **Credits** |  |
|  |  |  |  |
| SFC1001 | Inorganic Chemistry 1 | 20 |  |
| SFC1003 | Physical Chemistry 1 | 20 |  |
| SFC1004 | Analytical Science 1 | 20 |  |
| SFC1002 | Organic Chemistry 1 | 20 |  |
| SFC1005 | Data Handling | 20 |  |
| SFC1006 | Techniques of Practical Chemistry | 20 | Compulsory |

SFC1006 Techniques of Practical Chemistry is a pre-requisite for SIC2006 Practical Chemistry

**Year 2**

|  |  |  |  |
| --- | --- | --- | --- |
| **Module Code** | **Module Title** | **Credits** |  |
| SIC2001 | Inorganic Chemistry 2 | 20 | Core |
| SIC2002 | Organic Chemistry 2 | 20 | Compulsory |
| SIC2003 | Physical Chemistry 2 | 20 | Compulsory |
| SIC2004 | Analytical Science 2 | 20 | Core |
| **Either** |  |  |  |
| SIC2006 | Practical Chemistry | 20 | Compulsory |
| SIC2021 | Essential Biology | 20 | Optional |
| **OR:** |  |  |  |
| SIC2011 | Chemical Engineering 1 | 20 | Optional |
| SIC2006 | Practical Chemistry | 20 | Compulsory |
| **OR:** |  |  |  |
| SIC2006 | Practical Chemistry | 20 | Compulsory |
| SIC2011 | Chemical Engineering 1 | 20 | Optional |
| **OR** |  |  |  |
| SIC2006 | Practical Chemistry | 20 | Compulsory |
| SIG2015 | The Anthropocene | 20 | Optional |

SIC2006 Practical Chemistry is compulsory and prerequisite.

**Year 3**

|  |  |  |
| --- | --- | --- |
| **Module Code** | **Module Title** | **Credits** |
|  |  |  |
| SHC3003/SHC3013 | Industrial Training\*/Laboratory Techniques# | 40 |
| SHC3004/SHC3014 | Industrial Project\*/Investigative Project# | 20 |
| SHC4028 | Advanced General Chemistry | 20 |
| SHC4040 | Business Aspects of Science | 20 |
| SMC4004 | Scientific Communication | 20 |

**\* MChem Chemistry with Industrial Experience; # MChem Chemistry**

**Year 4**

|  |  |  |
| --- | --- | --- |
| **Module Code** | **Module Title** | **Credits** |
| **CORE** |  |  |
| SMC4005 | Applied Organometallic & Coordination Chemistry | 20 |
| SMC4002 | Targeted Synthesis of Organic Compounds | 20 |
| SMC4003 | Materials, Surfaces & Polymers | 20 |
| SMC4018 | Research Project | 40 |

**OPTIONAL**

|  |  |  |
| --- | --- | --- |
| SHC4004 | Analytical Science 3 | 20 |
| SHC4014 | Analytical Science 4 | 20 |
| SHC4011 | Chemical Engineering 2 | 20 |
| SHC4031 | Molecular Targets and Drug Design | 20 |
| SHC4016 | Chemical Therapeutics | 20 |
|  |  |  |
|  |  |  |
| SHC4037 | Sustainable Industrial Systems | 20 |

**MChem Chemistry or MChem Chemistry with Industrial Experience** can be awarded upon successful completion of modules which give the student 480 credits of which no more than 120 must be at Foundation level, no more than 120 must be at Intermediate level, no more than 120 must be at Honours level and no more than 120 must be at Masters level. They must also have achieved an average of at least 50% in the third year H and M level modules. Students must normally have achieved 120 credits to progress to the relevant next stage each year. To progress to the third year of the MChem the student must achieve an average > 60% in their first and second year modules. Students with an average of < 60% will transfer to the third year of the BSc (Hons) Chemistry Degree, BSc (Hons) Chemistry with Chemical Engineering Degree, or BSc (Hons) Chemistry with Forensic Science Degree.

The class of award is determined at the Course Assessment Board. Classification will be determined from an average of the marks obtained from the second year I level modules and the third and final year H and M level modules. Those marks obtained from the M level modules shall have twice the weighting of those obtained from the I and H level modules. The averages for each stage will be calculated from the best 100 credits, with the proviso that not more than 100 credits can be counted from any one academic year of study.

The aggregate percentage mark and the relevant classification will be as follows:

> 70 First Class

60 - 69 Upper Second Class

50 - 59 Lower Second Class

< 50 Fail

Students who score less than 50% may be eligible for the award of BSc (Hons) with a classification based on the provisions in the University of Huddersfield Regulations for Awards.

Students who enter directly into the third year will be classified based on the average of the marks from the best 100 H and 100 M level credit marks with the M level credit modules having a weighting of 2, with the proviso that no more than 100 credits can be counted from any one particular academic year of study.

At Masters level a student should have a comprehensive knowledge of their subject and a critical awareness of current problems and new insights at the forefront of chemistry. They should be able to critically evaluate current research, evaluate methodologies, develop critiques, show originality in the application of knowledge and, where appropriate, propose new hypotheses.

Students who are unable or do not wish to complete the MChem Chemistry or MChem Chemistry with Industrial Experience programme are able to gain intermediate awards determined by the number and type of credits as follows:

**Certificate of Higher Education in Chemistry**  120 “F” credits

**Diploma of Higher Education** **in Chemistry** 120 “F” credits + 120 “I” credits

**BSc Chemistry**  120 “F” credits + 180 “I”/”H” credits

(at least 60 “H” credits)

###### 14 Teaching, Learning and Assessment

In years 1, 2 and 4, modules are delivered over two terms with normally two hours formal contact per week per module. Practical sessions are normally 3 or 4 hours. A variety of teaching methods are used, including lectures, tutorials, seminars, practicals and directed reading. Unilearn is widely used for the provision or supporting material. Individual student-centered learning is achieved by the use of structured assignments, workbooks for practicals and IT based resources.

In Year 3 the programme of study is necessarily more flexible as students may commence their positions in industry (MChem with Industrial Experience) or academia (MChem) any time between the beginning of July and the end of September. There is a much greater emphasis on self-study and assignments, and students will need to be organised to manage several ongoing studies simultaneously. A series of workshops will be held in the post-examination period in year 2 to clarify the expected outcomes of the year 3 modules and provide any other necessary training.

Most modules are assessed through coursework (during the year) and a formal unseen examination in the third term. Coursework is made up mainly from laboratory reports, problem solving assignments and short tests, including MCQs, as well as a small number of essays, oral and poster presentations. Formative tests are widely used, especially in the first year. A summary of assessment is given in appendix 4. A schedule is given to all students at the start of the academic year. Reasonable adjustments, such as extra time, provision of a computer, separate room or amanuensis, are made to assessments for students with a Personal Learning Support Plan following clear written guidelines provided by the University’s Disability Support Service.

