UNIVERSITY OF LINCOLN

Programme Specification

Title:

Chemistry

Final Award: **Bachelor of Science with Honours (BSc (Hons))**

With Exit Awards at:
Certificate of Higher Education (CertHE)
Diploma of Higher Education (DipHE)
Bachelor of Science with Honours (BSc (Hons))

To be delivered from: 1 Sep 2014

Level	Date
Level 1 or Certificate of Higher Education (CertHE)	2019-20
Level 2 or Diploma of Higher Education (DipHE)	2020-21
Level 3 or Bachelor of Science with Honours (BSc (Hons))	2021-22

Table Of Contents

1. Introduction

This document describes one of the University of Lincoln's programmes using the protocols required by the UK National Qualifications Framework as defined in the publication *QAA guidelines for preparing programme specifications*.

This programme operates under the policy and regulatory frameworks of the University of Lincoln.

2. Basic Programme Data

Final Award:	Bachelor of Science with Honours (BSc (Hons))
Programme Title:	Chemistry
Exit Awards and Titles	Certificate of Higher Education (CertHE) Diploma of Higher Education (DipHE) Bachelor of Science with Honours (BSc (Hons))
Subject(s)	Chemistry
Mode(s) of delivery	Full Time Part Time
Is there a Placement or Exchange?	
UCAS code	F100
Awarding Body	University of Lincoln
Campus(es)	Lincoln Campus
School(s)	School of Chemistry
Programme Leader	Tasnim Munshi (TMunshi)
Relevant Subject Benchmark Statements	
Professional, Statutory or Regulatory Body Accreditation	
Programme Start Date	2019-20

3. Programme Description

3.1 Overview

Chemistry is defined as the science that studies systematically the composition, properties, and reactivity of matter at the atomic and molecular level.
Chemistry has been divided traditionally into three main branches: organic chemistry - the chemistry of (most) substances based on carbon; inorganic chemistry - the chemistry of all other substances; and physical chemistry - the application of concepts and laws to chemical phenomena. Analytical chemistry, addressing the identification and composition of substances is generally described as a fourth branch. However, it is the nature of modern chemistry that there are no distinct boundaries between the branches of the discipline or indeed with other disciplines.
The chemistry curriculum at Lincoln has been devised to integrate the main sub-disciplines of chemistry effectively, relating physical chemistry concepts to aspects of organic and inorganic chemistry, and to the methods used for analyzing substances. In these programmes, a comprehensive knowledge of chemistry is augmented with subject-specific and generic skills (particularly in practical chemistry) to develop a strong understanding of how chemistry is applied to problems with direct impact on society. In this way, the chemistry education at Lincoln is designed to produce highly employable graduates with a broad background in academic chemistry and significant experience of the application of chemistry in contexts relevant to society and industry.

3.2 Aims and Objectives

General Aims:
• To provide a stimulating and supportive learning environment that inspires students in the study of chemistry and instills within them an enthusiasm for study of the chemical sciences;
• To enable the development of a broad appreciation of the importance of chemistry in a variety of application contexts: academic, industrial, economic, environmental and social and its role in establishing a sustainable society;
• To develop a range of skills relating to professional practice in chemistry that are relevant both to chemistry and other graduate-level employment

Main aims
• To provide students with a broad appreciation of key chemical concepts and the interrelationship between traditional discipline areas in chemistry;
• To develop a skill set that enables the implementation of sound professional practice in chemistry that ensures safe operation in chemical laboratory environments based on effective risk assessment;
• To provide students with a range of experiences that enable the effective application of defined methodologies to appropriate standards;
• To provide students with knowledge of the application of chemistry in key sectors including an awareness of the importance of regulatory compliance;
• To instill a broad range of knowledge and skills required for graduate-level employment or as a base for advanced level study in chemistry and the chemical sciences.

3.3 Variations to Standard Regulations and Guidance

none

4. Programme Outcomes

Programme-level learning outcomes are identified below.

Refer to *Appendix I – Curriculum Map* for details of how outcomes are deployed across the programme.

4.1 Knowledge and Understanding

On successful completion of this programme a student will have knowledge and understanding of:

1 Chemical terminology, nomenclature, conventions and units
2 Fundamental physicochemical principles
3 Molecular and bulk properties of a range of inorganic, organic and bio-molecular materials
4 The synthesis of inorganic, organic and bio-molecular compounds including related isolation, purification and characterisation techniques
5 Principles and procedures used in chemical analysis for characterisation and quantitation
6 Industrial, economic, social and environmental contexts that demonstrate the importance of chemistry and the interface with other disciplines in tackling future challenges in these contexts

4.2 Subject Specific Intellectual Skills

On successful completion of this programme a student will be able to:

7 Demonstrate knowledge and understanding of essential facts, concepts, principles and theories
8 Solve qualitative and quantitative problems
9 Recognise and analyse problems and plan strategies for their solution
10 Evaluate, interpret and synthesise chemical information and data from a variety of sources
11 Use models, computational chemistry and data-processing relating to chemical information and data
12 Communicate scientific material and arguments in a variety of forms

4.3 Subject Specific Practical Skills

On successful completion of this programme a student will be able to:

