## CH3431 Chemistry Workshop

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| **SCOTCAT Credits:** | 15 | SCQF level 9 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Planned timetable:** | To be arranged. | | | |
| The aim of the module is to provide a basis in organic spectroscopy, molecular symmetry and point groups and their application to inorganic spectroscopy, and crystallography and X-ray diffraction. In addition, students will gain experience in chemical information retrieval and searching on-line databases. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass at least 2 modules from {CH2501, CH2601, CH2603, CH2701} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 x 2 hour lectures/seminars/problem solving workshops through weeks 1-9 Semester 1 and weeks 1-11 Semester 2, Some will be pre-recorded, some live teams sessions and some additional support through voluntary Q and A sessions. This will also include assessment. | | | |
| | **Scheduled learning:** 36 hours | | **Guided independent study:** 64 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 100%, Coursework = 0% | | | |
| | **As used by St Andrews:** 100% continual assessment. | | | |
| **Re-assessment pattern:** | 100% continual assessment. | | | |
| **Module coordinator:** | Professor S E M Ashbrook | | | |
| **Module teaching staff:** | Dr R A Aitken, Dr T Lebl, Prof M Buehl, Prof S E M Ashbrook, Dr N S Keddie, Prof P L Lightfoot | | | |

## CH3441 Mini Chemistry Project

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 20 | SCQF level 9 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | NOT RUNNING in AY2021-22 | | | |
| **Planned timetable:** | 9.00 am - 12.30 pm Mon - Fri for 5 weeks (Weeks 7 - 11). | | | |
| This is a group-based exercise where the students will tackle an unseen problem. Skills to be developed will vary but will include some or all of the following: The use of spectroscopy, retrosynthetic analysis, literature searching, web based searching and design, synthesis, catalysis, mechanistic studies, computational chemistry, surface chemistry, biological chemistry, communication skills. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass at least 2 modules from {CH2501, CH2601, CH2603, CH2701} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 3.5-hours x 5 days (Weeks 7 - 11) | | | |
| | **Scheduled learning:** 88 hours | | **Guided independent study:** 112 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 60%, Coursework = 40% | | | |
| | **As used by St Andrews:** 30-minute Practical Examination = 60%, Coursework = 40% | | | |
| **Re-assessment pattern:** | No Re-assessment available, requires lab attendance to complete coursework | | | |
| **Module coordinator:** | Dr J B O Mitchell | | | |
| **Module coordinator Email:** | jbom:st-andrews.ac.uk | | | |
| **Module teaching staff:** | A selection of the Academic Staff | | | |

## CH3512 Organometallic Chemistry

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 9 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module offers a systematic introductory treatment of organometallic compounds, emphasising fundamental concepts and the principal functional groups of organometallic chemistry. Topics include: the hapto nomenclature and 18-electron rule; synthesis of complexes of CO, alkyl, alkene, alkyne and carbocyclic ligands; static and dynamic structures; reactions of coordinated ligands; unit processes involved in homogeneous catalytic cycles. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2501 and pass at least 1 module from {CH2601, CH2603, CH2701} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 15 lectures in total during weeks 1-7 with 2-3 lectures per week; 2 whole class tutorials delivered in person (online) by the respective question setter, and supported by additional online Q and;A sessions/2 x 2h office hours provided by individual staff. | | | |
| | **Scheduled learning:** 17 hours | | **Guided independent study:** 83 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr A Stasch | | | |
| **Module teaching staff:** | Dr P Webb, Dr A Stasch | | | |

## CH3513 Chemistry of Materials

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 9 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module brings together a number of advanced concepts including advanced crystal chemistry, extended defects, semiconductor band theory and properties, phase equilibria and phase transformations. It is key to the understanding of many aspects of modern materials science. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2501 and pass at least 1 module from {CH2601, CH2603, CH2701} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2-3 lectures per week over weeks 1-7 online/in-person, 2-3 whole class tutorials delivered in person, 2 x 2h office hours provided by individual staff for online Q&A sessions | | | |
| | **Scheduled learning:** 17 hours | | **Guided independent study:** 83 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr P A Connor | | | |
| **Module teaching staff:** | Dr P A Connor, Dr R T Baker | | | |

## CH3514 Physical Inorganic Chemistry

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 9 | **Semester** | 1 |
| **Academic year:** | 2021-2022 | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module aims to develop the student's understanding of the mechanisms that lie behind the reactions of inorganic compounds. The material will include studies of the different types of reactions that occur at metal centres and how they operate in complex systems such as metal-containing drugs and homogeneous catalysis. A second major component of the module will cover the use of spectroscopic techniques, including multinuclear NMR and EPR, to characterise main group and other inorganic compounds. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2501 and pass at least 1 module from {CH2601, CH2603, CH2701} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 1-2 online lectures per week weeks 1-4 and 7-10 (15 total) a small group teams tutorial (live tutorials may be possible depending on available venues) each week 5 and 10. | | | |
| | **Scheduled learning:** 17 hours | | **Guided independent study:** 83 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 25%, Practical Examinations = 0%, Coursework = 75% | | | |
| | **As used by St Andrews:** Continuous assessment 25%: exam 75% | | | |
| **Re-assessment pattern:** | Oral Examination = 100% | | | |
| **Module coordinator:** | Dr B E Bode | | | |
| **Module teaching staff:** | Dr B E Bode, Dr J McNulty | | | |

## CH3521 Inorganic Chemistry Laboratory

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 15 | SCQF level 9 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Planned timetable:** | 9.00 am - 12.30 pm (Weeks 1 - 5) | | | |
| Practical experiments involving synthesis, characterisation and measurements in synthetic inorganic chemistry. Skills will be developed in the use of spectroscopy, data analysis, literature searching, web based searching, synthesis and mechanistic studies. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2501 and pass at least 1 module from {CH2601, CH2603, CH2701} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 1 x 3.5h over nine weeks across the academic year | | | |
| | **Scheduled learning:** 70 hours | | **Guided independent study:** 30 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100% | | | |
| | **As used by St Andrews:** 100% continual assessment. | | | |
| **Re-assessment pattern:** | No Re-assessment available, requires lab attendance to complete coursework | | | |
| **Module coordinator:** | Dr B A Chalmers | | | |
| **Module teaching staff:** | Dr P Kilian, Dr A Stasch, Dr B Chalmers | | | |

## CH3612 Synthetic Methodology

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 9 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module will cover a wide range of synthetic methods and applications of the methods to the synthesis of complex molecules. Students will gain a deep understanding of the importance of methods involving sulfur, phosphorus, boron, silicon, organolithium and organozinc reagents. Students will also be introduced to modern methods of alkene, alkyne and biaryl synthesis using palladium and ruthenium catalysts. The use of the protecting groups in conjunction with these synthetic methods will also be covered. | | | | |
| **Pre-requisite(s):** | Before taking this module you must ( pass CH2601 or pass CH2603 ) and pass at least 1 module from {CH2501, CH2701} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 5 - 7 weeks (Weeks 1-7) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 17 hours | | **Guided independent study:** 83 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Professor N J Westwood | | | |
| **Module teaching staff:** | Prof N J Westwood, Dr A J B Watson | | | |

