

School of Chemistry

General degree students wishing to enter 3000-level modules and non-graduating students wishing to enter 3000-level or 4000-level modules must consult with the relevant Honours Adviser within the School to confirm they are properly qualified to enter the module.

Chemistry (CH) modules

CH3431 Chemistry Workshop				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	Whole Year
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.				
Programme module type:	Compulsory for Biomolecular Science, Chemical Sciences, Chemistry, Chemistry and Geology, Chemistry with External Placement, Chemistry with Medicinal Chemistry, Chemistry with Medicinal Chemistry and External Placement, Chemistry and Physics, Materials Chemistry, Materials Chemistry with External Placement. Optional for Chemistry and Mathematics, Chemistry with French, Chemistry with French and External Placement, Chemistry with Mathematics.			
Pre-requisite(s):	Passes in at least two of CH2501, (CH2601 or CH2603) and CH2701			
Learning and teaching methods and delivery:	Weekly contact: 2 seminars and 1 or 2 lectures, and occasional tutorials, through afternoons of Semester 1 and afternoons (weeks 1 - 7) of Semester 2.			
	Scheduled learning: 50 hours		Guided independent study: 50 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 100%, Coursework = 0%			
	As used by St Andrews: 5 x 1-hour Practical Examinations = 100%			
Module Co-ordinator:	Dr R A Aitken			
Lecturer(s)/Tutor(s):	Dr R A Aitken, Dr T Lebl, Prof M Buehl, Prof P Lightfoot, Prof W Zhou, Prof P A Wright, Prof D Philp, Dr C H Botting, Prof S E M Ashbrook, Dr C Cazin			

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CH3441 Mini Chemistry Project			
SCOTCAT Credits:	20	SCQF Level 9	Semester: 2
Planned timetable:	9.00 am - 1.00 pm Mon - Fri for 4 weeks (Weeks 8 - 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.			
Programme module type:	Compulsory for Chemical Sciences, Chemistry, Chemistry with Medicinal Chemistry, Chemistry with French, Materials Chemistry, Chemistry with External Placement, Chemistry with French and External Placement, Chemistry with Mathematics, Chemistry with Medicinal Chemistry and External Placement, Chemistry and Physics, Materials Chemistry with External Placement. Optional for Chemistry and Mathematics.		
Pre-requisite(s):	Passes in at least two of CH2501, (CH2601 or CH2603) and CH2701		
Learning and teaching methods and delivery:	Weekly contact: 4 hours x 5 days (Weeks 8 - 11)		
	Scheduled learning: 80 hours	Guided independent study: 120 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%		
Module Co-ordinator:	Dr M L Clarke		
Lecturer(s)/Tutor(s):	A selection of the Academic Staff		

CH3512 Organometallic Chemistry				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	1
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 haptic 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.				
Programme module type:	Compulsory for Chemical Sciences, Chemistry, Chemistry with External Placement, Chemistry with Medicinal Chemistry, Chemistry with Medicinal Chemistry and External Placement, Chemistry and Physics. Optional for Chemistry and Mathematics, Chemistry with French, Chemistry with French and External Placement, Chemistry with Mathematics.			
Pre-requisite(s):	Passes in CH2501 and at least one of (CH2601 or CH2603) and CH2701			
Learning and teaching methods and delivery:	Weekly contact: 1 - 3 lectures per week over 9 - 10 weeks within Weeks 1 - 11 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%			
Module Co-ordinator:	Prof S P Nolan			
Lecturer(s)/Tutor(s):	Prof S P Nolan, Prof P C J Kamer			

CH3513 Advanced Solid State Chemistry				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	1
Planned timetable:	To be arranged.			
This module on Advanced Solid State Chemistry brings together a number of advanced concepts including advanced crystal chemistry, electronic effects, phase equilibria and extended defects. It is key to the understanding of both modern solid state chemistry and materials science.				
Programme module type:	Compulsory for Materials Chemistry, Materials Chemistry with External Placement.			
Pre-requisite(s):	Passes in CH2501 and at least one of (CH2601 or CH2603) and CH2701			
Required for:	CH5716			
Learning and teaching methods and delivery:	Weekly contact: 1 - 3 lectures per week over 9 - 10 weeks (within Weeks 1-11) 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%			
Module Co-ordinator:	Dr P A Connor			
Lecturer(s)/Tutor(s):	Dr P A Connor, Dr R T Baker			

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CH3514 Physical Inorganic Chemistry				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	2
Planned timetable:	To be arranged.			
<p>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.</p>				
Programme module type:	<p>Compulsory for Chemical Sciences, Chemistry, Chemistry and Geology, Materials Chemistry, Chemistry with External Placement, Chemistry with Medicinal Chemistry, Chemistry with Medicinal Chemistry and External Placement, Materials Chemistry with External Placement, Chemistry and Physics.</p> <p>Optional for Chemistry and Mathematics, Chemistry with French, Chemistry with French and External Placement, Chemistry with Mathematics.</p>			
Pre-requisite(s):	Passes in CH2501 and at least one of (CH2601 or CH2603) and CH2701			
Learning and teaching methods and delivery:	Weekly contact: 2 - 3 lectures per week over 5 - 7 weeks (Weeks 1-7) and 2 - 3 tutorials in total.			
	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%			
Module Co-ordinator:	Dr B E Bode			
Lecturer(s)/Tutor(s):	Dr B E Bode, Dr E Zysman-Colman			