###### 15 Support for Students and their Learning

All students are assigned a personal tutor. For each individual course within the chemistry suite there is a year tutor who often fulfills many of the roles of the personal tutor and is more often the main point of contact for students. The role of the year tutor/personal tutor in supporting students is seen as of primary importance. Students are encouraged to see their year tutor or personal tutor about any problems they have which do, or may, affect their ability to study and learn. The tutor will keep track of any serious on-going issues, but respect student confidentiality. Students may see other staff about an issue if they feel more comfortable doing so. Students are encouraged to see academic tutors if they have difficulty understanding material, or with coursework.

Students are also supported in their study and learning through the following activities and services:

- Induction week

- Flying start

- Student Handbook

- Access to BrightSpace virtual learning environment

- Specialised computing laboratories and chemical/forensic science laboratories

- Student e-mail and open personal access to teaching staff including the Head of Department and the Course Leader

- Drop-in sessions

- Access to a School Learning Support Assistant

- Access to student counselors at the University of Huddersfield

- Access to the Disability Support Service, which provides assistance and guidance for students with Personal learning Support Plans

- Access to the Students' Union Academic Affairs Officer.

Students are supported during Year 3 by a Visiting Tutor if they are based away from campus. Students will also be encouraged to maintain contact with their module tutors (by phone or e-mail, or in person if appropriate) to discuss the modules they are undertaking during Year 3. Guidance is provided in order to enable students to secure a Year 3 position. Staff provide guidance in the preparation of CVs, letters of application and interview techniques. Students apply for advertised posts or set up a suitable position through their own contacts.

###### 16 Criteria for Admission

The admissions process will be in conjunction with other courses of the chemical sciences suite.

Normally candidates will be at least 18 years of age by 31st December of the year of entry.

It is desirable that candidates have GCE/GCSE Grade C or above in English and Mathematics and an approved science subject.

For entry to the integrated masters degree candidates normally will have:

- Passes in 5 subjects at GCE/VCE/AVCE/GCSE including 12 units of study from 3, 6 and 12 unit awards with at least one 6 unit award in Chemistry or a 12 unit award in Science, *or*

- A BTEC Certificate/Diploma in science, *or*

- Successfully completed the University of Huddersfield Science Extended Degree*, or*

- Advanced, level 3, GNVQ or NVQ at an appropriate level, *or*

- Other qualifications deemed by the School to be acceptable.

Mature students, without formal qualifications may apply for admission through the School Accreditation of Prior Experiential Learning panel.

Entry to different stages is possible for all Courses. Each course has identified requirements for entry at different points and stages. Accreditation is approved by the SAVP in accordance with the procedures outlined in the School of Applied Sciences Undergraduate Scheme Document.

###### 17 Methods for Evaluating and Improving the Quality and Standards of Teaching

###### and Learning

***Mechanisms for review and evaluation of teaching, learning, assessment, the curriculum and outcome standards***

Module and Course reviews (student evaluations and staff reports)

Annual Evaluation Report prepared by the Course Leader and considered by Course Committee and School Annual Evaluation Committee

Peer observation of teaching

External Examiners' reports

Employers' reports for Year 3 students based in industry.

***Committees with responsibility for monitoring and evaluating quality and standards***

Student Panel

Course Committee

School of Applied Sciences Teaching and Learning Committee

School of Applied Sciences Annual Evaluation Committee

University Teaching and Learning Committee

Course Assessment Board - meets in June and July to consider marks, progression and awards.

***Mechanisms for gaining student feedback on the quality of teaching and their learning experience***

Student Panel and student representation on Course Committee

Student evaluation of modules.

***Staff development priorities include:***

Staff annual appraisal and institutional staff development courses

Updating professional developments

Regular Course meetings and annual review and planning for subsequent academic year.

###### 18 Regulation of Assessment

The minimum pass mark for each module is 40% at F, I and H level, and 50% at M level.

An overview of assessment details and procedures is provided in the Student Handbook and appendix 4.

To qualify for the award of MChem Chemistry or MChem Chemistry with Industrial Experience students must be credited with 480 credits and complete all the requirements of the Course. The degree classification is based on a weighted average calculation as detailed in section 11.

The university regulations for awards can be found on the Registry Website.

***Role of External Examiners***

External Examiners are appointed by the University Learning and Teaching Committee.

Three External Examiners are appointed from the academic community with responsibility for the chemical sciences suite of courses.

The role of the External Examiner is that of moderator. In order to do this they:

- approve examination papers

- review coursework and examination scripts

- interview borderline candidates for award

- attend the Course Assessment Board.

###### 19 Indicators of Quality and Standards

Reports of validation panels

Annual Course reviews

External Examiners’ reports

Qualifications and experience of staff

Report on University Subject Review of Chemical Sciences 2019

RSC Accreditation 2018.

**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 study module guide and course handbook. The accuracy of the information contained in this document is reviewed by the University and may be checked by the Quality Assurance Agency for Higher Education.**

**Key sources of information about the course can be found in:**

Student Handbook (Issued yearly)

University of Huddersfield Students’ Handbook of Regulations (issued yearly)

University of Huddersfield Prospectus (issued yearly).

**Appendix 1 Staffing and Management**

**MANAGEMENT OF PROGRAMMES**

The management structure for the MChem Chemistry and MChem Chemistry with Industrial Experience course operates within the School of Applied Sciences Scheme and acts on behalf of this and other Courses for which the Department of Chemical Sciences is responsible.

**Course Committee**

The Course will be under the overall management of the Course Committee which meets at least once per term and is responsible for any decisions concerning the suitability of modules for inclusion on the Course. The chair of that Committee is the Course Leader. The Course Leader will implement policies and decisions of that Committee and be responsible for the day-to-day running of the course. Feedback from student representatives is a standing item on the agenda.

**Year Tutors** are responsible to the Course Committee for the proper management and monitoring of each year of the Course. They will be responsible for advising students of their choice of modules and for support, guidance and counseling when appropriate. The final year tutor is responsible for the co-ordination and administration of the final year project. They will be responsible for allocating project supervisors to each student and will co-ordinate and oversee the assessment of the project.

**Module Leaders** will arrange and co-ordinate the teaching programme for the module(s) for which they are responsible, and maintain appropriate records. Module leaders meet on a regular basis with the teaching team involved in the delivery of the module and also the year tutor. The module leader also seeks feedback from student representatives regarding the module.

**Personal Academic Tutors** are allocated to all first-year students by the first year tutor.

**Admissions Officer** is responsible, through the Course Leader, to the Course Committee for the proper processing of all applications for admission to the Course.

**Examination Officer** is responsible, on behalf of the Course Leader, for co-ordinating examination arrangements, including the setting and vetting of examination papers.