13 Handle chemical materials safely, taking into account their physical and chemical properties including any specific hazards associated with their use and conduct risk assessments
14 Carry out documented laboratory procedures and standard operating procedures involved in synthetic and analytical work, in relation to both inorganic and organic systems
15 Monitor, record and document observations and measurements of chemical properties, events or change
16 Operate standard chemical instrumentation

17 Interpret and explain the limits of accuracy of experimental data in terms of significance and underlying theory

18 Recognise the professional, moral and ethical standards required for experimental work

4.4 Transferable Skills and Attributes

On successful completion of this programme a student will be able to:

19 Communicate chemistry to a variety of audiences using a range of formats including written and oral

20 solve qualitative and quantitative problems

21 Apply numeracy and mathematics, including error analysis, order-of-magnitude estimations, correct use of units and modes of data presentation

22 Use information retrieval, in relation to primary and secondary information sources, including online computer searches

23 Use a range of IT hardware and software for a variety of chemistry-specific and generic applications

24 Interact with other people and work as a member of a team, recognising and respecting the views, opinions and roles of other members of the team

25 Demonstrate time management and organisational skills, as evidenced by the ability to plan and implement efficient and effective modes of working

For details of each module contributing to the programme, please consult the module specification document.

5. Learning, Teaching and Assessment Strategies

5.1. Learning and Teaching Strategy

An Integrated Curriculum

We have chosen to interpret the presentation of the breadth of chemistry using an integrated approach that retains a clear delineation of traditional sub-disciplines. The teaching and learning strategy adopted within BSc Chemistry derives from the programme outcomes and is based upon an integration of the curriculum through five main components: Core and Extension Chemistry modules, Practical modules, Professional Practice modules and Project modules.

1. Core and Extension Modules

• The theoretical concepts of the main disciplines of chemistry (inorganic, organic and physical) are taught together in Core Chemistry modules based on a ‘spine’ of physical chemistry concepts. The physical chemistry key themes of: systems at equilibrium, systems under change, and the structure and bonding of systems are developed at each stage. The themes are contextualized with relevant organic and inorganic conceptual topics and these are exemplified to, respectively, build an organic chemistry reaction toolkit and, assemble a comprehensive survey of the chemistry of the elements. Together these modules provide the depth and breadth of core chemistry required for study of chemistry at this level.

• Selected aspects of advanced (pure) chemistry are presented through Extension Chemistry modules facilitating focus on key topics that are potentially of less relevance in applied areas. In this way, the core chemistry can be effectively integrated with combined programmes (e.g. Forensic Chemistry).

• The ‘Core Chemistry’ and ‘Extension Chemistry’ modules use lectures as the primary vehicle to deliver content. Student development is facilitated by interactive enquiry-based tasks and, in this context, emphasis is placed upon application of knowledge to solve problems. Seminars are used to support problem solving activities and provide opportunity for students to experience different learning techniques such as peer tutoring and collaborative learning. On moving from level 1 to 3, a systematic progression is established with both increasing subject depth and in the challenge from problems requiring adaptation of methods and extended strategies for their solution.

2. Practical Chemistry Modules

• Practical skills and associated data interpretation capabilities are developed in Practical Chemistry modules linked to professional practice. Practicals are explicitly linked to core chemistry programmes and the use of brief/debrief sessions around each laboratory class helps contextualize studies. Key skills in analytical and structural methods (e.g. chromatography, NMR, mass spectrometry, X-Ray crystallography) are developed in parallel using integrated lectures and workshops that focus on the development of skills for robust experimental design and interpretation of experimental data.

• Practical skills are developed at the bench in professional laboratory settings. Strong emphasis on gaining competence in techniques and with appropriate documentation of activities inline with industry practice. Routine and regular use of industry standard equipment and software support characterization of products and generation of reports. There is progression in the nature and demand of tasks and the style of teaching moving through the programme levels. Level 1 is concerned with developing confidence in manipulation of equipment and providing training in basic

skills and techniques. Level 2 introduces more complex procedures and more sophisticated interpretation is required. Skills are further developed at level 3 but students are expected to work with increasing independence. There is a transition from fully documented procedures and laboratory exercises to investigative style tasks where students are involved in experimental design, planning, preparation and execution. Extensive use is made of pre- and post-laboratory briefing sessions that link the learning experience to theoretical contexts. Student participation and increasing leadership of these meetings is expected as student autonomy and expertise increase.

3. Professional Practice modules

• Professional skills, employability and awareness of requirements for application of chemistry in commercial contexts are developed in Professional Practice modules. These include systematic development of transferable skills (including maths for chemistry) alongside industry briefings and training in the context of regulatory practice. These modules develop from a focus on generic industry activities (e.g. QC/analytical, Formulation) towards key employment sectors (e.g. Pharmaceuticals, Energy and Environment). A key aspect of the module at each level is the Team Challenge ‘mini-projects’ requiring students to plan and execute a project in response to industry-defined technical challenge.

• Professional Practice modules are delivered through a combination of lectures, seminars and IT workshops. The teaching sessions will be predominantly interactive and involve Team Based Learning (TBL). TBL provides a supportive peer learning environment and students will be profiled for assignment to groups with complimentary skills and attributes. Sessions will be conducted using a Readiness Assurance Process involving three phases: (i) guided study, (ii) readiness assessment and (iii) application phase. Application phases will vary from structured problem solving (e.g. chemistry or maths tutorials) to mini-projects from an industry brief. The module will be linked to the RSC undergraduate skills record as a framework for auditing skills development, to the School’s personal tutoring system and to the RSC’s Discover Maths for Chemistry web resources.