CH3521 Inorganic Chemistry Laboratory				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	2
Planned timetable:	9.00 am - 12.00 noon or 1.00 pm Mon to Fri (Weeks 1 - 6)			
This module comprises practical experiments involving synthesis, characterisation and measurements in inorganic chemistry.				
Programme module type:	Compulsory for Chemical Sciences, Chemistry, Chemistry and Geology, Chemistry with Medicinal Chemistry, Chemistry with External Placement, Chemistry with Medicinal Chemistry, Chemistry with Medicinal Chemistry and External Placement, Materials Chemistry, Materials Chemistry with External Placement. Optional for Chemistry and Mathematics, Chemistry with French, Chemistry with French and External Placement, Chemistry with Mathematics.			
Pre-requisite(s):	Passes in CH2501 and at least one of (CH2601 or CH2603) and CH2701			
Learning and teaching methods and delivery:	Weekly contact: Daily 3- or 4-hour morning practical classes (Weeks 1 - 6).			
	Scheduled learning: 90 hours		Guided independent study: 10 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Dr P Kilian			
Lecturer(s)/Tutor(s):	Dr P Kilian, Dr E Zysman-Colman, Dr F Laibe, Prof P Kamer			

CH3612 Synthetic Methodology				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	2
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.				
Programme module type:	Compulsory for Biomolecular Science, Chemical Sciences, Chemistry, Chemistry with Medicinal Chemistry, Chemistry with External Placement, Chemistry with Medicinal Chemistry, Chemistry with Medicinal Chemistry and External Placement . Optional for Chemistry with French, Chemistry with French and External Placement.			
Pre-requisite(s):	Passes in (CH2601 or CH2603) and at least one of CH2501 and CH2701			
Learning and teaching methods and 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%			
Module Co-ordinator:	Prof N J Westwood			
Lecturer(s)/Tutor(s):	Prof N J Westwood, Dr M L Clarke			

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CH3613 Carbohydrate and Nucleic Acid Chemistry				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	2
Planned timetable:	To be arranged.			
<p>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.</p>				
Programme module type:	Compulsory for Biomolecular Science, Chemistry with Medicinal Chemistry, Chemistry with Medicinal Chemistry and External Placement.			
Pre-requisite(s):	Passes in (CH2601 or CH2603) and at least one of CH2501 and CH2701			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr G J Florence			
Lecturer(s)/Tutor(s):	Dr G J Florence, Dr E R Kay			

CH3615 Mechanism in Organic Chemistry				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	1
Planned timetable:	To be arranged.			
<p>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.</p>				
Programme module type:	<p>Compulsory for Biomolecular Science, Chemical Sciences, Chemistry, Chemistry with Medicinal Chemistry, Chemistry with External Placement, Materials Chemistry, Materials Chemistry with External Placement, Chemistry with Medicinal Chemistry and External Placement, Chemistry and Physics.</p> <p>Optional for Chemistry and Mathematics, Chemistry with French, Chemistry with French and External Placement, Chemistry with Mathematics, Materials Chemistry MChem.</p>			
Pre-requisite(s):	Either passes in (CH2601 or CH2603) and at least one of (CH2501 and CH2701), or (CH2501 and CH2701) for students on the Chemistry and Physics programme only			
Learning and teaching methods and delivery:	Weekly contact: 1 - 3 lectures per week over 9 - 10 weeks within Weeks 1-11 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%			
Module Co-ordinator:	Prof D Philp			
Lecturer(s)/Tutor(s):	Prof D Philp, Prof A D Smith			

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CH3621 Organic Chemistry Laboratory				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	1
Planned timetable:	9.00 am - 12.00 noon or 1.00 pm Mon to Fri (Weeks 1-5)			
Practical experiments involving synthesis, characterisation and measurements in organic chemistry.				
Programme module type:	Compulsory for Biomolecular Science, Chemical Sciences, Chemistry, Chemistry with Medicinal Chemistry, Chemistry with External Placement, Chemistry with Medicinal Chemistry and External Placement. Optional for Chemistry and Mathematics, Chemistry with French, Chemistry with French and External Placement, Chemistry with Mathematics.			
Pre-requisite(s):	Passes in (CH1601 or CH1202) and at least two of CH2501, (CH2601 or CH2603), CH2701			
Anti-requisite(s):	CH3622			
Learning and teaching methods and delivery:	Weekly contact: Daily 3- or 4-hour morning practical classes over 5 weeks (Weeks 1-5).			
	Scheduled learning: 90 hours		Guided independent study: 10 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Dr M L Clarke			
Lecturer(s)/Tutor(s):	Dr M L Clarke, Dr I A Smellie			

CH3622 Organic Chemistry Laboratory (Materials)				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	1
Planned timetable:	9.00 am - 12.00 noon or 1.00 pm Mon to Fri (Weeks 1-5)			
Practical experiments involving synthesis, characterisation and measurements in organic chemistry with a particular emphasis on organic materials. Students will perform a selection of the experiments undertaken by CH3621 students in addition to 3-4 special materials experiments.				
Programme module type:	Compulsory for Materials Chemistry, Materials Chemistry with External Placement.			
Pre-requisite(s):	Passes in (CH2601 or CH2603) and at least one of CH2501 and CH2701			
Anti-requisite(s):	CH3621			
Learning and teaching methods and delivery:	Weekly contact: Daily 3- or 4-hour morning practical classes over 5 weeks (Weeks 1-5).			
	Scheduled learning: 90 hours		Guided independent study: 10 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Dr M L Clarke			
Lecturer(s)/Tutor(s):	Dr M L Clarke, Dr I A Smellie			

