Bachelor of Applied Science (Chemistry) (SC01)

Year offered: 2010
Admissions: Yes
CRICOS code: 003502J
Course duration (full-time): 3 Years
Course duration (part-time): 6 Years
Domestic fees (indicative): 2010: CSP $2,200 (indicative) per semester
International Fees (indicative): 2010: $11,750 (indicative) per semester
Domestic Entry: February and July
International Entry: February and July* (Conditions apply for July entry)
QTAC code: 418011
Past rank cut-off: 77
Past OP cut-off: 12
OP Guarantee: Yes
Assumed knowledge: English (4, SA) and Maths B (4, SA)
Preparatory studies: For information on acquiring assumed knowledge visit http://www.studentservices.qut.edu.au/apply/ug/info/knowledge.jsp
Total credit points: 288
Standard credit points per full-time semester: 48
Standard credit points per part-time semester: 24
Course coordinator: Dr Marion Bateson
Discipline coordinator: Dr Dennis Arnold
Campus: Gardens Point

Overview
Chemists are involved in most areas of science, technology, environment and industry, for example, medicinal drugs, nanotechnology, water and air quality and energy production. Manufacturing industries rely on chemists to ensure that quality and safety standards are maintained. The development of better and safer drugs depends heavily on the input of chemists.

Chemistry is the study of structures, properties, synthesis and reactions or molecules and materials and these principles are fundamental to many other disciplines, including biotechnology, environmental science, geosciences, materials science and food science. At QUT you will study analytical, physical, organic and inorganic chemistry with an additional focus on modern applications such as nanotechnology, analytical and environmental chemistry, polymer science and surface science.

Recommended Study
Chemistry.

Why Choose this Course
If you choose to study the chemistry major with a second major in chemistry for industry you can apply for a $3000 industrial chemistry bursary to assist with your studies.

The QUT chemistry degree is a qualification that is known and respected by employers.

QUT is among the few universities in Australia to offer three chemistry units in the first year, including Experimental Chemistry, devoted entirely to experimental techniques. Students have a total of 10 laboratory sessions in this unit and are exposed to a wide variety of experimental techniques. Our training in analytical chemistry throughout the chemistry degree is renowned nationally.

You will undertake a comprehensive laboratory program including experiments using modern computer-based analytical instruments and gain vital knowledge and experience in the health and safety aspects of handling chemicals. You will learn under the guidance of highly respected lecturers, most of whom are actively involved in cutting-edge research.

Career Outcomes
Among a diverse range of employment opportunities, you may become an industrial chemist, materials scientist, environmental chemist, quality control analyst, laboratory supervisor, food chemistry, or an organic/inorganic chemist. Your interactions with QUT experts in current fields of interest including drug development, clay and minerals chemistry, renewable energy sources, nanotechnology, environmental monitoring, and applications of modern analytical instrumentation may lead to careers in these areas.

QUT graduates are sought after by police and other forensics laboratories because of their extensive practical training using modern analytical instrumentation.

With the addition of a postgraduate diploma in education, you may wish to pursue opportunities in the teaching profession.

Professional Recognition
Graduates completing the chemistry major with the chemistry for industry second major or forensic science major are eligible for membership of the Royal Australian Chemical Institute (RACI).

Your Course
Year 1
You will undertake introductory core studies in a range of scientific areas including life sciences, chemistry, physics, mathematics and environmental science to give you a solid
foundation for your future studies. If you are taking the chemistry for industry second major you will be provided with opportunities to develop further laboratory skills. If you are taking chemistry with forensic science, you will also cover introductory life science topics that prepare you for important tasks like DNA profiling.

Year 2
You will begin more specialised study of the core chemistry sub-disciplines of analytical inorganic, organic and physical chemistry. In the chemistry for industry second major you will begin extensive studies in analytical chemistry, chemical and nanotechnologies. Problem solving and the development of critical thinking will be emphasised. You should expect plenty of practical work and hands-on experience. The communication skills, generic scientific skills, and report preparation tools you will learn at QUT will be vital to your future employment.