**A specialist tutor** is responsible for preparing students for their Year 3 position, liaising with providers to secure positions and (year 3 tutor) monitoring students whilst they are in Year 3.**Appendix 2** Mapping **of Learning Outcomes onto Modules**

**Year 1 - Foundation Level**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Core Modules | | | | Option Modules | | | |
| Learning Outcome | SFC1001 | SFC1003 | SFC1004 | SFC1002 | SFC1006 |  | SFC1005 |  |
| 1 | ✔ | ✔ | ✔ | ✔ | ✔ |  |  |  |
| 2 | ✔ | ✔ | ✔ | ✔ | ✔ |  |  |  |
| 3 | ✔ | ✔ | ✔ | ✔ | ✔ |  |  |  |
| 4 | ✔ | ✔ | ✔ | ✔ | ✔ |  |  |  |
| 5 |  | ✔ |  |  |  |  | ✔ |  |
| 6 |  |  |  |  |  |  |  |  |
| 7 |  |  |  |  |  |  |  |  |
| 8 | ✔ | ✔ | ✔ | ✔ |  |  |  |  |
| 9 |  |  |  |  |  |  | ✔ |  |
| 10 |  |  |  |  |  |  |  |  |
| 11 |  |  |  |  |  |  |  |  |
| 12 |  |  |  |  |  |  |  |  |
| 13 | ✔ | ✔ | ✔ | ✔ | ✔ |  |  |  |
| 14 | ✔ | ✔ | ✔ | ✔ |  |  |  |  |
| 15 | ✔ | ✔ | ✔ | ✔ | ✔ |  |  |  |
| 16 | ✔ | ✔ | ✔ | ✔ | ✔ |  |  |  |
| 17 | ✔ | ✔ | ✔ | ✔ | ✔ |  |  |  |
| 18 | ✔ | ✔ | ✔ | ✔ | ✔ |  |  |  |
| 19 |  | ✔ | ✔ |  | ✔ |  | ✔ |  |
| 20 |  |  |  |  |  |  |  |  |
| 21 |  |  |  |  |  |  |  |  |
| 22 |  |  |  |  |  |  |  |  |
| 23 | ✔ | ✔ | ✔ | ✔ | ✔ |  |  |  |
| 24 | ✔ | ✔ | ✔ | ✔ | ✔ |  |  |  |
| 25 | ✔ | ✔ | ✔ | ✔ | ✔ |  |  |  |
| 26 | ✔ | ✔ | ✔ | ✔ | ✔ |  |  |  |
| 27 |  |  |  |  |  |  |  |  |
| 28 |  |  |  |  |  |  |  |  |
| 29 |  |  |  |  |  |  |  |  |
| 30 | ✔ | ✔ | ✔ | ✔ | ✔ |  |  |  |
| 31 |  | ✔ |  |  |  |  | ✔ |  |
| 32 | ✔ | ✔ | ✔ | ✔ | ✔ |  |  |  |
| 33 | ✔ | ✔ | ✔ | ✔ | ✔ |  | ✔ |  |
| 34 |  |  |  |  |  |  | ✔ |  |
| 35 | ✔ | ✔ | ✔ | ✔ | ✔ |  | ✔ |  |
| 36 | ✔ | ✔ | ✔ | ✔ | ✔ |  | ✔ |  |
| 37 |  |  |  |  |  |  |  |  |
| 38 |  |  |  |  |  |  |  |  |
| 39 |  |  |  |  |  |  |  |  |
| 40 |  |  |  |  |  |  |  |  |

**Year 2 - Intermediate Level**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Core Modules | | | |  | | Option Modules | | | | |
| Learning Outcome | SIC2001 | SIC2002 | SIC2003 | SIC2004 | SIC2006 |  | |  | SIC2011 | SIG2015 | SIC2021 |
| 1 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  |  |  |  |
| 2 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  |  |  |  |
| 3 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  | ✔ |  | ✔ |
| 4 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  |  |  |  |
| 5 |  |  | ✔ | ✔ |  |  | |  |  |  |  |
| 6 |  |  |  |  |  |  | |  | ✔ | ✔ | ✔ |
| 7 |  |  |  |  |  |  | |  |  |  |  |
| 8 |  |  |  |  |  |  | |  |  |  |  |
| 9 |  |  |  |  |  |  | |  |  |  |  |
| 10 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  |  |  |  |
| 11 |  |  |  |  |  |  | |  | ✔ | ✔ | ✔ |
| 12 |  |  |  |  |  |  | |  |  |  |  |
| 13 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  | ✔ | ✔ | ✔ |
| 14 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  |  |  |  |
| 15 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  | ✔ | ✔ |  |
| 16 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  |  |  |  |
| 17 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  | ✔ | ✔ | ✔ |
| 18 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  | ✔ | ✔ | ✔ |
| 19 |  |  | ✔ | ✔ | ✔ |  | |  |  |  |  |
| 20 |  |  |  |  | ✔ |  | |  |  | ✔ |  |
| 21 |  |  |  |  |  |  | |  |  |  |  |
| 22 |  |  |  |  |  |  | |  |  |  |  |
| 23 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  |  |  |  |
| 24 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  | ✔ |  | ✔ |
| 25 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  | ✔ |  | ✔ |
| 26 | ✔ |  |  |  | ✔ |  | |  |  | ✔ |  |
| 27 |  |  |  |  | ✔ |  | |  |  |  |  |
| 28 |  |  |  |  |  |  | |  |  |  |  |
| 29 |  |  |  |  |  |  | |  |  |  |  |
| 30 | ✔ |  | ✔ |  | ✔ |  | |  | ✔ | ✔ |  |
| 31 |  |  | ✔ |  | ✔ |  | |  | ✔ | ✔ |  |
| 32 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  | ✔ | ✔ | ✔ |
| 33 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  | ✔ | ✔ | ✔ |
| 34 |  |  |  |  | ✔ |  | |  |  |  |  |
| 35 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  | ✔ | ✔ | ✔ |
| 36 | ✔ | ✔ | ✔ | ✔ | ✔ |  | |  | ✔ | ✔ | ✔ |
| 37 |  |  |  |  |  |  | |  |  |  |  |
| 38 |  |  |  |  |  |  | |  |  | ✔ |  |
| 39 |  |  |  |  |  |  | |  |  |  |  |
| 40 |  |  |  |  |  |  | |  |  |  |  |