CH3712 Quantum Theory of Atoms, Molecules and Solids				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	2
Planned timetable:	To be arranged.			
<p>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.</p>				
Programme module type:	<p>Compulsory for Chemical Sciences, Chemistry, Materials Chemistry, Chemistry and Geology, Chemistry with External Placement, Chemistry and Physics, Materials Chemistry with External Placement.</p> <p>Optional for Chemistry and Mathematics, Chemistry with French, Chemistry with French and External Placement, Chemistry with Mathematics.</p>			
Pre-requisite(s):	Passes in CH2701 and at least one of CH2501 and (CH2601 or CH2603)			
Required for:	CH5714			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr G Haehner			
Lecturer(s)/Tutor(s):	Dr F D Morrison, Dr G Haehner			

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CH3715 Introduction to Analysis of Materials				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	2
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 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.				
Programme module type:	Compulsory for Materials Chemistry, Materials Chemistry with External Placement. Optional for Chemistry and Mathematics, Chemistry with Mathematics.			
Pre-requisite(s):	Passes in CH2701 and at least one of CH2501 and (CH2601 or CH2603)			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr R T Baker			
Lecturer(s)/Tutor(s):	Dr R T Baker			

CH3716 Quantitative Aspects of Medicinal Chemistry				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	1
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.				
Programme module type:	Compulsory for Biomolecular Science, Chemistry with Medicinal Chemistry, Chemistry with Medicinal Chemistry and External Placement.			
Pre-requisite(s):	Passes in at least two of CH2501, CH2601, CH2701			
Anti-requisite(s):	CH3717			
Learning and teaching methods and delivery:	Weekly contact: 1 - 3 lectures per week over 9 - 10 weeks within Weeks 1-11 and 2 - 3 tutorials in total.			
	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%			
Module Co-ordinator:	Dr T van Mourik			
Lecturer(s)/Tutor(s):	Dr T van Mourik, Dr F M Gray, Prof N J Westwood			

CH3717 Statistical Mechanics and Computational Chemistry				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	1
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.				
Programme module type:	Compulsory for Chemical Sciences, Chemistry, Chemistry and Geology, Materials Chemistry, Chemistry with External Placement, Chemistry and Physics, Materials Chemistry with External Placement. Optional for Chemistry and Mathematics, Chemistry with French, Chemistry with French and External Placement, Chemistry with Mathematics.			
Pre-requisite(s):	Passes in CH2701 and at least one of CH2501 and (CH2601 or CH2603)			
Anti-requisite(s):	CH3716	Required for:	CH5714	
Learning and teaching methods and delivery:	Weekly contact: 1 - 3 lectures per week over 9 - 10 weeks within Weeks 1-11 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%			
Module Co-ordinator:	Dr T van Mourik			
Lecturer(s)/Tutor(s):	Dr T van Mourik, Dr J B O Mitchell			

CH3721 Physical Chemistry Laboratory				
SCOTCAT Credits:	10	SCQF Level 9	Semester:	1
Planned timetable:	9.00 am - 12.00 noon or 1.00 pm Mon to Fri (Weeks 6-10)			
This module comprises practical experiments involving physical measurements and the use of computational programmes in Chemistry.				
Programme module type:	Compulsory for Chemical Sciences, Chemistry, Chemistry and Geology, Chemistry with Medicinal Chemistry, Chemistry with External Placement, Chemistry with Medicinal Chemistry and External Placement, Materials Chemistry, Materials Chemistry with External Placement, Chemistry and Physics. Optional for Chemistry and Mathematics, Chemistry with French, Chemistry with French and External Placement, Chemistry with Mathematics.			
Pre-requisite(s):	Passes in CH2701 and at least one of CH2501 and (CH2601 or CH2603)			
Learning and teaching methods and delivery:	Weekly contact: Daily 3- or 4-hour morning practical classes over 5 weeks (Weeks 6-10).			
	Scheduled learning: 90 hours		Guided independent study: 10 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 0%, Practical Examinations = 0%, Coursework = 100%			
	As used by St Andrews: Coursework = 100%			
Module Co-ordinator:	Prof P A Wright			
Lecturer(s)/Tutor(s):	Prof P A Wright, Prof M Buck, Dr R Schaub, Dr T van Mourik, Prof M Buehl			

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CH4441 External Placement				
SCOTCAT Credits:	90	SCQF Level 10	Semester:	Whole Year
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.				
Programme module type:	Compulsory for Chemistry with External Placement, Chemistry with French with External Placement, Chemistry with Medicinal Chemistry and External Placement, Materials Chemistry with External Placement.			
Pre-requisite(s):	Passes in at least two of CH2501, (CH2601 or CH2603), CH2701			
Co-requisite(s):	CH4454 and CH4455 and (CH4453 or CH4456) or FR5810			
Learning and teaching methods and delivery:	This is a Study Abroad or Work 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%			
Module Co-ordinator:	Dr G Haehner			

CH4442 Chemistry Research Project				
SCOTCAT Credits:	50	SCQF Level 10	Semester:	Whole Year
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.				
Programme module type:	Compulsory for Biomolecular Science, Chemical Sciences, Chemistry, Chemistry and Mathematics, Chemistry with Medicinal Chemistry, Chemistry with French, Materials Chemistry, Chemistry with Mathematics.			
Pre-requisite(s):	Passes in at least two of CH2501, (CH2601 or CH2603), CH2701			
Anti-requisite(s):	CH4441, CH4444 - CH4449, ID4441			
Learning and teaching methods and delivery:	Weekly contact: Students spend a minimum of 22.5 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, 15 to 17 hours per week are laboratory related.			
	Scheduled learning: 340 hours		Guided independent study: 160 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%			
Module Co-ordinator:	Dr T van Mourik and Dr R Schaub			