4. Extended Projects

• Independent research and professional experience is undertaken through Research Projects. These activities build from group projects undertaken in Practical and Professional Practice but are introduced at an individual level at level 3 through the structured Research Project. This encourages students to draw together their experience and plan and execute a significant study with the support of the research teams at the University.

5. Student as Producer Principles

• The programme fully embraces the principles of Student as Producer. Problem solving is core to the teaching, learning and assessment strategy. Students will encounter a variety of problem types including those of a familiar and unfamiliar nature and open-ended problems. Problem solving is seen as an active method of learning the core chemistry material and all core chemistry modules will have a programme of seminars specifically for problem solving and the development of problem solving skills. These provide opportunity for students to work individually or in groups and for peer collaboration and tutoring. Seminars will include student-led sessions with the tutor taking more of a facilitator role. Core chemistry module examinations will assess problem solving learning outcomes. Professional practice will provide students with open-ended ‘industry informed’ real life problems. These will be worked upon in small groups and teams with both tutor and industrial support. Outputs

will consist of reports and presentations to industrial panels.

• Modules at level 3 are informed by academic staff research. Lectures will include personal research activities and papers will be used as part of the teaching material for modules. Some practicals will be designed to have an investigatory approach to allow students to work as a ‘researcher’ while carrying out experimental work. Team work on these tasks will be encouraged along with independent work to reflect the variety of environments likely to be encountered by chemistry graduates in employment. Project based learning plays a significant role at level 3. Students will carry out independent research projects within the research groups of academic staff or, if on external placement, within industrial research teams. Students will be involved in the planning and design of the project and will present their findings using a range of formats thus providing a full experience of working as a researcher.

• Technology will be at the forefront of the student experience. Blackboard will be used to provide module information and teaching material and to engage with students through discussion groups and on-line teaching activities. The teaching team has previously utilized funds to work with students to produce videos that support learning across a range of chemical science topics. Similar funding has also been used to develop on-line support for practical activities and JISC funding was used to produce a series of radio programmes and to create open access to level 1 chemistry teaching material. Computational chemistry will use a range of software packages and databases will be extensively used.

• The learning environment for chemistry is excellent. Modern, well equipped teaching laboratories are housed in the science building. A significant proportion of time is spent within the laboratory and students gain hands-on experience of a range of chemical equipment and chemical analysis instruments. Large laboratories have demonstration facilities with A/V systems so that students can be instructed without having to leave their work stations. Organisation of laboratory classes will ensure that demonstrators are available to support small groups of students. Research laboratory and equipment facilities in the new Joseph Banks Laboratories will be available for project work.

• Learning is supported by a core pack of textbooks covering inorganic, organic and physical chemistry. A range of other supporting texts and journals are available through the library. Students have a library induction in induction week provided by the chemistry librarian. The library also provides a range of workshops to support learning skills and these are made available to all students.

• A number of mechanisms are used to obtain student views about their learning. Subject committees are an important forum for obtaining feedback through elected student reps however reps are encouraged to work closely with programme teams throughout the academic year to ensure that issues are resolved in a timely manner. Other mechanisms for obtaining feedback include meetings with academic tutors, student meetings with external examiners, module evaluation forms and discussion groups.

• Employability is an integral part of the curriculum. Professional practice provides a vehicle for students to engage and experience a variety of chemical science commercial sectors. Professional practice also deals with the practical aspects of skill profiling, personal development and job applications. These sessions will be delivered with the chemistry careers and employability adviser. Summer placements both external and on-campus are encouraged and support is provided to help

students obtain suitable placements and to apply for sources of funding.

5.2. Assessment Strategy

A variety of assessment methods are used that enable students to demonstrate attainment of the programme learning outcomes. Methods include:

• Unseen examinations
• Laboratory and professional reports
• Problem-solving exercises
• Presentations (oral, poster, individual, group)
• Project work (individual, group)
• Literature review
• Personal development portfolios (including RSC Skills and Personal and Professional Blogs)

Assessment is a fundamental component of the teaching and learning process and is used to enable the student to confirm their achievement of learning outcomes. It is seen, therefore, as having two functions – formative and summative. Formative assessment is primarily delivered in small group seminars, laboratory or team-based settings relating to continuous assessment of problem-solving activities or practical and project work including proposals and experimental design. Formative feedback forms the basis for routine structured feedback to students. Summative assessment is derived from examinations, and written assignments and dissertations as final module assessments. Summative feedback also provides a vehicle for student feedback, either through discussion of individual pieces or as part of overall performance profiling within personal academic tutoring.