**Year 3 - Honours and Masters Levels**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Core Modules | | | | |
| Learning Outcome | SHC3003 / SHC3013 | SHC3004 / SHC3014 | SHC4028 | SHC4040 | SMC4004 |
| 1 | ✔ | ✔ | ✔ | ✔ | ✔ |
| 2 |  |  | ✔ |  |  |
| 3 | ✔ | ✔ |  |  |  |
| 4 | ✔ | ✔ | ✔ |  | ✔ |
| 5 | ✔ | ✔ | ✔ | ✔ | ✔ |
| 6 |  |  |  |  |  |
| 7 | ✔ | ✔ | ✔ | ✔ | ✔ |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |
| 10 | ✔ | ✔ | ✔ | ✔ | ✔ |
| 11 |  |  |  |  |  |
| 12 |  | ✔ | ✔ | ✔ | ✔ |
| 13 | ✔ | ✔ | ✔ | ✔ | ✔ |
| 14 |  |  | ✔ |  |  |
| 15 | ✔ | ✔ | ✔ |  | ✔ |
| 16 | ✔ | ✔ | ✔ | ✔ | ✔ |
| 17 | ✔ | ✔ | ✔ |  | ✔ |
| 18 | ✔ |  | ✔ | ✔ | ✔ |
| 19 | ✔ |  |  | ✔ |  |
| 20 | ✔ | ✔ |  |  |  |
| 21 |  | ✔ |  |  | ✔ |
| 22 |  | ✔ |  |  | ✔ |
| 23 | ✔ | ✔ |  |  |  |
| 24 | ✔ | ✔ |  |  |  |
| 25 | ✔ | ✔ |  |  |  |
| 26 | ✔ | ✔ |  |  | ✔ |
| 27 | ✔ | ✔ |  |  | ✔ |
| 28 | ✔ | ✔ |  |  |  |
| 29 | ✔ | ✔ |  |  | ✔ |
| 30 | ✔ |  |  |  |  |
| 31 |  |  | ✔ | ✔ |  |
| 32 | ✔ | ✔ | ✔ | ✔ | ✔ |
| 33 | ✔ | ✔ | ✔ | ✔ | ✔ |
| 34 |  |  |  | ✔ | ✔ |
| 35 | ✔ |  | ✔ | ✔ |  |
| 36 | ✔ | ✔ | ✔ |  | ✔ |
| 37 | ✔ | ✔ | ✔ | ✔ | ✔ |
| 38 | ✔ |  |  | ✔ |  |
| 39 | ✔ | ✔ |  | ✔ |  |
| 40 | ✔ | ✔ |  |  | ✔ |

**Year 4 - Honours and Masters Levels**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Core Modules | | | |
| Learning Outcome | SMC4005 | SMC4002 | SMC4003 | SMC4018 | SHC4004 | SHC4014 | SHC4011 |  | SHC4031 | SHC4016 |
| 1 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |  |  | ✔ | ✔ |
| 2 | ✔ | ✔ | ✔ |  | ✔ | ✔ |  |  |  |  |
| 3 |  |  |  | ✔ |  |  | ✔ |  |  |  |
| 4 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |  |  | ✔ | ✔ |
| 5 |  |  |  | ✔ |  |  |  |  |  |  |
| 6 |  |  |  |  | ✔ | ✔ | ✔ |  | ✔ | ✔ |
| 7 | ✔ | ✔ | ✔ | ✔ |  |  |  |  |  |  |
| 8 |  |  |  |  |  |  |  |  |  |  |
| 9 |  |  |  |  |  |  |  |  |  |  |
| 10 | ✔ | ✔ | ✔ |  | ✔ | ✔ |  |  | ✔ | ✔ |
| 11 |  |  |  |  | ✔ | ✔ | ✔ |  | ✔ | ✔ |
| 12 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |  |  | ✔ | ✔ |
| 13 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |  | ✔ | ✔ |
| 14 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |  |  | ✔ | ✔ |
| 15 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |  | ✔ | ✔ |
| 16 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |  | ✔ | ✔ |
| 17 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |  | ✔ | ✔ |
| 18 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |  | ✔ | ✔ |
| 19 |  |  |  | ✔ |  |  |  |  |  |  |
| 20 | ✔ | ✔ | ✔ | ✔ |  |  |  |  |  |  |
| 21 |  |  |  | ✔ |  |  |  |  |  |  |
| 22 |  |  |  | ✔ |  |  |  |  |  |  |
| 23 |  |  |  | ✔ |  |  |  |  |  |  |
| 24 |  |  |  | ✔ |  |  |  |  |  |  |
| 25 |  |  |  | ✔ |  |  | ✔ |  |  |  |
| 26 |  |  |  | ✔ |  |  | ✔ |  |  |  |
| 27 |  |  |  | ✔ |  |  |  |  |  |  |
| 28 |  |  |  | ✔ |  |  |  |  |  |  |
| 29 |  |  |  | ✔ |  |  |  |  |  |  |
| 30 |  |  |  | ✔ |  |  | ✔ |  |  |  |
| 31 |  |  | ✔ |  |  |  | ✔ |  |  |  |
| 32 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |  | ✔ | ✔ |
| 33 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |  | ✔ | ✔ |
| 34 |  |  |  | ✔ |  |  |  |  |  |  |
| 35 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |  | ✔ | ✔ |
| 36 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |  | ✔ | ✔ |
| 37 | ✔ | ✔ | ✔ | ✔ |  |  |  |  |  |  |
| 38 |  |  |  | ✔ |  |  |  |  |  |  |
| 39 |  |  |  | ✔ |  |  |  |  |  |  |
| 40 |  |  |  | ✔ |  |  |  |  |  |  |

**Appendix 3** **Mapping of Learning Outcomes to Benchmark Statement**

The learning outcomes have been mapped to the Chemistry Benchmark Statement, 21st January 2007. This is the best guide currently available as it lists the learning outcomes expected for a BSc (Hons) degree together with the additional learning outcomes appropriate for an integrated master’s degree. The latter are denoted by M in the tables below.

The learning outcomes can be divided into two areas - subject knowledge and ability.

**SUBJECT KNOWLEDGE**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| LEARNING OUTCOME | | 8 | 9 | 10 | 11 | 12 | 13 |
| BENCHMARK STATEMENT |  |  |  |  |  |  |  |
| 4.2.1 |  | ✔ |  | ✔ |  |  |  |
| 4.2.2 |  | ✔ |  | ✔ |  |  |  |
| 4.2.3 |  | ✔ |  | ✔ |  |  |  |
| 4.2.4 |  | ✔ |  | ✔ |  |  |  |
| 4.2.5 |  |  | ✔ |  | ✔ | ✔ |  |
| 4.4.1 | M |  | ✔ |  | ✔ | ✔ |  |
| 4.4.2 | M |  |  |  | ✔ | ✔ |  |
| 4.4.3 | M |  |  |  | ✔ |  |  |
| 4.4.4 | M |  |  | ✔ | ✔ | ✔ |  |
| 4.4.5 | M |  |  |  |  |  | ✔ |

**CHEMISTRY-RELATED COGNITIVE ABILITIES AND SKILLS**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| LEARNING OUTCOME | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| BENCHMARK STATEMENT |  |  |  |  |  |  |  |  |  |  |
| 5.3.1 |  | ✔ |  |  |  |  |  |  |  |  |
| 5.3.2 |  |  | ✔ |  |  |  |  |  |  |  |
| 5.3.3 |  |  |  |  | ✔ |  |  |  |  |  |
| 5.3.4 |  |  |  | ✔ |  |  |  |  |  |  |
| 5.3.5 |  |  |  |  |  | ✔ |  |  |  |  |
| 5.3.6 |  |  |  |  |  |  | ✔ |  |  |  |
| 5.4.1 | M |  |  |  |  |  |  | ✔ |  |  |
| 5.4.2 | M |  |  |  |  |  |  |  | ✔ |  |
| 5.4.3 | M |  |  |  |  |  |  |  |  | ✔ |