CH4444 Chemistry Research Project for Non-graduating Students (60)				
SCOTCAT Credits:	60	SCQF Level 10	Semester:	1 & 2 (taught twice)
Availability restrictions:	Available only for 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.				
Programme module type:	Available only for Non-graduating Students			
Anti-requisite(s):	CH4442, CH4445 - CH4449, ID4441, CH5441			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr T van Mourik and Dr R Schaub			

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CH4445 Chemistry Research Project for Non-graduating Students (90)				
SCOTCAT Credits:	90	SCQF Level 10	Semester:	Whole Year
Availability restrictions:	Available only for 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.				
Programme module type:	Available only for Non-graduating Students			
Anti-requisite(s):	CH4442, CH4444, CH4446 - CH4449, ID4441, CH5441			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr T van Mourik and Dr R Schaub			

CH4446 Chemistry Research Project for Non-graduating Students (120)				
SCOTCAT Credits:	120	SCQF Level 10	Semester:	Whole Year
Availability restrictions:	Available only for 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.				
Programme module type:	Available only for Non-graduating Students			
Anti-requisite(s):	CH4442 - CH4445, CH4448, CH4449, ID4441, CH5441			
Co-requisite(s):		Required for:		
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr T van Mourik and Dr R Schaub			

CH4448 Chemistry Project for Chemistry and Geology				
SCOTCAT Credits:	20	SCQF Level 10	Semester:	1
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.				
Programme module type:	Either (ES4010 and CH4448) or ID4441 are compulsory for Chemistry and Geology.			
Pre-requisite(s):	Passes in CH2501 and CH2701	Co-requisite(s):	ES4010	
Anti-requisite(s):	CH4442, CH5441, ID4441			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr T van Mourik and Dr R Schaub			

CH4449 Chemistry Research Project for Non-graduating Students (20)				
SCOTCAT Credits:	20	SCQF Level 10	Semester:	Whole Year
Availability restrictions:	Available only to Non-graduating Students where there is a specific degree programme requirement. Permission to take this module is required from the Director of Teaching.			
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.				
Programme module type:	With permission, and only for Non-graduating Students			
Anti-requisite(s):	CH4442 - CH4448, CH5441, ID4441			
Learning and teaching methods and delivery:	Weekly contact: Students spend a minimum of 9 hours per week of their time on the project. This time includes practical work, literature study, reading and preparation of reports and presentation. Typically, 6 to 7 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 Oral Examination = 20%, Coursework = 80%			
Module Co-ordinator:	Dr T van Mourik and Dr R Schaub			
Lecturer(s)/Tutor(s):	Teaching staff			

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CH4453 Chemistry Distance Learning (Materials Chemistry)				
SCOTCAT Credits:	10	SCQF Level 10	Semester:	Whole Year
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 Materials Chemistry. It aims to build on students' fundamental knowledge of metals and ceramics.				
Programme module type:	Compulsory for MChem in Materials Chemistry, MChem in Materials Chemistry with External Placement, BSc Materials Chemistry.			
Pre-requisite(s):	Passes in at least two of CH2501, (CH2601 or CH2603), CH2701			
Co-requisite(s):	For programmes with an External Placement: CH4441 and CH4454 and CH4455	Anti-requisite(s):	CH4452	
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr F M Gray			
Lecturer(s)/Tutor(s):	Dr F D Morrison, Dr R T Baker			

CH4454 Chemistry Distance Learning (Physical Chemistry)				
SCOTCAT Credits:	10	SCQF Level 10	Semester:	Whole Year
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 CH4714 in a distance learning mode to students on the MChem one-year placement. See the module description for CH4714 for details of module content.				
Programme module type:	Compulsory for MChem Chemistry with External Placement, MChem Chemistry with Medicinal Chemistry and External Placement and MChem Materials Chemistry with External Placement.			
Pre-requisite(s):	Passes in CH2701 and at least one of CH2501, (CH2601 or CH2603)			
Co-requisite(s):	CH4441, CH4455 and (CH4456 or CH4453)	Anti-requisite(s):	CH4714, CH4451	
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr F M Gray			
Lecturer(s)/Tutor(s):	Dr F M Gray			

CH4455 Chemistry Distance Learning (Inorganic Chemistry)				
SCOTCAT Credits:	10	SCQF Level 10	Semester:	Whole Year
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.				
Programme module type:	Compulsory for MChem Chemistry with External Placement, MChem Chemistry with Medicinal Chemistry and External Placement and MChem Materials Chemistry with External Placement.			
Pre-requisite(s):	Passes in CH2501 and at least one of (CH2601 or CH2603), CH2701			
Co-requisite(s):	CH4441, CH4454 and (CH4456 or CH4453)	Anti-requisite(s):	CH4514, CH4451	
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr F M Gray			
Lecturer(s)/Tutor(s):	Prof S Nolan, Dr B Bode			

CH4456 Chemistry Distance Learning (Organic Chemistry)				
SCOTCAT Credits:	10	SCQF Level 10	Semester:	Whole Year
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.				
Programme module type:	Compulsory for MChem Chemistry with External Placement and MChem Chemistry with Medicinal Chemistry and External Placement.			
Pre-requisite(s):	Passes in (CH2601 or CH2603) and at least one of CH2501, CH2701			
Co-requisite(s):	CH4441 and CH4454 and CH4455	Anti-requisite(s):	CH4614, CH4451	
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr F M Gray			
Lecturer(s)/Tutor(s):	Dr R A Aitken, Dr E Kay			