## CH3613 Carbohydrate and Nucleic Acid Chemistry

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 9 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Planned timetable:** | To be arranged. | | | |
| The aim of the module is to cover aspects of the chemistry of nucleic acids. It will begin with an introduction to carbohydrate chemistry including discussion of biological processes, the synthesis of carbohydrates and carbohydrate-based pharmaceuticals. The structure and chemical synthesis of nucleic acids will then be discussed. The chemical reactivity of DNA and the ways in which it is chemically damaged will be examined. The chemical reactions of DNA will be related to mechanisms of carcinogenesis. The ways in which a range of drugs interact with DNA will be discussed in detail. | | | | |
| **Pre-requisite(s):** | Before taking this module you must ( pass CH2601 or pass CH2603 ) and pass at least 1 module from {CH2501, CH2701} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2-3 lectures per week over weeks 1-7 online/in-person, 2-3 whole class tutorials delivered in person, 2 x 2h office hours provided by individual staff for online Q and A sessions | | | |
| | **Scheduled learning:** 17 hours | | **Guided independent study:** 83 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr E R Kay | | | |
| **Module teaching staff:** | Dr G J Florence, Dr E R Kay | | | |

## CH3615 Mechanism in Organic Chemistry

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 9 | **Semester** | 1 |
| **Academic year:** | 2021-2022 | | | |
| **Planned timetable:** | To be arranged. | | | |
| The objective of this module is to provide the student with a thorough understanding of the mechanistic aspects of organic chemistry. A problem-solving approach is employed in order to develop the ability to elucidate information, both qualitative and quantitative, concerning reaction mechanisms from experimental data. The module will also focus on the critical role of orbitals in determining the reactivity and selectivity of organic compounds. Reaction mechanism described as a flow of electrons through a correctly aligned orbital manifold will be developed as a tool to explore key topics in synthetic chemistry, with particular emphasis on stereoelectronic effects and aspects of alicyclic chemistry. | | | | |
| **Pre-requisite(s):** | Before taking this module you must ( pass 1 module from {CH2601, CH2603} and pass at least 1 module from {CH2501, CH2701} ) or pass 2 modules from {CH2501, CH2701} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 lectures per week , 1 online class tutoria l/ Q and ;A session per week over weeks 1-5/7-11. During weeks 1-5 and 7-10 the following will be provided: 2 pre-recorded lectures per week over weeks 1-5 and 8-11 will be provided online (17 h total; ADS 9; NSK 8) and released at the beginning of the week allowing students to watch in their own time. ii). An online summary of the major important points from each week's lectures will also be made available. iii). a set of questions for the cohort based on the lectures will be made available, and answered live to the whole class online, followed by an online Q nd A sessions for all students. The timing of this session will be during one of the timetabled lecture slots. | | | |
| | **Scheduled learning:** 17 hours | | **Guided independent study:** 83 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Professor A D Smith | | | |
| **Module teaching staff:** | Dr N S Keddie, Prof A D Smith | | | |

## CH3621 Organic Chemistry Laboratory

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 15 | SCQF level 9 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Planned timetable:** | 9.00 am - 12.30 pm Mon to Fri (Weeks 1 - 5) | | | |
| Practical experiments involving synthesis, characterisation and measurements in organic chemistry. Skills will be developed in the use of spectroscopy, retrosynthetic analysis, literature searching, web based searching and design, synthesis, catalysis, mechanistic studies, and biological chemistry. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2501 and pass at least 1 module from {CH2601, CH2603, CH2701} | | | |
| **Anti-requisite(s)** | You cannot take this module if you take CH3622 or take CH3623 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 9 x 3.5h laboratory sessions across Semester 1 and 2. | | | |
| | **Scheduled learning:** 70 hours | | **Guided independent study:** 30 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100% | | | |
| | **As used by St Andrews:** Coursework = 100% | | | |
| **Re-assessment pattern:** | No Re-assessment available, requires lab attendance to complete coursework | | | |
| **Module coordinator:** | Dr I A Smellie | | | |
| **Module teaching staff:** | Dr I A Smellie, Dr N S Keddie, Dr A J B Watson | | | |

## CH3622 Organic Chemistry Laboratory (Materials)

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 15 | SCQF level 9 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Planned timetable:** | 9.00 am - 12.30 pm Mon to Fri (Weeks 1 - 5) | | | |
| Practical experiments involving synthesis, characterisation and measurements in organic chemistry with a particular emphasis on organic materials. Skills will be developed in the use of spectroscopy, retrosynthetic analysis, literature searching, web based searching and design, synthesis, catalysis, mechanistic studies, and organic materials chemistry. | | | | |
| **Pre-requisite(s):** | Before taking this module you must ( pass CH2601 or pass CH2603 ) and pass at least 1 module from {CH2501, CH2701} | | | |
| **Anti-requisite(s)** | You cannot take this module if you take CH3621 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 9 x 3.5h laboratory sessions across Semester 1 and 2 | | | |
| | **Scheduled learning:** 70 hours | | **Guided independent study:** 30 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100% | | | |
| | **As used by St Andrews:** 100% continual assessment. | | | |
| **Re-assessment pattern:** | No Re-assessment available, requires lab attendance to complete coursework | | | |
| **Module coordinator:** | Dr I A Smellie | | | |
| **Module teaching staff:** | Dr I A Smellie, Dr N S Keddie, Dr A J B Watson | | | |

## CH3623 Organic Chemistry Laboratory (Biology and Chemistry)

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 15 | SCQF level 9 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Only available to students on joint BSc Biology and Chemistry degree and during phased withdrawal of BSc Biomolecular Science degree programme | | | |
| **Planned timetable:** | Practical - Mon-Wed (10.00-12.30), Thurs and Fri (9.00-12.30) | | | |
| Practical experiments involving synthesis, characterisation and measurements in organic chemistry with a particular emphasis on the organic compounds of biological interest. Skills will be developed in the use of spectroscopy, retrosynthetic analysis, literature searching, web based searching and design, synthesis, catalysis, mechanistic studies, and biological chemistry. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2501 and pass CH2601 or pass CH2603 or pass CH2701 | | | |
| **Anti-requisite(s)** | You cannot take this module if you take CH3621 or take CH3622 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 9 x 3.5h laboratory sessions across Semester 1 and 2 | | | |
| | **Scheduled learning:** 0 hours | | **Guided independent study:** 0 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 100% continual assessment. | | | |
| **Re-assessment pattern:** | Re-assessment not permitted for practical lab-based module. | | | |
| **Module coordinator:** | Dr I A Smellie | | | |
| **Module teaching staff:** | Dr Iain Smellie, Dr N S Keddie, Dr A J B Watson | | | |

## CH3712 Quantum Theory of Atoms, Molecules and Solids

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 9 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module builds on 'Quantum Theory of Atoms, Molecules and Solids. Part I' given in CH2701. It provides an introduction to further, basic concepts of quantum mechanics that are an essential part of the description of the electronic structures of atoms, molecules and solids. While the module is mathematically based, the emphasis throughout is on the physical and chemical implications of the mathematical results and how this provides a coherent, quantitative framework for understanding the beauty and complexities of the electronic structure of atoms, molecules and solids. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2701 and pass at least 1 module from {CH2501, CH2601, CH2603} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2-3 lectures per week over weeks 1-6 online (15 h total), 2-3 whole class tutorials delivered in person, 2 x 2h office hours provided by individual staff for online Q and A sessions. | | | |
| | **Scheduled learning:** 17 hours | | **Guided independent study:** 83 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr G Haehner | | | |
| **Module teaching staff:** | Dr F D Morrison, Dr G Haehner | | | |