**CHEMISTRY-RELATED PRACTICAL SKILLS**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| LEARNING OUTCOME | | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| BENCHMARK STATEMENT |  |  |  |  |  |  |  |  |
| 5.5.1 |  | ✔ |  |  |  | ✔ |  |  |
| 5.5.2 |  | ✔ |  |  |  |  |  |  |
| 5.5.3 |  |  |  | ✔ |  |  |  |  |
| 5.5.4 |  |  | ✔ |  |  |  |  |  |
| 5.5.5 |  |  |  |  | ✔ |  |  |  |
| 5.6.1 | M |  |  |  |  |  | ✔ |  |
| 5.6.2 | M |  |  |  |  |  | ✔ |  |
| 5.6.3 | M |  |  |  |  |  |  | ✔ |
| 5.6.4 | M |  |  |  |  |  |  | ✔ |

**TRANSFERABLE SKILLS**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| LEARNING OUTCOME | | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| BENCHMARK STATEMENT |  |  |  |  |  |  |  |  |  |  |  |  |
| 5.7.1 |  |  |  | ✔ |  |  |  |  |  |  |  |  |
| 5.7.2 |  |  |  |  |  |  |  | ✔ |  |  |  |  |
| 5.7.3 |  |  | ✔ |  |  |  |  |  |  |  |  |  |
| 5.7.4 |  |  |  |  |  | ✔ |  |  |  |  |  |  |
| 5.7.5 |  |  | ✔ |  |  |  |  |  |  |  |  |  |
| 5.7.6 |  | ✔ |  |  |  |  |  |  |  |  |  |  |
| 5.7.7 |  |  |  |  | ✔ |  |  |  |  |  |  |  |
| 5.7.8 |  |  |  |  |  |  | ✔ |  |  |  |  |  |
| 5.8.1 | M |  |  |  |  |  |  |  | ✔ |  |  |  |
| 5.8.2 | M |  |  |  |  |  |  |  |  | ✔ |  |  |
| 5.8.3 | M |  |  |  |  |  |  |  |  |  | ✔ |  |
| 5.8.4 | M |  |  |  |  |  |  |  |  |  |  | ✔ |
| 5.8.5 | M |  |  |  |  |  | ✔ |  |  |  |  |  |

**Appendix 4** Assessment **Strategies for Modules**

**YEAR ONE – FOUNDATION LEVEL MODULES**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Module**  **Code** | **Module**  **Title** | **Assessment Weighting** | | | **Assessment**  **Strategy** |
| **Exam** | **C/W** | |
| **practical** | **other** |
| Core Modules | | | | | |
| SFC1001 | Inorganic Chemistry 1 | 60 | 20 | 20 | 2 hr exam, lab reports, 2 tests |
| SFC1003 | Physical Chemistry 1 | 60 | 20 | 20 | 2 hr exam, lab reports, 2 tests |
| SFC1004 | Analytical Science 1 |  | 30 | 70 | lab reports and spectroscopy workshops (30%), quizzes and endo of term tests |
| SFC1002 | Organic Chemistry 1 | 60 | 20 | 20 | 2 hr exam, lab reports, 1 assignment |
| Optional Modules | | | | | |
| SFC1005 | Data Handling |  |  | 100 | maths tests (50%), computing exercise (50%) |
| SFC1006 | Techniques of Practical Chemistry |  | 100 |  | Lab reports |

**YEAR TWO – INTERMEDIATE LEVEL MODULES**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Module** | **Module Title** | **Assessment Weighting** | | | **Assessment Strategy** |
| **Code** |  | **Exam** | **C/W** | |  |
|  |  |  | **practical** | **other** |  |
| *Core Modules* | | | | | |
| SIC2001 | Inorganic Chemistry 2 | 35 | 30 | 35 | 2.5 hr exam, lab reports, test |
| SIC2002 | Organic Chemistry 2 | 60 | 25 | 15 | 2.5 hr exam, lab reports, assignment |
| SIC2003 | Physical Chemistry 2 | 60 | 40 |  | 2.5 hr exam, lab reports as coursework |
| SIC2004 | Analytical Science 2 |  | 20 | 80 | lab reports (20%), coursework (20%), 2 in-class tests (2 × 30%) |
| SIC2006 | Practical Chemistry |  | 100 |  | Lab reports |
| *Optional Modules* | | | | | |
| SIC2011 | Chemical  Engineering 1 | 60 | 40 |  | 2.5 hr exam, lab reports |
| SIG2015 | The Anthropocene |  |  | 100 | 60% c/w; 40% poster |
| SIC2021 | Biology for the Chemical and Forensic Sciences | 60 | 20 | 20 | 2.5 hr exam, lab reports, on-line quizzes |

**YEAR THREE – HONOURS & MASTERS LEVEL MODULES**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Module**  **Code** | **Module**  **Title** | **Assessment Weighting** | | | **Assessment**  **Strategy** |
| **Exam** | **C/W** | |
| **practical** | **other** |  |
| SHC3003  SHC3013 | Industrial Training\*  Laboratory Techniques# |  |  | 100 | \*Industrial and visiting supervisor assessment (70%), portfolio (30%); #Supervisor assessment (50%), portfolio (50%); |
| SHC3004  SHC3014 | Industrial Project  Investigative Project |  | 100 |  | Project (100%) |
| SHC4028 | Advanced General Chemistry |  |  | 100 | 3 assignments |
| SHC4040 | Aspects of Industrial Science |  |  | 100 | Company Review (40%), 3 Assignments (60%) |
| SMC4004 | Scientific Communication |  |  | 100 | Critique (40%), scientific paper (40%), oral (20%) |

**YEAR FOUR – HONOURS & MASTERS LEVEL MODULES**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Module**  **Code** | **Module**  **Title** | **Assessment Weighting** | | | **Assessment**  **Strategy** |
| **Exam** | **C/W** | |
| **practical** | **other** |  |
| *Core Modules* | | | | | |
| SMC4005 | Applied Organometallic & Coordination Chemistry | 45 |  | 55 | 2 hr exam, plus test 1 (10%) and Test 2 (45%) |
| SMC4002 | Targeted Synthesis of Organic Compounds | 45 |  | 55 | 2 hr exam, plus test (45%) plus continual assessment (10%) |
| SMC4003 | Materials, Surfaces and Polymers | 45 |  | 55 | 2 hr exam, plus test (45%) plus continual assessment (10%) |
| SMC4018 | Research Project |  | 15 | 85 | Practical (15%), report (50%), oral & poster presentations (10% each), assessment (15%) |
| *Optional Modules* | | | | | |
| SHC4004 | Analytical Science 3 |  |  | 100 | 2 tests at 50% each |
| SHC4011 | Chemical Engineering 2 | 75 | 25 |  | 3 hr exam, lab reports |
| SHC4037 | Sustainable Industrial Systems | 70 | 10 | 20 | 3 hr exam, lab report, coursework (15%) and on-line quizzes (5%) |
| SHC4014 | Analytical science 4 | 40 |  | 60 | 2 hr exam, test (40%) and coursework (20%) |
| SHC4031 | Molecular Targets and Drug Design | 60 |  | 40 | 3 hr exam, 5 MCQ assignments |
| SHC4016 | Chemical Therapeutics | 60 |  | 40 | 3 hr exam, 5 MCQ assignments |