• Knowledge and understanding. Summative assessment of knowledge and understanding is achieved through traditional-style examinations that are used at each Stage of the course and are, almost exclusively, composed from unseen problems. These are taken at the end of each semester and are the main assessment vehicle for the Core and Extension Chemistry modules. At Level 1, confirmation breadth of learning is the main objective and so examinations consist mainly of short structured questions. At Level 2, greater depth of analysis and understanding is expected and so examinations include combination of short and long answer questions and introduce problem-based components. At Levels 3, the formal examination is focussed on assessment of an individual’s breadth and depth of specialist knowledge and additionally probes ability to apply and adapt methods to unfamiliar problems. Examination tends therefore to focus on analysis and interpretation in problem-based contexts. Some use is made of primary scientific literature, assessing abilities to engage with, and critically evaluate research level material.

• Subject specific intellectual skills. Analysis of information and problem solving is assessed through a range of methods – primarily problem-solving exercises in continuous assessment and unseen examinations. Problem-solving activities on the Core and Extension concepts are assessed continuously through a programme of seminars and tutorials and these comprise a primary vehicle for student feedback and reflection. Group work activities in Professional Practice and in Practical Chemistry mini-projects also incorporate problem-solving activities – generally focused towards method selection and project design. By their nature, problems in these contexts are open-ended and contribute to the development and assessment of research and transferable skills.

• Subject specific practical skills. The range of skills developed in practical work requires a variety of assessment types. Student portfolios are used to audit the acquisition of manipulative and practical skills including at-bench evaluation and competency tests. These tests are used for on-going in-class feedback and additionally function as qualification training for independent use of instrumentation. Competence in data acquisition, recording and analysis is assessed through inspection of laboratory records and through structured report sheets contributing to student portfolios for final assessment. Familiarity with a range of formal reporting methods is assessed through formally submitted reports

and these allow interrogation of abilities to contextualise laboratory studies, interpret and validate experimental results, and draw conclusions from experimental data. Formal reports form the basis for summative assessment in Practical Chemistry modules.
• Research skills are assessed through individual research projects (at Stage 3) and group work in mini-projects in Practical chemistry and Professional Practice modules. These include project planning through a portfolio of tasks, execution of the planned work that is assessed continuously by the project supervisor and through the written report, analysis and interpretation of results that are assessed by the written report and individual or group presentation.
• Presentation and written communication skills are assessed at all levels. Written skills are assessed using a range of written tasks that include laboratory reports, scientific articles, job application, literature review, dissertation, professional report. Competence is developed through feedback through the programme Levels with the expectation that students will produce written outputs corresponding with recognised professional practice. These are many-fold but include presentation, structure and quality of writing that would satisfy the criteria for publication. Oral presentations are assessed formatively in group-working and seminar contexts. These include both individual and group presentations. Summative assessment of presentation skills is through group and individual presentations. Peer assessment of presentation skills is additionally used for informal feedback.

6. Programme Structure

The total number of credit points required for the achievement of Certificate of Higher Education (CertHE) is 120.
The total number of credit points required for the achievement of Diploma of Higher Education (DipHE) is 240.
The total number of credit points required for the achievement of Bachelor of Science with Honours (BSc (Hons)) is 360.

Level 1

Title	Credit Rating	Core / Optional
Practical Chemistry 1.1: Fundamental laboratory techniques 2019-20	15	Core
Introduction to Professional Practice 2019-20	15	Core
Practical Chemistry 1.2: Introduction to synthetic methodologies and molecular characterisation 2019-20	15	Core
Professional Practice 1: Analytical Sciences 2019-20	15	Core
Core Chemistry 1.1: Introduction to Energy, Change and Electronic Structure 2019-20	30	Core
Core Chemistry 1.2: Molecular Structure, Bonding and Mechanism 2019-20	15	Core
Chemistry Extension 1: Electronic Structure, Spectroscopy and Reactivity in p-Block Compounds 2019-20	15	Core

Level 2

Title	Credit Rating	Core / Optional
Professional Practice 2.1: Formulation Sciences 2020-21	15	Core
Professional Practice 2.2: Pharmaceutical Sciences 2020-21	15	Core
Practical Chemistry 2.1: Organic synthesis, purification and advanced characterisation 2020-21	15	Core
Practical Chemistry 2.2: Inorganic synthesis and structural methods 2020-21	15	Core
Core Chemistry 2.1: Stability, Structure and Mechanism in Molecular Systems 2020-21	30	Core
Core Chemistry 2.2: Chemistry of Activated Systems and Radicals 2020-21	15	Core
Chemistry Extension 2: Electronic Structure, Spectroscopy and Reactivity in d- and f-Block Compounds 2020-21	15	Core

Level 3

Title	Credit Rating	Core / Optional
Structured project 2021-22	30	Core
Professional Practice 3: Energy & Environmental Sciences 2021-22	15	Core
Practical Chemistry 3.1: Advanced techniques in IO-chemistry 2021-22	15	Core
Core Chemistry 3.1: Defining Shape, Symmetry and Stereochemistry 2021-22	30	Core
Core Chemistry 3.2: Heterogeneous Systems, Surfaces and	15	Core

Nanoscience 2021-22		
Biological Chemistry 2021-22	15	Optional
Drugs of Abuse 2021-22	15	Optional
Global Security: Nuclear Forensics and Bioterrorism 2021-22	15	Optional

Appendix I - Curriculum Map

This table indicates which modules assume responsibility for delivering and ordering particular programme learning outcomes.