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CH4461 Integrating Chemistry				
SCOTCAT Credits:	10	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
<p>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.</p>				
Programme module type:	Compulsory for Chemistry BSc, Chemistry with Medicinal Chemistry BSc, Materials Chemistry BSc. Optional for Chemistry with French BSc.			
Pre-requisite(s):	Passes in CH2501, (CH2601 or CH2603), CH2701			
Anti-requisite(s):	CH5461			
Learning and teaching methods and delivery:	Weekly contact: 2 classes per week over 9 weeks (Weeks 3-11) and a total of 3 x 1-hour seminars			
	Scheduled learning: 21 hours		Guided independent study: 79 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 60%, Practical Examinations = 0%, Coursework = 40%			
	As used by St Andrews: 2-hour Written Examination = 60%, Coursework = 40%			
Module Co-ordinator:	Dr F D Morrison			
Lecturer(s)/Tutor(s):	all staff			

CH4514 Advanced Metal Chemistry				
SCOTCAT Credits:	10	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
<p>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.</p>				
Programme module type:	Compulsory for Chemical Sciences, Chemistry, Chemistry with Medicinal Chemistry, Chemistry with French MChem, Materials Chemistry. Optional for Chemistry and Geology, Chemistry and Mathematics, Chemistry with French BSc, Chemistry with Mathematics.			
Pre-requisite(s):	Passes in CH2501 and at least one of (CH2601 or CH2603), CH2701			
Anti-requisite(s):	CH4451, CH4511, CH4455			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr B E Bode			
Lecturer(s)/Tutor(s):	Prof S P Nolan, Dr B E Bode			

CH4515 Advanced Main Group Chemistry				
SCOTCAT Credits:	10	SCQF Level 10	Semester:	2
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.				
Programme module type:	Compulsory for Materials Chemistry, Chemistry with Medicinal Chemistry MChem. Optional for Chemical Sciences, Chemistry, Chemistry and Mathematics, Chemistry with French, Chemistry with Mathematics.			
Pre-requisite(s):	Passes in CH2501 and at least one of (CH2601 or CH2603), CH2701			
Anti-requisite(s):	CH5513			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr P Kilian			
Lecturer(s)/Tutor(s):	Dr P Kilian			

CH4612 Blockbuster Pharmaceuticals				
SCOTCAT Credits:	10	SCQF Level 10	Semester:	2
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-fluorouracil, Zantac, viagra, β -blockers, prozac etc.				
Programme module type:	Compulsory for Chemistry with Medicinal Chemistry. Optional for Biomolecular Science, Chemical Sciences, Chemistry and Mathematics, Chemistry MChem, Chemistry with French, Chemistry with Mathematics			
Pre-requisite(s):	Passes in CH2501 and at least one of (CH2601 or CH2603), CH2701			
Anti-requisite(s):	CH5615			
Learning and teaching methods and 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%			
Module Co-ordinator:	Prof D O'Hagan			
Lecturer(s)/Tutor(s):	Prof D O'Hagan and visiting industrial lecturers			

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CH4614 Heterocyclic and Pericyclic Chemistry			
SCOTCAT Credits:	10	SCQF Level 10	Semester: 1
Planned timetable:	To be arranged.		
<p>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.</p>			
Programme module type:	Compulsory for Chemical Sciences, Chemistry, Chemistry with French MChem, Chemistry with Medicinal Chemistry. Optional for Biomolecular Science, Chemistry and Mathematics, Chemistry with French BSc, Chemistry with Mathematics.		
Pre-requisite(s):	Either passes in (CH2601 or CH2603) and at least one of CH2501, CH2701 or passes in CH2501, CH2701 and (CH1601 or CH1202)		
Anti-requisite(s):	CH4611, CH4451, CH4456		
Learning and teaching methods and 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%		
Module Co-ordinator:	Dr R A Aitken		
Lecturer(s)/Tutor(s):	Dr R A Aitken, Dr E R Kay		

CH4615 Fragrance, Food and Colour Chemistry				
SCOTCAT Credits:	10	SCQF Level 10	Semester:	2
Planned timetable:	To be arranged.			
<p>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.</p>				
Programme module type:	Compulsory for Chemistry with Medicinal Chemistry. Optional for Biomolecular Science, Chemical Sciences, Chemistry, Chemistry and Mathematics, Chemistry with French, Chemistry with Mathematics, Sustainable Development.			
Pre-requisite(s):	Either passes in (CH2601 or CH2603) and at least one of CH2501, CH2701, or passes in CH2501, CH2701 and (CH1601 or CH1202)			
Anti-requisite(s):	CH4613			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr R A Aitken			
Lecturer(s)/Tutor(s):	Dr R A Aitken, Dr R J M Goss, Dr T K Smith			

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CH4713 Interactions of Light with Matter				
SCOTCAT Credits:	10	SCQF Level 10	Semester:	2
Planned timetable:	To be arranged.			
This module describes the fascinating properties of matter relevant to their interaction with electromagnetic radiation. Absorption, transmission, reflection and diffraction of light across the electromagnetic spectrum is covered. The properties of matter, particularly in the gas and solid phases, which are important for the emission, modification and transport of light are discussed at the atomic and molecular level.				
Programme module type:	Compulsory for Materials Chemistry, Chemistry and Physics. Optional for Chemical Sciences, Chemistry, Chemistry and Mathematics, Chemistry with French, Chemistry with Mathematics.			
Pre-requisite(s):	Passes in CH2701 and at least one of CH2501, (CH2601 or CH2603)			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr R Schaub			
Lecturer(s)/Tutor(s):	Prof M Buehl, Dr R Schaub			