## CH3715 Introduction to Analysis of Materials

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 9 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Planned timetable:** | To be arranged. | | | |
| The objective of this module is to introduce the principles of the most popular materials analysis methods using X-ray, ion beams, electrons and diffraction methods. The module will cover analytical principles of scanning and transmission electron microscopy (SEM, TEM), X-ray photoelectron spectroscopy (XPS) and Auger electron spectroscopy (AES) together with secondary ion mass spectroscopy (SIMS) and X-ray Diffraction methods (XRD). Diffraction techniques will also be covered with the introductory aspects of Electron Energy Loss Spectroscopy (EELS) together with vibrational spectroscopic techniques. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2701 and pass at least 1 module from {CH2501, CH2601, CH2603} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 5 - 7 weeks (Weeks 1-7) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 17 hours | | **Guided independent study:** 83 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr R T Baker | | | |
| **Module teaching staff:** | Dr R T Baker, Prof W Zhou | | | |

## CH3716 Quantitative Aspects of Medicinal Chemistry

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 9 | **Semester** | 1 |
| **Academic year:** | 2021-2022 | | | |
| **Planned timetable:** | To be arranged. | | | |
| The aim of the module is to cover some of the quantitative aspects of Medicinal Chemistry and drug design. Initially some relevant fundamental thermodynamics will be discussed. The thermodynamics of the drug receptor interactions will then be covered along with other aspects of pharmacology. The pharmacokinetic phase of drug action will be described including the absorption, distribution, metabolism and elimination (ADME) of drugs. The use of computational chemistry in the modern drug design process will then be discussed, covering force field calculations, molecular docking, QSAR and virtual screening. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass 2 modules from {CH2501, CH2601, CH2701} | | | |
| **Anti-requisite(s)** | You cannot take this module if you take CH3717 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: Pharmacology and pharmacokinetics: 2hr x 2 weeks + 1hr x 1 week (5 lectures); one or two Teams tutorials Thermodynamics: 2hr x 2 weeks (4 lectures); one or two Teams tutorials, Computational chemistry: 2hr x 3 weeks lectures (6 lectures); several Teams tutorials with max 20 students | | | |
| | **Scheduled learning:** 18 hours | | **Guided independent study:** 82 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr T Van Mourik | | | |
| **Module teaching staff:** | Dr T van Mourik, Prof P A Wright, Prof T Smith | | | |

## CH3717 Statistical Mechanics and Computational Chemistry

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 9 | **Semester** | 1 |
| **Academic year:** | 2021-2022 | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module combines the study of statistical mechanics with an introduction to theoretical and computational methods as applied in modern chemistry. In the first set of lectures the molecular basis of thermodynamics is covered in an introduction to the study of statistical mechanics. The use of computational chemistry in the modern drug design process will then be discussed, covering force field calculations, molecular docking, QSAR and virtual screening. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2701 and pass at least 1 module from {CH2501, CH2601, CH2603} | | | |
| **Anti-requisite(s)** | You cannot take this module if you take CH3716 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: Statistical mechanics: 2hr x 4 weeks lectures + 1hr x 1 week (9 lectures in total); 1 x Teams tutorial per student (~9 groups of ~6 students) in one week if timetabling allows, otherwise within as short a time span as possible. Computational chemistry: 2hr x 3 weeks lectures (6 lectures in total); several 20-student Teams tutorials | | | |
| | **Scheduled learning:** 17 hours | | **Guided independent study:** 83 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr T Van Mourik | | | |
| **Module teaching staff:** | Dr T van Mourik, Dr J B O Mitchell | | | |

## CH3721 Physical Chemistry Laboratory

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 15 | SCQF level 9 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Planned timetable:** | 9.00 am - 1.00 pm Mon to Fri (Weeks 7-10) | | | |
| This module comprises practical experiments involving physical measurements and the use of computational programmes in Chemistry. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2701 and pass at least 1 module from {CH2501, CH2601, CH2603} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 9 x 3.5h laboratory sessions across Semester 1 and 2 Fewer lab hours per week available to students (on average, 3.5 hours scheduled per week over 9 weeks across the academic year). Normally the module would be scheduled in weeks 7-11 only. Temporary: 1 x 3.5h over nine weeks across the academic year Normally: Daily 3.5-hour morning practical classes over 5 weeks (Weeks 7 – 11, Semester 1) | | | |
| | **Scheduled learning:** 70 hours | | **Guided independent study:** 30 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100% | | | |
| | **As used by St Andrews:** 100% continual assessment | | | |
| **Re-assessment pattern:** | No Re-assessment available, requires lab attendance to complete coursework | | | |
| **Module coordinator:** | Professor M Buck | | | |
| **Module teaching staff:** | Prof P A Wright, Prof M Buck, Dr R Schaub, Dr T van Mourik, Prof M Buehl, TBC | | | |

## CH4421 Chemistry Research Skills Laboratory

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 30 | SCQF level 10 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Only available to students enrolled in MChem Chemistry, MChem Materials Chemistry or MChem with Medicinal Chemistry | | | |
| **Planned timetable:** | 9:00 - 13:00 | | | |
| This module integrates advanced practical inorganic, organic and physical chemistry. The major objective is improvement of problem solving abilities and confidence in independent research work in a chemical laboratory. This will be achieved via - (1) problem-solving driven design of a variety of experiments based on literature precedent (from electronic databases and primary literature) - (2) adjusting the identified procedures to available equipment and characterisation techniques - (3) performing experiments with due care and safety - (4) evaluation of results via written and oral laboratory reports. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH3521 and ( pass CH3621 or pass CH3721 ) | | | |
| **Anti-requisite(s)** | You cannot take this module if you take CH4442 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: Two or three days a week, 3.5-hour morning practical classes or 2 hour workshops between Semester 1 - Week 1 and Semester 2 - Week 8 | | | |
| | **Scheduled learning:** 166 hours | | **Guided independent study:** 134 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100% | | | |
| | **As used by St Andrews:** Coursework = 100% | | | |
| **Module coordinator:** | Dr P Kilian | | | |
| **Module teaching staff:** | Dr P Kilian, Dr B Chalmers, Dr D Cordes, Dr I Smellie, Prof P Lightfoot, Dr FD Morrison, Dr G. Haehner, Prof M Buhl, Dr T van Mourik, Dr J B O Mitchell | | | |

## CH4431 Scientific Writing

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 20 | SCQF level 10 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Only available to students on the MChem Chemistry, Chemistry with Medicinal Chemistry and Materials Chemistry programmes | | | |
| **Planned timetable:** | To be arranged | | | |

This module aims to provide a comprehensive experience in sourcing and working with scientific literature related to a topic of chemical research, and seeks to develop a number of important skills concerning the dissemination of complex ideas to a wider scientific audience. Via a short sequence of seminars, supervisory meetings, and on line resources, students are provided with detailed guidance on how to conduct a research literature search and evaluate critically scientific articles. In addition, students will develop skills relating to the communication of science, both written and oral. As a consequence, this module provides valuable experience and preparation for a Final Year Honours Research Project. An insight into the academic peer review process is also provided.