Key: ✓ Delivered and Assessed Delivered ✓ Assessed

Level 1

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Chemistry Extension 1: Electronic Structure, Spectroscopy and Reactivity in p-Block Compounds 2019-20	✓	✓	✓			✓	✓		✓			✓
Core Chemistry 1.1: Introduction to Energy, Change and Electronic Structure 2019-20	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Core Chemistry 1.2: Molecular Structure, Bonding and Mechanism 2019-20	✓	✓	✓	✓	✓		✓	✓				
Introduction to Professional Practice 2019-20	✓						✓	✓			✓	✓
Practical Chemistry 1.1: Fundamental laboratory techniques 2019-20	✓	✓	✓		✓		✓	✓				
Practical Chemistry 1.2: Introduction to synthetic methodologies and molecular characterisation 2019-20	✓	✓	✓	✓	✓		✓	✓				✓
Professional Practice 1: Analytical Sciences 2019-20							✓	✓		✓		✓

	PO13	PO14	PO15	PO16	PO17	PO18	PO19	PO20	PO21	PO22	PO23	PO24
Chemistry Extension 1: Electronic Structure, Spectroscopy and Reactivity in p-Block Compounds 2019-20							✓	✓				
Core Chemistry 1.1: Introduction to Energy, Change and Electronic Structure 2019-20							✓	✓	✓			
Core Chemistry 1.2: Molecular Structure,								✓	✓			

Bonding and Mechanism 2019-20												
Introduction to Professional Practice 2019-20							✓	✓	✓		✓	✓
Practical Chemistry 1.1: Fundamental laboratory techniques 2019-20	✓	✓	✓		✓			✓	✓			
Practical Chemistry 1.2: Introduction to synthetic methodologies and molecular characterisation 2019-20	✓	✓	✓	✓	✓		✓	✓	✓			
Professional Practice 1: Analytical Sciences 2019-20					✓		✓	✓	✓	✓		

	PO25
Chemistry Extension 1: Electronic Structure, Spectroscopy and Reactivity in p-Block Compounds 2019-20	
Core Chemistry 1.1: Introduction to Energy, Change and Electronic Structure 2019-20	
Core Chemistry 1.2: Molecular Structure, Bonding and Mechanism 2019-20	
Introduction to Professional Practice 2019-20	
Practical Chemistry 1.1: Fundamental laboratory techniques 2019-20	
Practical Chemistry 1.2: Introduction to synthetic methodologies and molecular characterisation 2019-20	
Professional Practice 1: Analytical Sciences 2019-20	

Level 2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Chemistry Extension 2: Electronic Structure, Spectroscopy and Reactivity in d- and f-Block Compounds 2020-21	✓	✓	✓	✓	✓	✓	✓		✓			✓
Core Chemistry 2.1: Stability, Structure and Mechanism in Molecular Systems 2020-21	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Core Chemistry 2.2: Chemistry of Activated Systems and Radicals 2020-21	✓	✓	✓	✓			✓	✓	✓	✓		
Practical Chemistry 2.1: Organic synthesis, purification and advanced characterisation				✓	✓			✓	✓	✓		✓

2020-21												
Practical Chemistry 2.2: Inorganic synthesis and structural methods 2020-21	✓	✓		✓				✓	✓	✓		✓
Professional Practice 2.1: Formulation Sciences 2020-21						✓		✓		✓	✓	✓
Professional Practice 2.2: Pharmaceutical Sciences 2020-21						✓						✓

	PO13	PO14	PO15	PO16	PO17	PO18	PO19	PO20	PO21	PO22	PO23	PO24
Chemistry Extension 2: Electronic Structure, Spectroscopy and Reactivity in d- and f-Block Compounds 2020-21								✓				
Core Chemistry 2.1: Stability, Structure and Mechanism in Molecular Systems 2020-21							✓	✓	✓			
Core Chemistry 2.2: Chemistry of Activated Systems and Radicals 2020-21								✓	✓			
Practical Chemistry 2.1: Organic synthesis, purification and advanced characterisation 2020-21	✓	✓	✓	✓	✓			✓	✓			
Practical Chemistry 2.2: Inorganic synthesis and structural methods 2020-21		✓	✓	✓	✓		✓	✓	✓			
Professional Practice 2.1: Formulation Sciences 2020-21							✓		✓	✓	✓	
Professional Practice 2.2: Pharmaceutical Sciences 2020-21							✓					✓

	PO25
Chemistry Extension 2: Electronic Structure, Spectroscopy and Reactivity in d- and f-Block Compounds 2020-21	
Core Chemistry 2.1: Stability, Structure and Mechanism in Molecular Systems 2020-21	
Core Chemistry 2.2: Chemistry of Activated Systems and Radicals 2020-21	
Practical Chemistry 2.1: Organic synthesis, purification and advanced characterisation 2020-21	
Practical Chemistry 2.2: Inorganic synthesis and structural methods 2020-21	
Professional Practice 2.1: Formulation Sciences 2020-21	