CH4714 Conductivity, Electrochemical Processes and the Structure of Polymers				
SCOTCAT Credits:	10	SCQF Level 10	Semester:	1
Planned timetable:	To be arranged.			
This module covers electrolyte solutions and ionic conductivity, equilibrium electrochemistry and electrode processes, and, the synthesis, classification and structure of polymers.				
Programme module type:	Compulsory for Chemical Sciences, Chemistry, Chemistry with French, Materials Chemistry, Chemistry with Medicinal Chemistry, Chemistry and Physics. Optional for Chemistry and Geology, Chemistry and Mathematics, Chemistry with Mathematics.			
Pre-requisite(s):	Either passes in (CH2601 or CH2603) and at least one of CH2501, CH2701 or passes in CH2501, CH2701 and (CH1601 or CH1202)			
Anti-requisite(s):	CH4451, CH4454, CH4711			
Learning and teaching methods and delivery:	Weekly contact: 2 - 3 lectures per week over 9 - 10 weeks 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%			
Module Co-ordinator:	Dr F M Gray			
Lecturer(s)/Tutor(s):	Dr F M Gray			

CH4715 Functional Materials and Electrons in Solids				
SCOTCAT Credits:	10	SCQF Level 10	Semester:	2
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.				
Programme module type:	Compulsory for Materials Chemistry, Chemistry and Physics. Optional for Chemical Sciences, Chemistry, Chemistry and Mathematics, Chemistry and Geology, Chemistry with French, Chemistry with Mathematics.			
Pre-requisite(s):	Either: passes in CH2701 and at least one of CH2501, (CH2601 or CH2603)			
Anti-requisite(s):	CH5712			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr F D Morrison			
Lecturer(s)/Tutor(s):	Dr F D Morrison, Prof M. Buck			

CH5441 Research Project				
SCOTCAT Credits:	50	SCQF Level 11	Semester:	Whole Year
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 supervisor and student and a literature survey will be carried out.				
Programme module type:	Compulsory for Chemistry with French MChem, Chemistry with External Placement, Chemistry with French and External Placement, Chemistry with Mathematics, Chemistry with Medicinal Chemistry MChem, Chemistry MChem, Chemistry with Medicinal Chemistry and External Placement, Chemistry and Physics MSci(or PH5101), Materials Chemistry with External Placement, Materials Chemistry MChem.			
Pre-requisite(s):	Passes in at least two of CH2501, (CH2601 or CH2603), CH2701			
Learning and teaching methods and delivery:	Weekly contact: Students spend a minimum of 22.5 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, 15 to 17 hours per week are laboratory related.			
	Scheduled learning: 340 hours		Guided independent study: 160 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%			
Module Co-ordinator:	Dr T van Mourik and Dr R Schaub			
Lecturer(s)/Tutor(s):	all staff			

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CH5461 Integrating Chemistry			
SCOTCAT Credits:	10	SCQF Level 11	Semester: 1
Planned timetable:	To be arranged.		
<p>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.</p>			
Programme module type:	Compulsory for Chemistry MChem, Chemistry with Medicinal Chemistry MChem, Chemistry with Medicinal Chemistry and External Placement, Chemistry with French MChem, Chemistry with External Placement, Chemistry with French and External Placement, Chemistry with Mathematics, Materials Chemistry MChem, Materials Chemistry with External Placement.		
Pre-requisite(s):	Passes in CH2501, (CH2601 or CH2603), CH2701		
Anti-requisite(s):	CH4461		
Learning and teaching methods and delivery:	Weekly contact: 2 classes per week over 9 weeks (Weeks 3-11) and a total of 3 x 1-hour seminars.		
	Scheduled learning: 21 hours	Guided independent study: 79 hours	
Assessment pattern:	As defined by QAA: Written Examinations = 60%, Practical Examinations = 0%, Coursework = 40%		
	As used by St Andrews: 2-hour Written Examination = 60%, Coursework = 40%		
Module Co-ordinator:	Dr F D Morrison		
Lecturer(s)/Tutor(s):	all staff		

CH5511 Homogeneous Catalysis				
SCOTCAT Credits:	10	SCQF Level 11	Semester:	1
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.				
Programme module type:	Compulsory for Chemistry MChem, Chemistry with External Placement, Chemistry with Medicinal Chemistry MChem, Chemistry with Medicinal Chemistry and External Placement. Optional for Chemistry with French MChem, Chemistry with French and External Placement, Chemistry with Mathematics, Materials Chemistry MChem, Materials Chemistry with External Placement.			
Pre-requisite(s):	Passes in CH2501 and at least one of (CH2601 or CH2603), CH2701			
Learning and teaching methods and 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%			
Module Co-ordinator:	Prof P C J Kamer			
Lecturer(s)/Tutor(s):	Prof P C J Kamer, Prof R P Tooze			