Year 3
You will tackle more challenging advanced concepts in the core sub-disciplines of chemical science. In this second major, you will have the advantage of field trips to major industrial sites. All third year chemistry studies will undertake a one-semester research project under the guidance of experienced staff. Students will be trained in start-of-the-art techniques and will have the opportunity to pursue a field of interest to them. Whether you are seeking your first job or contemplating higher research degree studies, you will have access to advice from qualified professionals.

Chemistry Full-time Course Structure: First Semester Entry

<table>
<thead>
<tr>
<th>Year 1, Semester 1</th>
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<tbody>
<tr>
<td>SCB110</td>
<td>Science Concepts and Global Systems</td>
</tr>
<tr>
<td>SCB111</td>
<td>Chemistry 1</td>
</tr>
<tr>
<td>SCB112</td>
<td>Cellular Basis of Life</td>
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<tr>
<td>Plus ONE of:</td>
<td></td>
</tr>
<tr>
<td>MAB101</td>
<td>Statistical Data Analysis 1</td>
</tr>
<tr>
<td>MAB105</td>
<td>Preparatory Mathematics</td>
</tr>
<tr>
<td>MAB120</td>
<td>Algebra and Calculus</td>
</tr>
<tr>
<td>MAB121</td>
<td>Calculus and Differential Equations</td>
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NOTE: 1. Students without a Sound Achievement (4 semesters) in Maths A should enrol in MAB101. 2. Students with a Sound Achievement in Maths B and NOT wishing to major in Physics should enrol in MAB101. 3. Students with a Sound Achievement in Maths C and wishing to major in Physics should enrol in MAB121. 4. Students without a Sound Achievement in Maths C and wishing to major in Physics should enrol in MAB120. 5. Students without a Sound Achievement in Maths B or Maths A should consult with the course coordinator.

Year 1, Semester 2
SCB121 Chemistry 2
SCB123 Physical Science Applications
SCB131 Experimental Chemistry
   Plus either
MAB120 Algebra and Calculus
   Or
SCB122 Cell and Molecular Biology

Note: MAB120 is the preferred option for the Chemistry major. Only students taking Forensic Science, Microbiology, Biochemistry or Biotechnology as a second major should select SCB122 Cell and Molecular Biology

Year 2, Semester 1
PQB312 Analytical Chemistry For Scientists and Technologists
PQB331 Structure and Bonding
   Plus TWO other units selected according to the second major requirements

Year 2, Semester 2 *
P QB401 Reaction Kinetics, Thermodynamics and Mechanisms
PQB442 Chemical Spectroscopy
   Plus TWO other units selected according to the second major requirements

Year 3, Semester 1 *
PQB502 Advanced Physical Chemistry
PQB531 Organic Mechanisms and Synthesis
   Plus TWO other units selected according to the second major requirements

Year 3, Semester 2 *
PQB631 Advanced Inorganic Chemistry
PQB642 Chemical Research
   Plus TWO other units selected according to the second major requirements

Recommended Second Majors:
Biochemistry, Biotechnology, Chemistry for Industry
Industry, Forensic Science

* Elective Unit in all Majors:

SCB500 Industry Project

NOTE: SCB500 Industry Project is a unit that will be offered as an elective in all majors. This unit requires 84 credit points of Level 2 and/or 3 Science units, so it may only be taken at the completion of Year 2 in Summer or during Year 3.

Chemistry Full-time Course Structure: Mid-Year Entry

Mid-Year (July) Entry

FOR DOMESTIC STUDENTS: Due to the careful construction of scientific knowledge demanded in the SC01 degree, mid-year entry requires some compromises. There are two ways to construct a mid-year program:

1. Take foundation units and their follow-up units together, rather than in sequence. This will be very challenging, but will allow you to start second year units at the start of the next year. Please contact either the course coordinator or the discipline coordinator to devise a suitable program of study. Please note: as this option usually involves taking units from different levels concurrently, which may not timetable appropriately, in some cases it may not be possible to complete within the standard time frame.