| | | |
|---|---|---|
| **Pre-requisite(s):** | Before taking this module you must pass at least 2 modules from {CH2501, CH2601, CH2603, CH2701} | |
| **Anti-requisite(s)** | You cannot take this module if you take CH4442 | |
| **Co-requisite(s):** | null | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2hr x 4 weeks workshops, 3 in semester 1 and 1 in semester 2, 4 meetings between student and supervisor, 13-minute presentation by each student. | |
| | **Scheduled learning:** 17 hours | **Guided independent study:** 186 hours |
| **Assessment pattern:** | **As defined by QAA:**<br>Written Examinations = 0%, Practical Examinations = 15%, Coursework = 85% | |
| | **As used by St Andrews:**<br>Short Presentation = 15%, Coursework = 85% | |
| **Re-assessment pattern:** | Resubmission of coursework = 100% | |
| **Module coordinator:** | Dr T Van Mourik | |
| **Module teaching staff:** | Dr N S Keddie, Dr J B O Mitchell, Prof D O'Hagan | |

## CH4441 External Placement

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 90 | SCQF level 10 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Available only to students on Chemistry degree programmes with External Placement | | | |
| **Planned timetable:** | Please Contact School | | | |
| This module is intended to provide each individual student with direct experience of work in an industrial or similar laboratory. Activities are very varied, according to the nature of the particular company's or organisation's area of business. Some students will be engaged in synthetic work and some in analytical/measurement activities. Some will be based exclusively in a laboratory, while others will also be involved in liaison with the company's plant operators or with its customers. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass at least 2 modules from {CH2501, CH2601, CH2603, CH2701} | | | |
| **Co-requisite(s):** | You must also take CH4458 and take CH4455 and ( take CH4453 or take CH4456 ) or take FR5810 | | | |
| **Learning and teaching methods of delivery:** | This is a Study Abroad or External Placement module | | | |
| | **Weekly contact**: Day-to-day supervision by company supervisor, liaising with member of School academic staff. | | | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100% | | | |
| | **As used by St Andrews:** Coursework = 100% | | | |
| **Re-assessment pattern:** | No Re-assessment available; requires year-long external work to complete coursework | | | |
| **Module coordinator:** | Dr G Haehner | | | |

## CH4442 Chemistry Research Project

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 60 | SCQF level 10 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | 2 days per week, to be arranged. | | | |
| The research project at Level 4000 aims to develop the students' skills in the following areas: experimental design and problem-solving; abstraction, evaluation and interpretation of data in the chemical literature; practical skills and teamwork; communication of results orally and in a dissertation. The project will be selected and supervised by a member of the academic staff. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass at least 2 modules from {CH2501, CH2601, CH2603, CH2701} | | | |
| **Anti-requisite(s)** | You cannot take this module if you take all modules from {CH4441, CH4444, CH4445, CH4446, CH4447, CH4448, CH4449, ID4441} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: Students spend a minimum of 27 hours per week of their time on the project through semesters 1 and 2. This time includes practical work, literature study, reading and preparation of reports and presentation. Typically, 18 to 20 hours per week are laboratory related. | | | |
| | **Scheduled learning:** 220 hours | | **Guided independent study:** 374 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 20%, Coursework = 80% | | | |
| | **As used by St Andrews:** 1-hour Practical Examination = 20%,Coursework = 80% | | | |
| **Re-assessment pattern:** | No Re-assessment available, requires lab attendance to complete coursework | | | |
| **Module coordinator:** | Dr R Schaub | | | |

## CH4443 Chemistry Research Project for Non-graduating students (45)

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 45 | SCQF level 10 | **Semester** | Both |
| **Academic year:** | 2021-2022 | | | |
| The research project at Level 4000 only aims to develop the students' skills in the following areas: experimental design and problem-solving; abstraction, evaluation and interpretation of data in the chemical literature; practical skills and teamwork; communication of results orally and in a dissertation. The project will be selected and supervised by a member of the academic staff. | | | | |
| **Anti-requisite(s)** | You cannot take this module if you take CH4442 or take CH4444 or take CH4445 or take CH4446 or take CH4448 or take CH5441 or take ID4441 | | | |
| **Learning and teaching methods of delivery:** | **Scheduled learning:** 0 hours | | **Guided independent study:** 0 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** TBC | | | |

## CH4444 Chemistry Research Project for Non-graduating Students (60)

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 60 | SCQF level 10 | **Semester** | Both |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Available only to non-graduating students. | | | |
| **Planned timetable:** | To be arranged. | | | |
| The research project at Level 4000 aims to develop the students' skills in the following areas: experimental design and problem-solving; abstraction, evaluation and interpretation of data in the chemical literature; practical skills and teamwork; communication of results orally and in a dissertation. The project will be selected and supervised by a member of the academic staff. | | | | |
| **Anti-requisite(s)** | You cannot take this module if you take all modules from {CH4442, CH4445, CH4446, CH4447, CH4448, CH4449, ID4441, CH5441} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: Students spend a minimum of 54 hours of their time on the project. This time includes practical work, literature study, reading and preparation of reports and presentation. Typically, 36 hours are laboratory related. | | | |
| | **Scheduled learning:** 400 hours | | **Guided independent study:** 200 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 20%, Coursework = 80% | | | |
| | **As used by St Andrews:** 1-hour Practical Examination = 20%, Coursework = 80% | | | |
| **Re-assessment pattern:** | No Re-Assessment available, requires lab attendance to complete coursework | | | |
| **Module coordinator:** | Dr R Schaub | | | |

## CH4445 Chemistry Research Project for Non-graduating Students (90)

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 90 | SCQF level 10 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Available only to non-graduating students. | | | |
| **Planned timetable:** | To be arranged. | | | |
| The research project at Level 4000 aims to develop the students' skills in the following areas: experimental design and problem-solving; abstraction, evaluation and interpretation of data in the chemical literature; practical skills and teamwork; communication of results orally and in a dissertation. The project will be selected and supervised by a member of the academic staff. | | | | |
| **Anti-requisite(s)** | You cannot take this module if you take all modules from {CH4442, CH4444, CH4446, CH4447, CH4448, CH4449, ID4441, CH5441} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: Students spend a minimum of 40 hours per week of their time on the project. This time includes practical work, literature study, reading and preparation of reports and presentation. Typically, 27 to 28 hours per week are laboratory related. | | | |
| | **Scheduled learning:** 600 hours | | **Guided independent study:** 300 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 20%, Coursework = 80% | | | |
| | **As used by St Andrews:** 2-hour Practical Examination = 20%, Coursework = 80% | | | |
| **Re-assessment pattern:** | No Re-Assessment available, requires lab attendance to complete coursework | | | |
| **Module coordinator:** | Dr R Schaub | | | |

## CH4446 Chemistry Research Project for Non-graduating Students (120)

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 120 | SCQF level 10 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Available only to non-graduating students. | | | |
| **Planned timetable:** | To be arranged. | | | |
| The research project at Level 4000 aims to develop the students' skills in the following areas: experimental design and problem-solving; abstraction, evaluation and interpretation of data in the chemical literature; practical skills and teamwork; communication of results orally and in a dissertation. The project will be selected and supervised by a member of the academic staff. | | | | |
| **Anti-requisite(s)** | You cannot take this module if you take all modules from {CH4442, CH4443, CH4444, CH4445, CH4448, CH4449, ID4441, CH5441} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: Students spend a minimum of 54 hours per week of their time on the project. This time includes practical work, literature study, reading and preparation of reports and presentation. Typically, 36 hours per week are laboratory related. | | | |
| | **Scheduled learning:** 800 hours | | **Guided independent study:** 400 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 20%, Coursework = 80% | | | |
| | **As used by St Andrews:** 2-hour Practical Examination = 20%, Coursework = 80% | | | |
| **Re-assessment pattern:** | No Re-Assessment available, requires lab attendance to complete coursework | | | |
| **Module coordinator:** | Dr R Schaub | | | |