Professional Practice 2.2: Pharmaceutical Sciences 2020-21	✓

Level 3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Biological Chemistry 2021-22	✓		✓	✓		✓	✓	✓	✓	✓		✓
Core Chemistry 3.1: Defining Shape, Symmetry and Stereochemistry 2021-22	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	
Core Chemistry 3.2: Heterogeneous Systems, Surfaces and Nanoscience 2021-22	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Drugs of Abuse 2021-22					✓		✓		✓	✓		✓
Global Security: Nuclear Forensics and Bioterrorism 2021-22	✓	✓			✓		✓	✓	✓	✓		✓
Practical Chemistry 3.1: Advanced techniques in IO-chemistry 2021-22	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Professional Practice 3: Energy & Environmental Sciences 2021-22						✓				✓		✓
Structured project 2021-22	✓				✓	✓			✓	✓	✓	✓

	PO13	PO14	PO15	PO16	PO17	PO18	PO19	PO20	PO21	PO22	PO23	PO24
Biological Chemistry 2021-22								✓		✓		
Core Chemistry 3.1: Defining Shape, Symmetry and Stereochemistry 2021-22							✓	✓	✓			
Core Chemistry 3.2: Heterogeneous Systems, Surfaces and Nanoscience 2021-22								✓	✓	✓	✓	
Drugs of Abuse 2021-22			✓		✓		✓	✓				
Global Security: Nuclear Forensics and Bioterrorism 2021-22								✓	✓			
Practical Chemistry 3.1: Advanced techniques in IO-chemistry 2021-22		✓	✓	✓	✓		✓		✓		✓	✓
Professional Practice 3: Energy &							✓			✓		

Environmental Sciences 2021-22												
Structured project 2021-22			✓	✓	✓	✓	✓		✓	✓		

	PO25
Biological Chemistry 2021-22	
Core Chemistry 3.1: Defining Shape, Symmetry and Stereochemistry 2021-22	
Core Chemistry 3.2: Heterogeneous Systems, Surfaces and Nanoscience 2021-22	
Drugs of Abuse 2021-22	
Global Security: Nuclear Forensics and Bioterrorism 2021-22	
Practical Chemistry 3.1: Advanced techniques in IO-chemistry 2021-22	
Professional Practice 3: Energy & Environmental Sciences 2021-22	
Structured project 2021-22	✓

Appendix II - Assessment Map

This table indicates the spread of assessment activity across the programme. Percentages indicate assessment weighting.

Level 1

	01	02	03	04	05	06	07	08	09	10	11	12
Chemistry Extension 1: Electronic Structure, Spectroscopy and Reactivity in p-Block Compounds 2019-20												
Core Chemistry 1.1: Introduction to Energy, Change and Electronic Structure 2019-20												30
Core Chemistry 1.2: Molecular Structure, Bonding and Mechanism 2019-20												
Introduction to Professional Practice 2019-20												
Practical Chemistry 1.1: Fundamental laboratory techniques 2019-20												
Practical Chemistry 1.2: Introduction to synthetic methodologies and molecular characterisation 2019-20												
Professional Practice 1: Analytical Sciences 2019-20												

	13	14	15	16	17	18	19	20	21	22	23	24
Chemistry Extension 1: Electronic Structure, Spectroscopy and Reactivity in p-Block Compounds 2019-20												
Core Chemistry 1.1: Introduction to Energy, Change and Electronic Structure 2019-20				70								
Core Chemistry 1.2: Molecular Structure, Bonding and Mechanism 2019-20												
Introduction to Professional Practice 2019-20	25			75								

Practical Chemistry 1.1: Fundamental laboratory techniques 2019-20	100											
Practical Chemistry 1.2: Introduction to synthetic methodologies and molecular characterisation 2019-20												
Professional Practice 1: Analytical Sciences 2019-20												

	25	26	27	28	29	30	31	32	33	34	35	36
Chemistry Extension 1: Electronic Structure, Spectroscopy and Reactivity in p-Block Compounds 2019-20							30					
Core Chemistry 1.1: Introduction to Energy, Change and Electronic Structure 2019-20												
Core Chemistry 1.2: Molecular Structure, Bonding and Mechanism 2019-20							30					
Introduction to Professional Practice 2019-20												
Practical Chemistry 1.1: Fundamental laboratory techniques 2019-20												
Practical Chemistry 1.2: Introduction to synthetic methodologies and molecular characterisation 2019-20				30		70						
Professional Practice 1: Analytical Sciences 2019-20				60					40			

	37	38	39	40	41	42	43	44	45	46	47	48
Chemistry Extension 1: Electronic Structure, Spectroscopy and Reactivity in p-Block Compounds 2019-20												
Core Chemistry 1.1: Introduction to Energy, Change and Electronic Structure 2019-20												
Core Chemistry 1.2: Molecular Structure, Bonding and Mechanism 2019-20												

Introduction to Professional Practice 2019-20												
Practical Chemistry 1.1: Fundamental laboratory techniques 2019-20												
Practical Chemistry 1.2: Introduction to synthetic methodologies and molecular characterisation 2019-20												
Professional Practice 1: Analytical Sciences 2019-20												

	49	50	51	52	EP 1 (Wk 16)	EP 2 (Wks 33, 34, 35)
Chemistry Extension 1: Electronic Structure, Spectroscopy and Reactivity in p-Block Compounds 2019-20						70
Core Chemistry 1.1: Introduction to Energy, Change and Electronic Structure 2019-20						
Core Chemistry 1.2: Molecular Structure, Bonding and Mechanism 2019-20						70
Introduction to Professional Practice 2019-20						
Practical Chemistry 1.1: Fundamental laboratory techniques 2019-20						
Practical Chemistry 1.2: Introduction to synthetic methodologies and molecular characterisation 2019-20						
Professional Practice 1: Analytical Sciences 2019-20						