2. Take three units per semester for the first three semesters, adding one semester to your degree completion time. This allows you to do your first year units in the correct sequence, at a slightly more leisurely pace, while still being officially a full-time student. You may enrol in a fourth unit (level 2 unit from your chosen major) provided you have the necessary pre-requisites. This is the recommended option.

FOR INTERNATIONAL STUDENTS: Mid-year entry is only available under certain circumstances. Please contact the Course Coordinator to discuss available midyear entry and advance standing options on a case by case basis.

Year 1, semester commencing July

SCB111 Chemistry 1
SCB112 Cellular Basis of Life
MAB101 Statistical Data Analysis 1
MAB105 Preparatory Mathematics

Year 2, semester commencing February

MAB120 Algebra and Calculus
SCB110 Science Concepts and Global Systems
SCB121 Chemistry 2

Year 2, semester commencing July

SCB123 Physical Science Applications
SCB131 Experimental Chemistry

MAB101 Statistical Data Analysis 1
Or Elective

Chemistry Part-time Course Structure

Students interested in undertaking this major part-time should consult the discipline coordinator.

UNIT SYNOPSISES

MAB101 STATISTICAL DATA ANALYSIS 1
Experiments, observational studies, sampling, and polls; data and variables; framework for describing and manipulating probability; independence; Binomial and Normal distributions; population parameters and sample statistics; concepts of estimation and inference; standard error; confidence intervals for means and proportions; tests of hypotheses on means and proportions (one sample and two independent samples); inference using tables of counts; modelling relationships using regression analysis; model diagnosis; use of statistical software.

Antirequisites: BSB123, EFB101, MAB141, MAN101
Assumed knowledge: Grade of at least Sound Achievement in Senior Mathematics B (or equivalent) or MAB105 is assumed knowledge. Credit points: 12
Contact hours: 4 per week  Campus: Gardens Point
Teaching period: 2010 SUM-2, 2010 SEM-1 and 2010 SEM-2

MAB105 PREPARATORY MATHEMATICS
This unit is a substitute for Senior Mathematics B for those students who need the equivalent background for the successful study of units which assume it. It includes: basic number facts, natural numbers, integers, rational numbers, real numbers and their operations; basic algebra; functions and equations, graphs, linear functions, equations and applications; systems of linear equations; quadratic, exponential, logarithmic and trigonometric functions, properties and applications; introduction to calculus; rates of change, derivatives, rules of differentiation, second derivatives, maxima and minima and applications;
integration and applications. This unit is incompatible with an exit assessment of High Achievement or better in Senior Mathematics B.

**Assumed knowledge:** Year 10 Level 6 Mathematics is assumed knowledge  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1 and 2010 SEM-2

**MAB120 ALGEBRA AND CALCULUS**
This unit introduces and reviews the elementary concepts of function, calculus, matrices and vectors with special reference to applications in science, technology and business where appropriate. Topics covered include the algebra of complex numbers, elementary functions (polynomial, trigonometric, exponential and logarithmic) and their properties, differentiation and integration methods and principles, geometric and algebraic applications of vectors and the solution of linear systems using matrices.

**Assumed knowledge:** Grade of at least Sound Achievement in Senior Mathematics B (or equivalent) or MAB105 is assumed knowledge  
**Equivalents:** MAB100, MAB125, MAB180  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1, 2010 SEM-2 and 2010 SUM

**MAB121 CALCULUS AND DIFFERENTIAL EQUATIONS**
This unit extends the areas of function and calculus introduced in MAB120 by introducing series representations for functions and more advanced methods of differentiation and integration for functions of one variable. A strong connection to real world problems is made by introducing the use of differential equations in modelling, and exploring appropriate methods of solution. Practical calculations of volumes and surface areas of solids of revolution extend your interpretations of the definite integral. Taylor and Fourier series are introduced as a means of approximating functions by sums of polynomials and periodic functions. Some more advanced methods for indefinite integrals, such as partial fraction decomposition, are also introduced.