CH5516 Advanced Ligand Design				
SCOTCAT Credits:	10	SCQF Level 11	Semester:	2
Planned timetable:	To be arranged.			
Phosphines and carbenes represent the most common ligands used in many applications of metal complexes. Recent developments have allowed very precise design of properties of complexes as a result of new ligand design. In this module design principles will be addressed and applications of these important complexes in industry will be discussed.				
Programme module type:	Optional for Chemical Sciences, Chemistry, Chemistry with French MChem, Chemistry with External Placement, Chemistry with Medicinal Chemistry MChem, Chemistry with French and External Placement, Chemistry with Mathematics, Materials Chemistry MChem, Materials Chemistry with External Placement.			
Pre-requisite(s):	Passes in CH2501 and at least one of (CH2601 or CH2603), CH2701			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr C S J Cazin			
Lecturer(s)/Tutor(s):	Prof P C J Kamer, Dr C S J Cazin			

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CH5517 Advanced Molecular Inorganic Chemistry				
SCOTCAT Credits:	10	SCQF Level 11	Semester:	2
Planned timetable:	To be arranged.			
This module involves three sections: advanced discussion of the properties of selected main group compounds, spectroscopy and magnetism of transition metal complexes, and molecular modeling applied to transition metal complexes.				
Programme module type:	Optional for Chemical Sciences, Chemistry, Chemistry with French MChem, Chemistry with External Placement, Chemistry with Medicinal Chemistry MChem, Chemistry with French and External Placement, Chemistry with Mathematics, Materials Chemistry MChem, Materials Chemistry with External Placement.			
Pre-requisite(s):	Passes in CH2501 and at least one of (CH2601 or CH2603), CH2701			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr E Zysman-Colman			
Lecturer(s)/Tutor(s):	Prof M Buehl, Dr E Zysman-Colman, Dr B Bode			

CH5518 Blockbuster Solids				
SCOTCAT Credits:	10	SCQF Level 11	Semester:	2
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.				
Programme module type:	Compulsory for Chemistry and Geology. Optional for Chemical Sciences, Chemistry, Chemistry with French MChem, Chemistry with External Placement, Chemistry with Medicinal Chemistry MChem, Chemistry with French and External Placement, Chemistry with Mathematics, Materials Chemistry MChem, Materials Chemistry with External Placement.			
Pre-requisite(s):	Passes in CH2501 and at least one of (CH2601 or CH2603), CH2701			
Learning and teaching methods and 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%			
Module Co-ordinator:	Prof P Lightfoot			
Lecturer(s)/Tutor(s):	Prof P Lightfoot, Prof R E Morris			

CH5611 Asymmetric Synthesis				
SCOTCAT Credits:	10	SCQF Level 11	Semester:	1
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.				
Programme module type:	Compulsory for Chemistry with Medicinal Chemistry, Chemistry MChem, Chemistry with External Placement, Chemistry with Medicinal Chemistry and External Placement. Optional for Biomolecular Science, Chemistry with French MChem, Chemistry with French and External Placement, Chemistry with Mathematics.			
Pre-requisite(s):	Either passes in (CH2601 or CH2603) and at least one of CH2501, CH2701 or passes in CH2501, CH2701 and (CH1601 or CH1202)			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr M L Clarke			
Lecturer(s)/Tutor(s):	Dr M L Clarke, Prof A D Smith			

CH5612 Natural Products, Biosynthesis and Enzyme Co-factors				
SCOTCAT Credits:	10	SCQF Level 11	Semester:	2
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.				
Programme module type:	Compulsory for Chemistry with Medicinal Chemistry MChem, Chemistry with Medicinal Chemistry and External Placement. Optional for Biomolecular Science, Chemical Sciences, Chemistry, Chemistry with Medicinal Chemistry BSc, Chemistry with French MChem, Chemistry with External Placement, Chemistry with French and External Placement, Chemistry with Mathematics.			
Pre-requisite(s):	Either passes in (CH2601 or CH2603) and at least one of CH2501, CH2701 or passes in CH2501, CH2701 and (CH1601 or CH1202)			
Learning and teaching methods and 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%			
Module Co-ordinator:	Prof D O'Hagan			
Lecturer(s)/Tutor(s):	Prof D O'Hagan, Dr T K Smith, Dr G J Florence			

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CH5613 Reactive Intermediates				
SCOTCAT Credits:	10	SCQF Level 11	Semester:	2
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.				
Programme module type:	Compulsory for Chemistry with Medicinal Chemistry MChem, Chemistry with Medicinal Chemistry and External Placement. Optional for Biomolecular Science, Chemical Sciences, Chemistry, Chemistry with Medicinal Chemistry BSc, Chemistry with French MChem, Chemistry with External Placement, Chemistry with French and External Placement, Chemistry with Mathematics.			
Pre-requisite(s):	Either passes in (CH2601 or CH2603) and at least one of CH2501, CH2701 or passes in CH2501, CH2701 and (CH1601 or CH1202)			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr R A Aitken			
Lecturer(s)/Tutor(s):	Dr R A Aitken, Dr I A Smellie			

CH5614 Chemical Biology				
SCOTCAT Credits:	10	SCQF Level 11	Semester:	2
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.				
Programme module type:	Compulsory for Chemistry with Medicinal Chemistry MChem, Chemistry with Medicinal Chemistry and External Placement. Optional for Biomolecular Science, Chemical Sciences, Chemistry, Chemistry with Medicinal Chemistry BSc, Chemistry with French MChem, Chemistry with External Placement, Chemistry with French and External Placement, Chemistry with Mathematics.			
Pre-requisite(s):	Either passes in (CH2601 or CH2603) and at least one of CH2501, CH2701 or passes in CH2501, CH2701 and (CH1601 or CH1202)			
Learning and teaching methods and 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%			
Module Co-ordinator:	Prof J H Naismith			
Lecturer(s)/Tutor(s):	Prof J H Naismith, Prof N J Westwood			