## CH4448 Chemistry Project for Chemistry and Geology

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 20 | SCQF level 10 | **Semester** | 1 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Available only to students on Chemistry and Geology degree programme | | | |
| **Planned timetable:** | To be arranged. | | | |
| The research project at Level 4000 aims to develop the students' skills in the following areas: experimental design and problem-solving; abstraction, evaluation and interpretation of data in the chemical literature; practical skills and teamwork; communication of results orally and in a dissertation. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2501 and pass CH2701 | | | |
| **Anti-requisite(s)** | You cannot take this module if you take CH4442 or take CH5441 or take ID4441 | | | |
| **Co-requisite(s):** | CH4441 Co-Requisite | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: Students spend a minimum of 18 hours per week of their time on the project. This time includes practical work, literature study, reading and preparation of reports and presentation. Typically, 12 to 13 hours per week are laboratory related. | | | |
| | **Scheduled learning:** 135 hours | | **Guided independent study:** 65 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 20%, Coursework = 80% | | | |
| | **As used by St Andrews:** 30-minute Practical Examination = 20%, Coursework = 80% | | | |
| **Re-assessment pattern:** | No Re-assessment available, requires lab attendance to complete coursework | | | |
| **Module coordinator:** | Dr T Van Mourik | | | |

## CH4449 Chemistry Research Project for Non-graduating Students (20)

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 20 | SCQF level 10 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Anti-requisite(s)** | You cannot take this module if you take all modules from {CH4442, CH4443, CH4444, CH4445, CH4446, CH4447, CH4448, ID4441, CH5441} | | | |
| **Learning and teaching methods of delivery:** | **Scheduled learning:** 135 hours | | **Guided independent study:** 65 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 20%, Coursework = 80% | | | |
| | **As used by St Andrews:** TBC | | | |
| **Module coordinator:** | Dr R Schaub | | | |

## CH4453 Chemistry Distance Learning (Materials Chemistry)

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 10 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Available only to students on the MChem Materials Chemistry, MChem Materials Chemistry with External Placement and BSc Materials Chemistry degree programmes. | | | |
| **Planned timetable:** | n/a - Distance Learning | | | |
| This distance-learning module allows students to develop an advanced understanding of the basic concepts of various topics in Materials Chemistry. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass at least 2 modules from {CH2501, CH2601, CH2603, CH2701} | | | |
| **Co-requisite(s):** | For programmes with an External Placement: CH4441 and CH4458 and CH4455 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: Distance learning | | | |
| | **Scheduled learning:** 0 hours | | **Guided independent study:** 100 hours | |
| **Assessment pattern:** | **As defined by QAA:**<br>Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100% | | | |
| | **As used by St Andrews:**<br>Coursework = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr E R Kay | | | |
| **Module teaching staff:** | Dr R T Baker, Prof W Zhou | | | |

## CH4455 Chemistry Distance Learning (Inorganic Chemistry)

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 10 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Available only to students on the MChem Chemistry with External Placement, MChem Chemistry with Medicinal Chemistry and External Placement and MChem Materials Chemistry with External Placement degree programmes. | | | |
| **Planned timetable:** | n/a - Distance learning | | | |
| This module offers the material covered by level 4000 BSc/MChem module CH4514 in a distance learning mode to students on the MChem one-year placement. See the module description for CH4514 for details of module content. | | | | |
| **Pre-requisite(s):** | Only Chemistry students on external placement may take this module.. Before taking this module you must pass CH2501 and pass at least 1 module from {CH2601, CH2603, CH2701} | | | |
| **Anti-requisite(s)** | You cannot take this module if you take CH4514 | | | |
| **Co-requisite(s):** | CH4455 co-requisite | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: Distance Learning | | | |
| | **Scheduled learning:** 0 hours | | **Guided independent study:** 100 hours | |
| **Assessment pattern:** | **As defined by QAA:**<br>Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100% | | | |
| | **As used by St Andrews:**<br>Coursework = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr E R Kay | | | |
| **Module teaching staff:** | Prof E Zysman-Colman, Dr B Bode | | | |

## CH4456 Chemistry Distance Learning (Organic Chemistry)

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 10 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Available only to students on the MChem Chemistry with External Placement and MChem Chemistry with Medicinal Chemistry and External Placement degree programmes. | | | |
| **Planned timetable:** | n/a - Distance Learning | | | |
| This module offers the material covered by level 4000 BSc/MChem module CH4614 in a distance learning mode to students on the MChem one-year placement. See the module description for CH4614 for details of module content. | | | | |
| **Pre-requisite(s):** | Only Chemistry students on external placement may take this module.. Before taking this module you must pass 1 module from {CH2601, CH2603} and pass at least 1 module from {CH2501, CH2701} | | | |
| **Anti-requisite(s)** | You cannot take this module if you take CH4614 | | | |
| **Co-requisite(s):** | You must also take CH4441 and take CH4458 and take CH4455 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: Distance Learning | | | |
| | **Scheduled learning:** 0 hours | | **Guided independent study:** 100 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100% | | | |
| | **As used by St Andrews:** Coursework = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr E R Kay | | | |
| **Module coordinator Email:** | ek28@st-andrews.ac.uk | | | |
| **Module teaching staff:** | Dr R A Aitken, Dr E Kay | | | |

## CH4458 Chemistry Distance Learning (Physical Chemistry)

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 10 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Available only to students on the MChem Chemistry with External Placement, MChem Chemistry with Medicinal Chemistry and External Placement, and MChem Materials Chemistry with External Placement degree programmes. | | | |
| **Planned timetable:** | n/a - Distance learning | | | |
| This module offers the material covered by level 4000 BSc/MChem module CH4716 in a distance learning mode to students on the MChem one-year External Placement. See the module description for CH4716 for details of module content. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2701 and pass 1 module from {CH2501, CH2601, CH2603} | | | |
| **Anti-requisite(s)** | You cannot take this module if you take CH4716 | | | |
| **Co-requisite(s):** | CH4454 co-requisite | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: n/a distance learning | | | |
| | **Scheduled learning:** 0 hours | | **Guided independent study:** 100 hours | |
| **Assessment pattern:** | **As defined by QAA:**<br>Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100% | | | |
| | **As used by St Andrews:**<br>Coursework (Open-book problem-solving assessment) = 100% | | | |
| **Re-assessment pattern:** | Re-assessment by oral examination. Students will be required to return to St Andrews at an appropriate time (for example at the end of their external placement) to be re-assessed. Details of reassessment as for CH4716. | | | |
| **Module coordinator:** | Dr E R Kay | | | |
| **Module teaching staff:** | Prof M Buck, Prof M Buehl | | | |