Level 2

	01	02	03	04	05	06	07	08	09	10	11	12
Chemistry Extension 2: Electronic Structure, Spectroscopy and Reactivity in d- and f-Block Compounds 2020-21												
Core Chemistry 2.1: Stability, Structure and												30

Mechanism in Molecular Systems 2020-21												
Core Chemistry 2.2: Chemistry of Activated Systems and Radicals 2020-21												
Practical Chemistry 2.1: Organic synthesis, purification and advanced characterisation 2020-21										70		
Practical Chemistry 2.2: Inorganic synthesis and structural methods 2020-21												
Professional Practice 2.1: Formulation Sciences 2020-21												
Professional Practice 2.2: Pharmaceutical Sciences 2020-21												

	13	14	15	16	17	18	19	20	21	22	23	24
Chemistry Extension 2: Electronic Structure, Spectroscopy and Reactivity in d- and f-Block Compounds 2020-21												
Core Chemistry 2.1: Stability, Structure and Mechanism in Molecular Systems 2020-21				70								
Core Chemistry 2.2: Chemistry of Activated Systems and Radicals 2020-21												
Practical Chemistry 2.1: Organic synthesis, purification and advanced characterisation 2020-21	30											
Practical Chemistry 2.2: Inorganic synthesis and structural methods 2020-21												
Professional Practice 2.1: Formulation Sciences 2020-21	40			60								
Professional Practice 2.2: Pharmaceutical Sciences 2020-21												40

	25	26	27	28	29	30	31	32	33	34	35	36
Chemistry Extension 2: Electronic Structure,							30					

Spectroscopy and Reactivity in d- and f-Block Compounds 2020-21												
Core Chemistry 2.1: Stability, Structure and Mechanism in Molecular Systems 2020-21												
Core Chemistry 2.2: Chemistry of Activated Systems and Radicals 2020-21							30					
Practical Chemistry 2.1: Organic synthesis, purification and advanced characterisation 2020-21												
Practical Chemistry 2.2: Inorganic synthesis and structural methods 2020-21							70	30				
Professional Practice 2.1: Formulation Sciences 2020-21												
Professional Practice 2.2: Pharmaceutical Sciences 2020-21						60						

	37	38	39	40	41	42	43	44	45	46	47	48
Chemistry Extension 2: Electronic Structure, Spectroscopy and Reactivity in d- and f-Block Compounds 2020-21												
Core Chemistry 2.1: Stability, Structure and Mechanism in Molecular Systems 2020-21												
Core Chemistry 2.2: Chemistry of Activated Systems and Radicals 2020-21												
Practical Chemistry 2.1: Organic synthesis, purification and advanced characterisation 2020-21												
Practical Chemistry 2.2: Inorganic synthesis and structural methods 2020-21												
Professional Practice 2.1: Formulation Sciences 2020-21												
Professional Practice 2.2: Pharmaceutical Sciences 2020-21												

	49	50	51	52	EP 1 (Wk 16)	EP 2 (Wks 33, 34, 35)
Chemistry Extension 2: Electronic Structure, Spectroscopy and Reactivity in d- and f-Block Compounds 2020-21						70
Core Chemistry 2.1: Stability, Structure and Mechanism in Molecular Systems 2020-21						
Core Chemistry 2.2: Chemistry of Activated Systems and Radicals 2020-21						70
Practical Chemistry 2.1: Organic synthesis, purification and advanced characterisation 2020-21						
Practical Chemistry 2.2: Inorganic synthesis and structural methods 2020-21						
Professional Practice 2.1: Formulation Sciences 2020-21						
Professional Practice 2.2: Pharmaceutical Sciences 2020-21						

Level 3

	01	02	03	04	05	06	07	08	09	10	11	12
Biological Chemistry 2021-22												
Core Chemistry 3.1: Defining Shape, Symmetry and Stereochemistry 2021-22												30
Core Chemistry 3.2: Heterogeneous Systems, Surfaces and Nanoscience 2021-22												
Drugs of Abuse 2021-22												
Global Security: Nuclear Forensics and Bioterrorism 2021-22												
Practical Chemistry 3.1: Advanced techniques in IO-chemistry 2021-22												
Professional Practice 3: Energy & Environmental Sciences 2021-22												

Structured project 2021-22												

	13	14	15	16	17	18	19	20	21	22	23	24
Biological Chemistry 2021-22												
Core Chemistry 3.1: Defining Shape, Symmetry and Stereochemistry 2021-22				70								
Core Chemistry 3.2: Heterogeneous Systems, Surfaces and Nanoscience 2021-22												
Drugs of Abuse 2021-22											50	50
Global Security: Nuclear Forensics and Bioterrorism 2021-22												100
Practical Chemistry 3.1: Advanced techniques in IO-chemistry 2021-22	70			30								
Professional Practice 3: Energy & Environmental Sciences 2021-22	40			60								
Structured project 2021-22												