CH5616 Molecular Recognition				
SCOTCAT Credits:	10	SCQF Level 11	Semester:	2
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.				
Programme module type:	Compulsory for Chemistry with Medicinal Chemistry MChem, Chemistry with Medicinal Chemistry and External Placement. Optional for Biomolecular Science, Chemical Sciences, Chemistry, Chemistry with Medicinal Chemistry BSc, Chemistry with French MChem, Chemistry with External Placement, Chemistry with French and External Placement, Chemistry with Mathematics.			
Pre-requisite(s):	Either passes in (CH2601 or CH2603) and at least one of CH2501, CH2701 or passes in CH2501, CH2701 and (CH1601 or CH1202)			
Learning and teaching methods and 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%			
Module Co-ordinator:	Prof D Philp			
Lecturer(s)/Tutor(s):	Prof D Philp, Dr E R Kay			

CH5711 Advanced Spectroscopic Methods				
SCOTCAT Credits:	10	SCQF Level 11	Semester:	1
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.				
Programme module type:	Compulsory for Chemistry MChem, Chemistry with External Placement, Chemistry with Mathematics. Optional for Chemistry and Geology, Chemistry with French MChem, Chemistry with French and External Placement, Chemistry and Physics, Materials Chemistry MChem, Materials Chemistry with External Placement.			
Pre-requisite(s):	Passes in CH2701 and CH2501			
Learning and teaching methods and 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%			
Module Co-ordinator:	Prof M Buck			
Lecturer(s)/Tutor(s):	Prof M Buck, Dr G Haehner			

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CH5713 Surface Science and Heterogeneous Catalysis				
SCOTCAT Credits:	10	SCQF Level 11	Semester:	2
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.				
Programme module type:	Compulsory for Chemistry with Mathematics. Optional for Chemical Sciences, Chemistry, Chemistry with French MChem, Chemistry with External Placement, Chemistry with French and External Placement, Chemistry and Physics, Materials Chemistry MChem, Materials Chemistry with External Placement.			
Pre-requisite(s):	Passes in CH2701 and CH2501			
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr C J Baddeley			
Lecturer(s)/Tutor(s):	Dr C J Baddeley, Prof P A Wright			

CH5714 Chemical Applications of Electronic Structure Calculations				
SCOTCAT Credits:	10	SCQF Level 11	Semester:	2
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.				
Programme module type:	Compulsory for Chemistry with Mathematics. Optional for Chemical Sciences, Chemistry, Chemistry with French MChem, Chemistry with External Placement, Chemistry with French and External Placement, Chemistry and Physics, Materials Chemistry MChem, Materials Chemistry with External Placement.			
Pre-requisite(s):	Passes in CH2701, CH2501, CH3712 and CH3717			
Learning and teaching methods and 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%			
Module Co-ordinator:	Prof M Buehl			
Lecturer(s)/Tutor(s):	Prof M Buehl, Dr J B O Mitchell			

CH5715 Energy Conversion and Storage				
SCOTCAT Credits:	10	SCQF Level 11	Semester:	2
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.				
Programme module type:	Compulsory for Chemistry with Mathematics, Materials Chemistry MChem, Materials Chemistry with External Placement. Optional for Chemical Sciences, Chemistry, Chemistry and Geology, Chemistry with External Placement, Chemistry with French MChem, Chemistry with French and External Placement, Chemistry and Physics.			
Pre-requisite(s):	Passes in CH2701 and CH2501	Anti-requisite(s):	CH4712	
Learning and teaching methods and 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%			
Module Co-ordinator:	Dr R T Baker			
Lecturer(s)/Tutor(s):	Dr R T Baker, Prof J T S Irvine			

CH5716 Processing of Materials				
SCOTCAT Credits:	10	SCQF Level 11	Semester:	1
Planned timetable:	To be arranged.			
This module focuses on the processing of materials. Fundamental materials properties such as crystallinity, composition, crystal phase, phase mixing, domain structure, grains and grain boundaries, porosity and pore structure will be covered and the main methods used to control these properties in order to develop and improve materials for specific applications will be addressed. Processes including casting, extrusion, physical and chemical vapour deposition, calcination, sintering, annealing, plasma treatments, mechanical working, crystallisation and dopant addition will be described and explained. Applications in high-value metals, ceramics and semiconductor materials will be emphasised.				
Programme module type:	Compulsory for Materials Chemistry MChem, Materials Chemistry with External Placement.			
Pre-requisite(s):	Passes in CH2701, CH2501 and CH3513			
Learning and teaching methods and 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%			
Module Co-ordinator:	Prof J T S Irvine			
Lecturer(s)/Tutor(s):	Prof J T S Irvine, Dr M Cassidy			

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CH5717 Nanostructured Materials			
SCOTCAT Credits:	10	SCQF Level 11	Semester: 1
Planned timetable:	To be arranged.		
<p>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.</p>			
Programme module type:	<p>Compulsory for Materials Chemistry MChem, Materials Chemistry with External Placement.</p> <p>Optional for Chemical Sciences, Chemistry and Geology, Chemistry MChem, Chemistry with French MChem, Chemistry with External Placement, Chemistry with French and External Placement, Chemistry with Mathematics, Chemistry and Physics.</p>		
Pre-requisite(s):	Passes in CH2701 and CH2501		
Learning and teaching methods and 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%		
Module Co-ordinator:	Prof W Zhou		
Lecturer(s)/Tutor(s):	Prof W Zhou, Prof M Buck		