# Appendix 5 - Subject benchmark statements Chemistry

# Draft for consultation January 2007

[Review of subject benchmark statements index](http://www.qaa.ac.uk/academicinfrastructure/benchmark/review06.asp)

[Chemistry benchmark statement 2000](http://www.qaa.ac.uk/academicinfrastructure/benchmark/honours/chemistry.asp)

[PDF version](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.pdf)

## Contents

* [Preface](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#preface#preface)
* [Foreword](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#foreword#foreword)
* [Introduction](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#introduction#introduction)
* [Nature and extent of subject](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#nature#nature)
* [Aims of degree programmes in chemistry](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#aims#aims)
* [Subject knowledge and understanding](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#subject#subject)
* [Abilities and skills](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#abilities#abilities)
* [Teaching, learning and assessment](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#teaching#teaching)
* [Benchmark standards](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#benchmark#benchmark)
* [Appendix 1 – Membership of the review group for the subject benchmark statement for chemistry](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#appendA#appendA)
* [Appendix 2 – Membership of the original benchmarking group for chemistry](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#AppendB#AppendB)

## Preface

Subject benchmark statements provide a means for the academic community to describe the nature and characteristics of programmes in a specific subject or subject area. They also represent general expectations about standards for the award of qualifications at a given level in terms of the attributes and capabilities that those possessing qualifications should have demonstrated.

This subject benchmark statement, together with others published concurrently, refers to the **bachelor’s degree with honours** [**[1]**](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#note1#note1). In addition, some subject benchmark statements provide guidance on integrated master’s awards.

Subject benchmark statements are used for a variety of purposes. Primarily, they are an important external source of reference for higher education institutions (HEIs) when new programmes are being designed and developed in a subject area. They provide general guidance for articulating the learning outcomes associated with the programme but are not a specification of a detailed curriculum in the subject.

Subject benchmark statements also provide support to HEIs in pursuit of internal quality assurance. They enable the learning outcomes specified for a particular programme to be reviewed and evaluated against agreed general expectations about standards. Subject benchmark statements allow for flexibility and innovation in programme design and can stimulate academic discussion and debate upon the content of new and existing programmes within an agreed overall framework. Their use in supporting programme design, delivery and review within HEIs is supportive of moves towards an emphasis on institutional responsibility for standards and quality.

Subject benchmark statements may also be of interest to prospective students and employers, seeking information about the nature and standards of awards in a given subject or subject area.

The relationship between the standards set out in this document and those produced by professional, statutory or regulatory bodies for individual disciplines will be a matter for individual HEIs to consider in detail.

This subject benchmark statement represents a revised version of the original published in 2000. The review process was overseen by the Quality Assurance Agency for Higher Education (QAA) as part of a periodic review of all subject benchmark statements published in this year. The review and subsequent revision of the subject benchmark statement was undertaken by a group of subject specialists drawn from and acting on behalf of the subject community. The revised subject benchmark statement went through a full consultation with the wider academic community and stakeholder groups.

QAA publishes and distributes this subject benchmark statement and other subject benchmark statements developed by similar subject-specific groups.

The Disability Equality Duty (DED) came into force on 4 December 2006 [[2]](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#note2#note2). The DED requires public authorities, including HEIs, to act proactively on disability equality issues. The Duty complements the individual rights focus of the *Disability Discrimination Act* (DDA) and is aimed at improving public services and outcomes for disabled people as a whole. Responsibility for making sure that such duty is met lies with HEIs.

The Disability Rights Commission (DRC) has published guidance[[3]s](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#note3#note3) to help HEIs prepare for the implementation of the Duty and provided illustrative examples on how to take the duty forward. HEIs are encouraged to read this guidance when considering their approach to engaging with components of the Academic Infrastructure[[4]](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#note4#note4), of which subject benchmark statements are a part.

Additional information that may assist HEIs when engaging with subject benchmark statements can be found in the DRC revised *Code of Practice: Post-16 Education*[[5]](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#note5#note5), and also through the Equality Challenge Unit[[6]](http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/drafts/Chemistrydraft07.asp#note6#note6) which is established to promote equality and diversity in higher education.

## Foreword

This document is a revision of the subject benchmark statement for chemistry first published by the Quality Assurance Agency for Higher Education (QAA) in 2000.

In 2005, QAA asked the Royal Society of Chemistry (RSC) to consider whether, and if so, to what extent, the subject benchmark statement for chemistry should be revised. It also asked it to consider incorporating integrated master’s degrees in accordance with UK qualifications frameworks and to take into account other relevant developments within higher education (HE) and the chemical science profession.

The review group for the subject benchmark statement for chemistry acknowledges the contribution of the original benchmarking group for chemistry in preparing its original subject benchmark statement and recognises the valuable contribution of the subject benchmark statement to chemistry HE in the UK (and beyond) during the past six years.

In revising the subject benchmark statement, the review group seeks to maintain the original intentions and purposes while giving consideration to recent developments in the discipline, HE and the profession. Studies at master’s level have been incorporated to provide one comprehensive subject benchmark statement covering not only bachelor’s degrees with honours but also all master’s degrees in chemistry, i.e. integrated master’s degrees, typically titled MChem or MSci, and standalone master’s degrees, typically titled MSc or MRes, but not studies leading to the award of MPhil.

The group adopted this approach since it considered the subject benchmark statement will more clearly illustrate not only the commonalities of degrees in chemistry but, more importantly, the distinct differences at the two levels. It also provides evident articulation to existing UK qualification frameworks and the Framework of Qualifications for the European Higher Education Area which was agreed by ministers as part of the Bologna process and which draws on the Dublin Descriptors.

Revisions to the original bachelor’s degree with honours sections of the subject benchmark statement are minor in most respects. The most significant amendment is possibly that the review group agreed to redraft the essential subject-matter components and make the subject knowledge section less specific. This is to address the continually increasing breadth of the discipline and diversity of contemporary chemistry qualifications.

## 1       Introduction

1.1       This subject benchmark statement sets out the benchmark threshold standards in chemistry. It focuses on four major aspects concerning programmes leading to bachelor’s degree with honours and master’s degree qualifications.

i The major aims and purposes that may be associated with degree programmes in chemistry.

ii An outline of subject-matter that may be expected to be covered in study programmes leading to such degree qualifications.

iii The abilities, competencies and skills to be developed in students through the study of chemistry.

iv Recommendations concerning procedures appropriate for the teaching, learning and assessment of the knowledge, abilities and skills set out above.

1.2       The subject benchmark statement is intended to provide a broad framework within which HE providers can develop purposeful and challenging chemistry programmes that respond to the needs of their students, as well as to the evolving nature of the chemistry discipline.  Its purpose is not to impose a set of rigid conditions on HE providers that would stifle innovation in programme development and in the design of learning experiences. It is hoped that the subject benchmark statement will continue to make a valuable contribution to chemistry HE and assist in the maintenance of the standard of chemistry degrees and the graduates they supply to the job market.

1.3       Details of the aims, objectives and content of individual programmes will be found in the programme specifications and/or other documentation issued by HE providers.