## CH4461 Integrating Chemistry

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 10 | **Semester** | 1 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This is a general chemistry module aimed at developing and consolidating fundamental aspects of basic understanding. Students will be encouraged to gain a deeper understanding of elementary core material by a combination of discussion, general reading, essay work and problem solving at a more advanced level than previously required. Students will be expected to read externally on related topics. In addition, each student will be required to submit an essay which will be on a topic relevant to the broader issues of chemical study and knowledge. The problems will apply the knowledge gained in Level 2000 Chemistry modules. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass at least 3 modules from {CH2501, CH2601, CH2603, CH2701} | | | |
| **Anti-requisite(s)** | You cannot take this module if you take CH5461 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 classes per week over 8 weeks (Weeks 3-11) and a total of 3 x 1-hour seminars | | | |
| | **Scheduled learning:** 18 hours | | **Guided independent study:** 82 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 50%, Practical Examinations = 0%, Coursework = 50% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 50%, Coursework = 50% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr R Schaub | | | |
| **Module teaching staff:** | All staff | | | |

## CH4514 Advanced Metal Chemistry

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 10 | **Semester** | 1 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module covers the heavier d-block and f-block metals and also the theory behind bonding, magnetism and electronic spectroscopy in d-block metal complexes. At the end of the module students should be in a position to understand fully the nature of bonding in d- and f-block metal systems, to understand the electronic spectra of d-block complexes and to rationalise trends in chemical properties both down and across the periodic table. The module also aims to explore the role played by inorganic systems in biology and their growing importance in medicine. There will also be discussion of the mechanisms of action of some inorganic systems in biology. | | | | |
| **Pre-requisite(s):** | Undergraduate - Before taking this module you must pass CH2501 and pass at least 1 module from {CH2601, CH2603, CH2701} | | | |
| **Anti-requisite(s)** | Undergraduate - You cannot take this module if you take CH4455 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr B E Bode | | | |
| **Module teaching staff:** | Dr J McNulty, Dr B E Bode | | | |

## CH4515 Advanced Main Group Chemistry

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 10 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module discusses the importance of and structural similarities between rings, cages and clusters particularly in main group chemistry. The general rules for predicting geometry in cage/cluster systems will be introduced and used to provide a framework for the range of systems to be discussed e.g. boranes, Zintl anions, phosphides. Further advanced topics in s and p block chemistry will be introduced, for example the stabilisation of heavier main group multiple bonds, low coordinate main group element centres, biradicaloids and use of weakly coordinating anions. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2501 and pass at least 1 module from {CH2601, CH2603, CH2701} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 tutorials in total. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr P Kilian | | | |
| **Module teaching staff:** | Dr P Kilian, Dr A Stasch | | | |

## CH4612 Blockbuster Pharmaceuticals

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 10 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| The module will discuss case studies from the most successful pharmaceutical products. How the compounds came to be discovered, what diseases they are targeting, how they work and how they are made and delivered to the market. Compounds that will feature are aspirin, penicillin, AZT, 5-flourouracil, Zantac, viagra, ?-blockers, prozac etc. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2501 and pass at least 1 module from {CH2601, CH2603, CH2701} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2hrs x 10 weeks (18 hrs), 1hr Tutorial lecture (1hr) Proposed, DOH 12 lectures Visitors (Astra Zeneca, Sygnature Chemicals, GSK), 3 x 2 = 6 lectures | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Professor D O'Hagan | | | |
| **Module teaching staff:** | Prof D O'Hagan and visiting industrial lecturers | | | |

## CH4614 Heterocyclic and Pericyclic Chemistry

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 10 | **Semester** | 1 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |

This module covers the important areas of heterocyclic and pericyclic chemistry in detail. In heterocyclic chemistry, the nomenclature and numbering of single and fused ring systems, and structure, reactivity, synthesis and applications of the main five and six-membered ring systems with one and two heteroatoms will be covered. Selected industrial syntheses of heterocyclic medicinal compounds are used to illustrate the basic principles as well as the factors to be considered in large scale synthesis. In pericyclic chemistry, a frontier molecular orbital approach based on the Woodward-Hoffmann rules will be applied to pericyclic reactions and used to provide an understanding of the energetics and stereochemistry of Diels-Alder and 1,3-dipolar cycloaddition reactions as well as electrocyclic processes and sigmatropic rearrangements. Synthetic applications of these processes will also be illustrated.

| | | |
|---|---|---|
| **Pre-requisite(s):** | Undergraduate - Before taking this module you must ( pass 1 module from {CH2601, CH2603} and pass at least 1 module from {CH2501, CH2701} ) or ( pass 2 modules from {CH2501, CH2701} and pass CH1601 or pass CH1202 ) | |
| **Anti-requisite(s)** | Undergraduate - You cannot take this module if you take CH4456 | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total, plus a half-day site visit. | |
| | **Scheduled learning:** 20 hours | **Guided independent study:** 80 hours |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | |
| **Module coordinator:** | Dr E R Kay | |
| **Module teaching staff:** | Dr E R Kay, Dr A Watson | |

## CH4615 Fragrance, Food and Colour Chemistry

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 10 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module considers three areas where applications of organic chemistry have been able to benefit society and given rise to important industries. The fragrance, perfumery and food flavouring industry will be covered from the early extraction of essential oils to the modern marketplace with an overview of the key structural features required for perfumes and flavours and some major manufacturing processes. The chemical constituents of food will be considered with an emphasis on health effects and the molecular mechanism of antioxidants, vitamins and other food constituents. The chemistry of organic dyes and pigments will be discussed including the historical development of colour compounds and how these affected society and art. Coloured compounds in nature will also be discussed. | | | | |
| **Pre-requisite(s):** | Before taking this module you must ( pass 1 module from {CH2601, CH2603} and pass at least 1 module from {CH2501, CH2701} ) or ( pass 2 modules from {CH2501, CH2701} and pass CH1601 or pass CH1202 ) | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Professor R J M Goss | | | |
| **Module teaching staff:** | Dr R A Aitken, Prof R J M Goss | | | |

## CH4715 Functional Materials and Electrons in Solids

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 10 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| The module introduces the physical concepts of dielectrics, semiconductors, and metals. Electronic properties of interfaces and thin films which are fundamental to devices such as microprocessors, lasers in CD players, or solar cells will be discussed. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2701 and pass at least 1 module from {CH2501, CH2601, CH2603} | | | |
| **Anti-requisite(s)** | You cannot take this module if you take CH4458 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr F D Morrison | | | |
| **Module teaching staff:** | Dr F D Morrison, Prof M Buck | | | |

## CH4716 Electrochemistry and Computational Chemistry

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 10 | **Semester** | 1 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| One component of the module covers electrolyte solutions and ionic conductivity, equilibrium electrochemistry, electrode processes and applications of electrochemistry. The other component is a computational element, and will introduce aspects of modern computational chemistry related to the electronic structure of atoms, molecules and solids to achieve a basic understanding of the underlying approximations made in practical calculations, and consider applications of computed structures and energies in chemistry. | | | | |
| **Pre-requisite(s):** | Before taking this module you must ( pass CH2701 and pass 1 module from {CH2501, CH2601, CH2603} ) or ( pass 2 modules from {CH2501, CH2701} and pass CH1601 or pass CH1202 ) | | | |
| **Anti-requisite(s)** | You cannot take this module if you take CH4458 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 hours of lectures (x 9 weeks) and 2 hours of tutorials over the semester. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Professor M Buck | | | |
| **Module teaching staff:** | Prof M Buck, Prof M Buehl | | | |