	25	26	27	28	29	30	31	32	33	34	35	36
Biological Chemistry 2021-22	50											
Core Chemistry 3.1: Defining Shape, Symmetry and Stereochemistry 2021-22												
Core Chemistry 3.2: Heterogeneous Systems, Surfaces and Nanoscience 2021-22							30					
Drugs of Abuse 2021-22												
Global Security: Nuclear Forensics and Bioterrorism 2021-22												
Practical Chemistry 3.1: Advanced techniques in IO-chemistry 2021-22												
Professional Practice 3: Energy & Environmental Sciences 2021-22												
Structured project 2021-22				75		25						

	37	38	39	40	41	42	43	44	45	46	47	48

Biological Chemistry 2021-22												
Core Chemistry 3.1: Defining Shape, Symmetry and Stereochemistry 2021-22												
Core Chemistry 3.2: Heterogeneous Systems, Surfaces and Nanoscience 2021-22												
Drugs of Abuse 2021-22												
Global Security: Nuclear Forensics and Bioterrorism 2021-22												
Practical Chemistry 3.1: Advanced techniques in IO-chemistry 2021-22												
Professional Practice 3: Energy & Environmental Sciences 2021-22												
Structured project 2021-22												

	49	50	51	52	EP 1 (Wk 16)	EP 2 (Wks 33, 34, 35)
Biological Chemistry 2021-22						50
Core Chemistry 3.1: Defining Shape, Symmetry and Stereochemistry 2021-22						
Core Chemistry 3.2: Heterogeneous Systems, Surfaces and Nanoscience 2021-22						70
Drugs of Abuse 2021-22						
Global Security: Nuclear Forensics and Bioterrorism 2021-22						
Practical Chemistry 3.1: Advanced techniques in IO-chemistry 2021-22						
Professional Practice 3: Energy & Environmental Sciences 2021-22						
Structured project 2021-22						

Appendix III - Benchmark Analysis

This table maps programme learning outcomes to relevant QAA subject benchmark statements or PSRB guidelines.

Knowledge and Understanding

	ChemHons 01	ChemHons 02	ChemHons 03	ChemHons 04	ChemHons 05	ChemHons 06	ChemHons 07	ChemHons 08	ChemMstr0 1
PO1	✓				✓				
PO2	✓				✓				
PO3	✓				✓				
PO4	✓				✓				
PO5	✓				✓				
PO6	✓				✓				

	ChemMstr0 2	ChemMstr0 3	ChemMstr0 4	ChemMstr0 5
PO1				
PO2				
PO3				
PO4				
PO5				
PO6				

Subject Specific Intellectual Skills

	ChemHons 01	ChemHons 02	ChemHons 03	ChemHons 04	ChemHons 05	ChemHons 06	ChemHons 07	ChemHons 08	ChemMstr0 1
PO7	✓				✓				
PO8	✓	✓			✓	✓			
PO9		✓				✓			

PO10		✓			✓	✓			
PO11					✓	✓			
PO12	✓				✓			✓	

	ChemMstr02	ChemMstr03	ChemMstr04	ChemMstr05
PO7				
PO8				
PO9				
PO10				
PO11				
PO12				

Subject Specific Practical Skills

	ChemHons01	ChemHons02	ChemHons03	ChemHons04	ChemHons05	ChemHons06	ChemHons07	ChemHons08	ChemMstr01
PO13			✓				✓		
PO14			✓				✓		
PO15			✓				✓		
PO16			✓				✓		
PO17									
PO18									

	ChemMstr02	ChemMstr03	ChemMstr04	ChemMstr05
PO13				
PO14				
PO15				
PO16				
PO17				

PO18				

Transferable Skills and Attributes

	ChemHons 01	ChemHons 02	ChemHons 03	ChemHons 04	ChemHons 05	ChemHons 06	ChemHons 07	ChemHons 08	ChemMstr0 1
PO19				✓				✓	
PO20		✓		✓		✓		✓	
PO21				✓				✓	
PO22				✓				✓	
PO23				✓				✓	
PO24				✓				✓	
PO25				✓				✓	

	ChemMstr0 2	ChemMstr0 3	ChemMstr0 4	ChemMstr0 5
PO19				
PO20				
PO21				
PO22				
PO23				
PO24				
PO25				

Appendix IV:
Benchmark Benchmark Statement(s)

ChemHons01 - *A basic knowledge and understanding of the content covered in the course is evident.*

ChemHons02 - *Problems of a routine nature are generally adequately solved.*

ChemHons03 - *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.*

ChemHons04 - *Generic skills have been developed to a basic level.*

ChemHons05 - *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.*

ChemHons06 - *Problems of a familiar nature are solved in a logical manner, and solutions are generally correct or acceptable.*

ChemHons07 - *Experimental work is carried out in a reliable and efficient manner.*

ChemHons08 - *Performance in generic skills is sound and shows no significant deficiencies.*

ChemMstr01 - *Knowledge base extends to a systematic understanding and critical awareness of topics which are informed by the forefront of the discipline.*

ChemMstr02 - *Problems of an unfamiliar nature are tackled with appropriate methodology and taking into account the possible absence of complete data.*

ChemMstr03 - *Experimental work is carried out independently and with some originality.*

ChemMstr04 - *Substantial research project at the forefront of the discipline is completed effectively.*

ChemMstr05 - *Generic skills are developed appropriately for professional practice.*