## 2         Nature and extent of chemistry

2.1       Chemistry can be defined as the science that studies systematically the composition, properties, and reactivity of matter at the atomic and molecular level. Since matter is everything that can be touched, seen, smelt or felt, it follows that the scope of the chemistry discipline is essentially limitless.

2.2       The subject of chemistry has been divided traditionally into three main branches; organic chemistry – the chemistry of (most) substances containing the element carbon; inorganic chemistry – the chemistry of all other substances; and physical chemistry – the application of concepts and laws to chemical phenomena. Analytical chemistry, which is concerned with the identification of materials and the determination of composition, has become accepted generally as a fourth branch. The nature of chemistry is such that there are no distinct boundaries between the branches of the discipline or indeed with other disciplines.

2.3       Historically, bachelor’s degrees with honours in chemistry were developed to encompass all the main branches with a consequent emphasis on breadth of study as well as depth. While a breadth of understanding remains relevant, modern chemistry is less likely to be categorised strictly in branches and, in reflecting this, degree programmes are designed increasingly to include topics that overlap traditional branches and address the interfaces of chemistry with other disciplines, such as chemical biology and chemical physics, and with applied fields, such as environmental chemistry and materials chemistry.

2.4       Broadly based degrees, commonly titled chemistry, remain relevant to the contemporary employment needs of the chemical science profession. Many HE providers now also award chemistry degrees with titles denoting a specialism, e.g. medicinal chemistry, analytical chemistry, environmental chemistry. These courses tend to attract students with more definite career aspirations.  It is accepted that the extent of breadth of study and the depth to which individual topics are treated will vary with the nature of specific chemistry programmes.  It is, however, critical for employers of chemists that specialist learning objectives in terms of chemistry reflect the degree title.

## 3       Aims of degree programmes in chemistry

3.1       Degree programmes in chemistry should:

* instill in students an enthusiasm for chemistry, an appreciation of its application in different contexts and to involve them in an intellectually stimulating and satisfying experience of learning and studying
* establish in students an appreciation of the importance and sustainability of the chemical sciences in an industrial, academic, economic, environmental and social context
* develop in students, through an education in chemistry, a range of appropriate generic skills, of value in chemical and non-chemical employment.

3.2**Bachelor’s** degree with honours programmes in chemistry should:

* provide students with a broad and balanced appreciation of key chemical concepts
* develop in students a range of practical skills so that they can understand and assess risks and work safely in the laboratory
* develop in students the ability to apply standard methodology to the solution of problems in chemistry
* provide students with a knowledge and skills base from which they can proceed to further studies in chemistry or multidisciplinary areas involving chemistry.

3.3**Master’s** degree programmes in chemistry should:

* extend students’ comprehension of key chemical concepts and so provide them with an in-depth understanding of specialised areas of chemistry
* provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes
* develop in students the ability to adapt and apply methodology to the solution of unfamiliar types of problems
* instill a critical awareness of advances at the forefront of the chemical science discipline
* prepare students effectively for professional employment or doctoral studies in the chemical sciences.

3.4       Integrated master’s degree programmes (e.g. MChem, MSci) should encompass both honours and master’s level aims. Master’s degree programmes (e.g. MSc, MRes) should ensure, through admissions processes or additional study, that the honours level aims have been covered.

## 4       Subject knowledge and understanding

4.1       Each HE provider awarding qualifications in chemistry is free to decide on the content, nature and organisation of its courses or modules and thus chemistry programmes offered by individual HE providers will have their own particular characteristics.  Articulation of learning outcomes in chemistry to relevant sections of *The framework for higher education qualifications in England, Wales and Northern Ireland* is considered key.

4.2       Bachelor’s degrees with honours programmes ensure that students

* are fully conversant with major aspects of chemical terminology
* demonstrate a systematic understanding of fundamental physicochemical principles with the ability to apply that knowledge to the solution of theoretical and practical problems
* gain knowledge of a range of inorganic and organic materials
* can evidence their understanding of general synthetic pathways, including related isolation, purification and characterisation techniques
* develop an awareness of issues within chemistry that overlap with other related disciplines.

4.3       A systematic and broad understanding of key chemical concepts will be assumed prior to undertaking master’s level study. Master’s level students will develop an in-depth knowledge and critical awareness of a substantial area of chemistry and be suitably prepared for contemporary professional practice in the chemical sciences or for studying further at doctoral level.

4.4       While recognising master’s degrees can cover a very wide range of chemistry areas, the desirable characteristics of a degree programme in terms of activities to be undertaken by the student are given below.

### Research training

* Project specific experimental skills.
* Accessing literature.
* Planning, including evaluation of hazards and environmental effects.
* Making oral presentations, writing reports, including critical evaluation.
* Participating in colloquia.

### Research project

* Implementation of planned experiments.
* Recording of data and their critical analysis.
* Dissertation.
* Outcome potentially publishable.

### Advanced studies

* In area of specialism to support research topic.
* Complementary studies outside, but cognate to, area of specialism.

### Problem solving

* Development of general strategies including the identification of additional information required and problems where there is not a unique solution.
* Application of advanced studies to the solution of problems.

### Professional studies

* Ethics and societal responsibilities.
* Environmental impact.
* Sustainability.

4.4       The proportion of each activity will vary depending upon the programme’s learning objectives. However, research studies (training and project) are likely to form at least one half of the master’s level studies.

## 5       Abilities and skills

5.1       Students studying for chemistry degree qualifications are expected to develop a wide range of different abilities and skills. These may be divided into three broad categories:

i chemistry-related cognitive abilities and skills, i.e. abilities and skills relating to intellectual tasks, including problem solving

ii chemistry-related practical skills, e.g. skills relating to the conduct of laboratory work

iii generic skills that may be developed in the context of chemistry and are of a general nature and applicable in many other contexts.

5.2       The main abilities and skills that students are expected to have developed by the end of their programme in chemistry are as follows.

### Chemistry-related cognitive abilities and skills

5.3       For **bachelor’s degree with honours** qualifications, students should develop:

* the ability to demonstrate knowledge and understanding of essential facts, concepts, principles and theories relating to the subject areas identified above.
* the ability to apply such knowledge and understanding to the solution of qualitative and quantitative problems of a familiar nature
* the ability to recognise and analyse problems and plan strategies for their solution
* skills in the evaluation, interpretation and synthesis of chemical information and data
* skills in communicating scientific material and arguments
* information technology (IT) and data-processing skills, relating to chemical information and data.

5.4       Additionally for **master’s** degree qualifications, students should develop:

* the ability to adapt and apply methodology to the solution of unfamiliar problems
* the ability to assimilate, evaluate and present research results objectively
* skills required to undertake a research project the outcome of which is of a quality that is potentially publishable.