## CH4717 Fundamentals of the Spectroscopy of Molecules and Solids

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 10 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module describes the properties of matter relevant to their interaction with electromagnetic radiation. Absorption, transmission, reflection and diffraction of light across the electromagnetic spectrum are covered. There is a focus on microwave, infrared and NMR spectroscopy. Solid-state NMR spectroscopy will be compared with solution-state NMR and the advantages of solid-state NMR in obtaining structural information discussed. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2701 and ( pass CH2501 or pass CH2601 or pass CH2603 ) | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 hours of lectures (x 9 weeks) and 2 hours of tutorials over the semester. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-Hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Professor S E M Ashbrook | | | |
| **Module teaching staff:** | Dr R Schaub, Prof S E M Ashbrook | | | |

## CH5441 Research Project

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 60 | SCQF level 11 | **Semester** | Full Year |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | 2 days per week, to be arranged. | | | |
| The research project at Level 5000 of the MChem and MSci programmes aims to develop the students' skills in the following areas: experimental design and problem-solving; abstraction, evaluation and interpretation of data in the chemical literature; practical skills and teamwork; communication of results orally and in a dissertation. The project is supervised by a member of the academic staff. The project topic and aims will be selected by both superviser and student and a literature survey will be carried out. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass at least 2 modules from {CH2501, CH2601, CH2603, CH2701} | | | |
| **Anti-requisite(s)** | You cannot take this module if you take all modules from {CH4444, CH4445, CH4446, CH4447, CH4448, CH4449, ID4441} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: Students spend a minimum of 27 hours per week of their time on the project through semesters 1 and 2. This time includes practical work, literature study, reading and preparation of reports and presentation. Typically, 18 to 20 hours per week are laboratory related. | | | |
| | **Scheduled learning:** 220 hours | | **Guided independent study:** 374 hours | |
| **Assessment pattern:** | **As defined by QAA:**<br>Written Examinations = 0%, Practical Examinations = 20%, Coursework = 80% | | | |
| | **As used by St Andrews:**<br>1-hour Practical Examination = 20%, Coursework = 80% | | | |
| **Re-assessment pattern:** | No Re-assessment available, requires lab attendance to complete coursework | | | |
| **Module coordinator:** | Dr R Schaub | | | |
| **Module teaching staff:** | all staff | | | |

## CH5461 Integrating Chemistry

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 11 | **Semester** | 1 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This is a general chemistry module aimed at developing and consolidating fundamental aspects of basic understanding. Students will be encouraged to gain a deeper understanding of elementary core material by a combination of discussion, general reading, essay work and problem solving at a more advanced level than previously required. Students will be expected to read externally on related topics. In addition, each student will be required to submit an essay which will be on a topic relevant to the broader issues of chemical study and knowledge. The problems will apply the knowledge gained in Level 2000 Chemistry modules. | | | | |
| **Pre-requisite(s):** | Undergraduate - Before taking this module you must pass 3 modules from {CH2501, CH2601, CH2603, CH2701} | | | |
| **Anti-requisite(s)** | You cannot take this module if you take CH4461 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 classes per week over 8 weeks (Weeks 3-11) and a total of 3 x 1-hour seminars. | | | |
| | **Scheduled learning:** 18 hours | | **Guided independent study:** 82 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 50%, Practical Examinations = 0%, Coursework = 50% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 50%, Coursework = 50% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr R Schaub | | | |
| **Module teaching staff:** | All staff | | | |

## CH5511 Homogeneous Catalysis

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 11 | **Semester** | 1 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module discusses the use of metal based systems in organic transformations and a detailed treatment of homogeneous catalysis. Important processes in the petrochemicals industry will be used to exemplify the principles described. | | | | |
| **Pre-requisite(s):** | Undergraduate - Before taking this module you must pass CH2501 and pass at least 1 module from {CH2601, CH2603, CH2701} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr P B Webb | | | |
| **Module teaching staff:** | Prof R P Tooze, Dr P Webb | | | |

## CH5517 Advanced Physical Inorganic Chemistry

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 11 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module involves inorganic 'open shell' compounds including the synthesis, characterisation and applications of paramagnetic inorganic species. A number of examples including advanced electron paramagnetic resonance applications in homogeneous catalysis, bioinorganic chemistry and biophysics will be discussed. | | | | |
| **Pre-requisite(s):** | Undergraduate - Before taking this module you must pass CH2501 and pass at least 1 module from {CH2501, CH2601, CH2603}. Undergraduate - Before taking this module you must pass CH2501 and pass 1 module from {CH2501, CH2601, CH2603} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr B E Bode | | | |
| **Module teaching staff:** | Dr Bela Bode and additional speakers from BSRC (St Andrews) | | | |

## CH5518 Blockbuster Solids

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 11 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module covers two major topics. The first deals with modern materials which have a major impact on our lives, focusing on how the material's structure influences its electrical, magnetic and thermal properties. In the second section, emphasis will be placed on metal organic frameworks and how they can be used for the storage and release of gases. | | | | |
| **Pre-requisite(s):** | Undergraduate - Before taking this module you must pass CH2501 and pass at least 1 module from {CH2601, CH2603, CH2701}. Undergraduate - Before taking this module you must pass CH2501 and pass at least 1 module from {CH2601, CH2603, CH2701} | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Professor P Lightfoot | | | |
| **Module teaching staff:** | Prof P Lightfoot, Prof R E Morris | | | |

## CH5611 Asymmetric Synthesis

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 11 | **Semester** | 1 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module discusses the methods available for the synthesis of chiral compounds. After a detailed introduction to the specialised terminology and analytical methods used, the main methods using chiral auxiliaries, chiral reagents and chiral catalysts will be described. This will then be combined with a consideration of synthetic strategy and total syntheses of several complex chiral compounds will be discussed. | | | | |
| **Pre-requisite(s):** | Before taking this module you must ( pass 1 module from {CH2601, CH2603} and pass at least 1 module from {CH2501, CH2701} ) or ( pass 2 modules from {CH2501, CH2701} and pass CH1601 or pass CH1202 ) | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Professor A D Smith | | | |
| **Module teaching staff:** | Prof M L Clarke, Prof A D Smith | | | |

## CH5612 Natural Products, Biosynthesis and Enzyme Co-factors

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 11 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| The module will investigate the biosynthesis of the main natural products groups (polyketides, terpenes, alkaloids). Unifying features of their structures and biosynthesis will be described and methods for studying the biosynthesis of natural products will be taught (isotope tracer methods). The common enzyme co-factors (PLP, TPP, NADH, co-enzyme B12) will be highlighted and their mechanistic role in mediating enzymatic transformations will be explored. | | | | |
| **Pre-requisite(s):** | Before taking this module you must ( pass 1 module from {CH2601, CH2603} and pass at least 1 module from {CH2501, CH2701} ) or ( pass 2 modules from {CH2501, CH2701} and pass CH1601 or pass CH1202 ) | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Professor D O'Hagan | | | |
| **Module teaching staff:** | Prof D O'Hagan, Prof T K Smith, Dr C Lancefield | | | |

## CH5613 Reactive Intermediates

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 11 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| Aspects of the organic chemistry of the most important reactive intermediates viz.: carbo-cations, carbanions, free radicals, carbenes, nitrenes and arynes will be covered. Means of generating each type of reactive intermediate will be introduced. The key reactions of each intermediate will be reviewed and their characteristic reactions highlighted. An understanding of the use of each species in organic synthesis and of their significance in mechanistic analysis will be developed. | | | | |
| **Pre-requisite(s):** | Before taking this module you must ( pass 1 module from {CH2601, CH2603} and pass at least 1 module from {CH2501, CH2701} ) or ( pass 2 modules from {CH2501, CH2701} and pass CH1601 or pass CH1202 ) | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr R A Aitken | | | |
| **Module teaching staff:** | Dr R A Aitken, Dr I A Smellie | | | |

## CH5614 Chemical Biology

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 11 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module will examine new methodologies for drug discovery. An overview of the processes of target discovery, lead discovery and lead optimisation will be given. The use of structural biology (protein crystallography, NMR), computational chemistry and combinatorial chemistry in 'rational drug design' will be described. The module will look at the technologies behind combinatorial library design, synthesis and high throughput screening. Broad and focused libraries will be discussed. Several examples will be explored, such as the development of drugs against AIDS and influenza. | | | | |
| **Pre-requisite(s):** | Before taking this module you must ( pass 1 module from {CH2601, CH2603} and pass at least 1 module from {CH2501, CH2701} ) or ( pass 2 modules from {CH2501, CH2701} and pass CH1601 or pass CH1202 ) | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Professor N J Westwood | | | |
| **Module teaching staff:** | Prof N J Westwood, TBC | | | |

## CH5616 Molecular Recognition

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 11 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module offers a systematic introductory treatment of molecular recognition, emphasising fundamental concepts of intermolecular interactions and molecular recognition in solution. The nature, strength and directionality of orbital, hydrogen-bonding and hydrophobic interactions will be explored. Spectroscopic and other techniques for studying these interactions will be outlined with examples. | | | | |
| **Pre-requisite(s):** | Before taking this module you must ( pass 1 module from {CH2601, CH2603} and pass at least 1 module from {CH2501, CH2701} ) or ( pass 2 modules from {CH2501, CH2701} and pass CH1601 or pass CH1202 ) | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 lectures per week over 9 weeks; 2 class workshops; 2 revision classes. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr E R Kay | | | |
| **Module teaching staff:** | Prof D Philp, Dr E R Kay | | | |

## CH5711 Advanced Spectroscopic Methods

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 11 | **Semester** | 1 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module describes the importance of more advanced spectroscopic methods for the elucidation of structure and properties of increasingly complex molecules and materials. Particular attention will be paid to those techniques which exploit synchrotron radiation. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2501 and pass CH2701 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials per week. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Professor C J Baddeley | | | |
| **Module teaching staff:** | Prof C J Baddeley, Dr G Haehner | | | |

## CH5713 Surface Science and Heterogeneous Catalysis

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 11 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| The module describes the Chemistry of solid surfaces with particular reference to the structure of metal, oxide and semiconductor surfaces. The techniques available to characterise the uppermost atomic layers of a solid are presented and the novel reactivity of surfaces is linked to applications in sensors, electronic devices, heterogeneous catalysis as well as the processes of corrosion, friction and wear. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2501 and pass CH2701 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Professor C J Baddeley | | | |
| **Module teaching staff:** | Prof C J Baddeley, Prof P A Wright | | | |

## CH5714 Chemical Applications of Electronic Structure Calculations

| | | | | |
|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 11 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module will build on the foundations laid in CH2701 and CH3712 and introduce further aspects and methods of modern computational chemistry related to the electronic structures of atoms and molecules. It will be shown how results of such calculations can be used to complement, interpret, and guide experiments in many areas of chemistry. | | | | |
| **Pre-requisite(s):** | Undergraduate - Before taking this module you must pass CH2501 and pass CH2701 and pass CH3712 and pass CH3717. Undergraduate - Before taking this module you must pass CH2501 and pass CH2701 and pass CH3712 and pass CH3717 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Professor M Buehl | | | |
| **Module teaching staff:** | Prof M Buehl, Dr J B O Mitchell | | | |

## CH5715 Energy Conversion and Storage

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 11 | **Semester** | 2 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| In our efforts to mitigate global warming it is essential to develop new and improved methods of generation and storage of energy. Foremost among these methods are the electrochemical technologies of batteries and fuel cells. In this module we will discuss the technical details and applications of such devices. Particular emphasis will be placed on the underlying electrochemistry and materials chemistry. | | | | |
| **Pre-requisite(s):** | Undergraduate - Before taking this module you must pass CH2501 and pass CH2701. Undergraduate - Before taking this module you must pass CH2501 and pass CH2701 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Dr R T Baker | | | |
| **Module teaching staff:** | Dr R T Baker, Dr A R Armstrong, Dr Julia Payne | | | |

## CH5716 Processing of Materials

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| **SCOTCAT Credits:** | 10 | SCQF level 11 | **Semester** | 1 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module focuses on the processing of materials, ceramics in particular. Fundamental properties such as crystallinity, composition, crystal phase, phase mixing, domain structure, grains and grain boundaries, as well as porosity will be covered. The main methods used to control these properties in order to develop and improve materials for specific applications will be addressed. Processes such as calcination, sintering, annealing, plasma treatments, mechanical working, crystallisation and dopant addition will be addressed. A discussion will be made on the influence of these processes on specific ceramic systems using phase diagrams. Specific techniques for preparation of bulk and thinner components, including sol-gel method, casting, extrusion, physical and chemical vapor deposition, screen printing or tape casting will be discussed. The role of various aspects of materials processing and their influence on the material and its integration in practical devices will be addressed. | | | | |
| **Pre-requisite(s):** | Undergraduate - Before taking this module you must pass CH2501 and pass CH2701 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:** Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:** 2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Professor J T S Irvine | | | |
| **Module teaching staff:** | Prof J T S Irvine, Dr C Savaniu | | | |

## CH5717 Nanostructured Materials

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|---|---|---|---|---|
| **SCOTCAT Credits:** | 10 | SCQF level 11 | **Semester** | 1 |
| **Academic year:** | 2021-2022 | | | |
| **Availability restrictions:** | Not automatically available to General Degree students | | | |
| **Planned timetable:** | To be arranged. | | | |
| This module will introduce the concepts and science behind the design and synthesis of a wide range of nanostructures and the application of these structures in functional materials and devices. The relationship between nanoscale structure and composition and macroscale properties and behaviour will be emphasised. Structures will be classified and introduced in terms of their number of dimensions: clusters, nanoparticles and quantum dots (0-D); nanotubes, nanowires and nanorods (1-D); nanosheets and films (2-D); and porous crystals, mesoporous structures and metal-organic frameworks (3-D). Other specific topics will include the science of clusters, molecular assemblies and assemblies of nanostructures. Novel carbon based materials, including simple and functionalised fullerenes, carbon nanotubes and graphene and related materials will be described and their physical and chemical properties related to their structure and bonding. Advanced characterisation techniques and applications related to nanotechnology, MEMs, biomaterials, catalysis, and optical and magnetic devices will be addressed. | | | | |
| **Pre-requisite(s):** | Before taking this module you must pass CH2501 and pass CH2701 | | | |
| **Learning and teaching methods of delivery:** | **Weekly contact**: 2 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) and 2 - 3 tutorials in total. | | | |
| | **Scheduled learning:** 20 hours | | **Guided independent study:** 80 hours | |
| **Assessment pattern:** | **As defined by QAA:**<br>Written Examinations = 100%, Practical Examinations = 0%, Coursework = 0% | | | |
| | **As used by St Andrews:**<br>2-hour Written Examination = 100% | | | |
| **Re-assessment pattern:** | Oral Re-assessment = 100% | | | |
| **Module coordinator:** | Professor W Zhou | | | |
| **Module teaching staff:** | Prof W Zhou, Prof M Buck | | | |