### Chemistry-related practical skills

5.5       For **bachelor’s degree with honours** qualifications, students should develop:

* skills in the safe handling of chemical materials, taking into account their physical and chemical properties, including any specific hazards associated with their use and the ability to conduct risk assessments
* skills required for the conduct of documented laboratory procedures involved in synthetic and analytical work, in relation to both inorganic and organic systems
* skills in the monitoring, by observation and measurement, of chemical properties, events or changes, and the systematic and reliable recording and documentation thereof
* skills in the operation of standard chemical instrumentation
* the ability to interpret and explain the limits of accuracy of their own experimental data in terms of significance and underlying theory.

5.6       Additionally for **master’s** degree qualifications, students should develop:

* the ability to select appropriate techniques and procedures
* competence in the planning, design and execution of experiments
* skills required to work independently and be self critical in the evaluation of risks, experimental procedures and outcomes
* the ability to use an understanding of the limits of accuracy of experimental data to inform the planning of future work.

### Generic skills

5.7       For **bachelor’s degree with honours** qualifications, students should develop:

* communication skills, covering both written and oral communication
* problem-solving skills, relating to qualitative and quantitative information
* numeracy and mathematical skills, including such aspects as error analysis, order-of-magnitude estimations, correct use of units and modes of data presentation
* information-retrieval skills, in relation to primary and secondary information sources, including information retrieval through online computer searches
* IT skills
* interpersonal skills, relating to the ability to interact with other people and to engage in team working
* time management and organisational skills, as evidenced by the ability to plan and implement efficient and effective modes of working
* skills needed to undertake appropriate further training of a professional nature.

5.8       Additionally for **master’s** degree qualifications, students should develop:

* problem-solving skills; demonstrate self-direction and originality
* the ability to communicate and interact with professionals from other disciplines
* exercise initiative and personal responsibility
* decision-making skills in complex and unpredictable situations
* independent learning ability required for continuing professional development.

## 6       Teaching, learning and assessment

6.1       Teaching and learning strategies should be designed fundamentally to provide students with the necessary subject knowledge, understanding, abilities and skills for the chemical science profession.

6.2       HE providers should use a variety of teaching methods to ensure that students remain engaged, motivated and challenged to learn. Chemistry as a subject for learning is amenable to the full range of teaching methodologies, whether well established or innovative. Despite this, the chemical science profession requires graduates who are safe and competent practical workers and so it is crucial that there is a substantial laboratory based practical component. Teaching methods must ultimately be valid, effective and meet the stated learning objectives.

6.3       It is essential that the procedures used for the assessment of students' achievement in chemistry correspond to the knowledge, abilities and skills that are to be developed through their degree programme.

6.4       Evidence on which the assessment of student achievement is based should include:

* formal examinations, including a significant proportion of 'unseen' examinations
* laboratory reports and skills
* problem-solving exercises
* oral presentations
* planning, conduct and reporting of project work.

6.5       Additional evidence of use for the assessment of student achievement may include:

* essay assignments
* portfolios on chemical activities undertaken
* literature surveys and evaluations
* collaborative project work
* preparation and displays of 'posters' reporting project work
* reports on external placements (where appropriate).

6.6       At the master’s level, there will be a strong emphasis towards requiring students to apply their knowledge of chemistry to the solution of unfamiliar problems. Assessment of the research project, based upon much of the evidence listed above, will be crucial in determining whether master’s level learning outcomes have been achieved.

## 7       Benchmark standards

7.1       All students graduating with a degree qualification in chemistry are expected to demonstrate that they have acquired the knowledge, abilities and skills in the areas identified in the foregoing sections.

7.2       The following statements describe generally the **threshold** level of competence for holders of a bachelor’s degree with honours in chemistry.

* A basic knowledge and understanding of the content covered in the course is evident.
* Problems of a routine nature are generally adequately solved.
* Standard laboratory experiments can be carried out safely and with reasonable success though the significance and limitations of experimental data and/or observations may not be fully recognised.
* Generic skills have been developed to a basic level.

7.3       The following statements describe the **typical** level of competence for holders of a bachelors degree with honours in chemistry.

* Knowledge base covers essential aspects of subject matter dealt with in the programme and shows some evidence of enquiry beyond this. Conceptual understanding is good.
* Problems of a familiar nature are solved in a logical manner; solutions are generally correct or acceptable.
* Experimental work is carried out in a reliable and efficient manner.
* Performance in generic skills is sound and shows no significant deficiencies.

7.4       This level should apply to the majority of graduates who consequently will possess the potential to progress to a master degree programme in chemistry.

7.5       The following statements describe generally the **threshold** level of competence for holders of a master’s qualification in chemistry.

* Knowledge base extends to a systematic understanding and critical awareness of topics which are informed by the forefront of the discipline.
* Problems of an unfamiliar nature are tackled with appropriate methodology and taking into account the possible absence of complete data.
* Experimental work is carried out independently and with some originality.
* Substantial research project at the forefront of the discipline is completed effectively.
* Generic skills are developed appropriately for professional practice.

## Appendix 1 - Membership of the review group for the subject benchmark statement for chemistry

Professor D Phillips (Chair) - Imperial College London

Dr A D Ashmore - Royal Society of Chemistry

Dr D W Barr (Secretary) - Royal Society of Chemistry

Dr P R Davies - Cardiff University

Professor R F W Jackson - University of Sheffield

Professor J Leonard - AstraZeneca plc

Professor D Littlejohn - University of Strathclyde

Dr G Nicholson - AWE plc

Professor F L Pearce - University College London

Professor C C Perry - Nottingham Trent University

Dr G J Price - University of Bath

Professor N V Richardson - University of St Andrews

## ****Appendix 2 - Membership of the original benchmarking group for chemistry****

Details below appear as published in the original subject benchmark statement for chemistry (2000).

Professor E W Abel (Chair) - University of Exeter

Professor P W Atkins - University of Oxford

Professor L I B Haines - University of North London

Professor R C F Jones - Open University

Dr S J Gruber (Secretary) - Royal Society of Chemistry

Professor R F Kempa - University of Keele

Professor M I Page - University of Huddersfield

Professor B J Parsons - North East Wales Institute

Professor D Phillips - Imperial College London

Professor D A Rice - University of Reading

Professor K Smith - University of Wales, Swansea

Professor A Townshend  - University of Hull

Professor P Tasker

Professor J M Winfield - University of Glasgow

[1] This is equivalent to the honours degree in the Scottish Credit and Qualifications Framework (level 10) and in the Credit and Qualifications Framework for Wales (level 6).

[2] In England, Scotland and Wales

[3] Copies of the guidance *Further and higher education institutions and the Disability Equality Duty*, guidance for principals, vice-chancellors, governing boards and senior managers working in further education colleges and HEIs in England, Scotland and Wales, may be obtained from the DRC at www.drc-gb.org/library/publications/disabilty\_equality\_duty/further\_and\_higher\_education.aspx

[4] An explanation of the Academic Infrastructure, and the roles of subject benchmark statements within it, is available at www.qaa.ac.uk/academicinfrastructure

[5] Copies of the DRB revised *Code of Practice: Post-16 Education* may be obtained from the DRC at www.drc-gb.org/employers\_and\_service\_provider/education/higher\_education.aspx

[6] Equality Challenge Unit, www.ecu.ac.uk