**Assumed knowledge:** Grade of at least Sound Achievement in Senior Mathematics C (or equivalent) or MAB125 or MAB180 or MAB120 is assumed knowledge  
**Equivalents:** MAB111, MAB126  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1, 2010 SEM-2 and 2010 SUM

**PQB312 ANALYTICAL CHEMISTRY FOR SCIENTISTS AND TECHNOLOGISTS**
Reliable chemical analysis and testing is fundamental to the functioning of our society. This generic unit is designed for future scientists and technologists in the fields of chemistry, forensic science and other similar sciences. It introduces students to concepts of quality assurance, good laboratory practice and the vital instrumental areas of analysis – chromatography and spectroscopy. Laboratory work is a key extensive activity in this unit.

**Prerequisites:** SCB131  
**Equivalents:** PCB414  
**Credit points:** 12  
**Contact hours:** 4.5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1 and 2010 SEM-2

**PQB331 STRUCTURE AND BONDING**
This unit provides detailed coverage of the theories of bonding in organic, inorganic and coordination compounds including orbital hybridisation valence bond theory, coordination theory and crystal field theory. The cause and effect relationships between bonding and structure are developed leading to an understanding of structural variability, chirality, and other modes of isomerism for a broad range of chemical compounds. An introduction to molecular symmetry, which is central to the study of molecular geometry and shape, also provides the background for later studies in spectroscopy. Lectures are complemented by 7 laboratory experiments and 4 hands-on style workshops.

**Prerequisites:** SCB121 and SCB131  
**Antirequisites:** PCB334, PCB354  
**Credit points:** 12  
**Contact hours:** 4.5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1

**PQB401 REACTION KINETICS, THERMODYNAMICS AND MECHANISMS**
This unit deals with the way in which the fundamental concepts of physical chemistry govern the extent and rates of chemical reactions and applies them to actual reaction types from the fields of organic and inorganic chemistry. Topics include: thermodynamics including enthalpy, heat capacity, entropy, Gibbs free energy, chemical equilibria and an introduction to electrochemistry: chemical kinetics including rate laws, mechanisms of chemical reactions, collision theory of reaction rates and the steady state principle as well as acids and bases in both aqueous and non aqueous environments.

**Prerequisites:** PQB331  
**Antirequisites:** PCB354, PCB405  
**Credit points:** 12  
**Contact hours:** 4.5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-2

**PQB442 CHEMICAL SPECTROSCOPY**
Spectroscopic techniques are now widespread in scientific laboratories. An appreciation of both the principles and practice of spectroscopy is essential for those contemplating a career in chemistry. The use of spectroscopic methods to elucidate molecular structure provides an excellent vehicle for training in the scientific method, particularly the logical application of experimental data to deduce the solution to a complex problem. Whilst the fundamental theoretical concepts will be dealt with in the early part of the unit, later emphasis will be on developing practical skills in problem
solving, a skill of value to all fields of scientific and technological endeavour.

**Prerequisites:** PQB331  
**Equivalents:** PCB444  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-2

**PQB502 ADVANCED PHYSICAL CHEMISTRY**

A Chemistry graduate in today's highly technological world requires knowledge of the principles that govern the behaviour of solids, liquids, gases, and mixtures thereof. This leads to an appreciation of how fundamental physical chemical principles determine the bulk properties of materials and how the chemical nature of interfaces govern chemical reactions in many important applications. This unit is placed appropriately in fifth semester, following the second year units that provide the basic principles, language and tools of chemistry.

**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1

**PQB531 ORGANIC MECHANISMS AND SYNTHESIS**

This unit deals with organic reaction mechanisms and their application in organic synthesis. Topics in mechanisms include: structural and electronic effects that govern reactivity of organic molecules; major classes of mechanisms including elimination reactions, nucleophilic additions to carbonyl compounds, nucleophilic acyl substitution, electrophilic addition to alkenes and electrophilic substitution of aromatics. Topics in synthesis include the principles of organic synthesis design using the retrosynthetic approach; carbon-carbon bond formation to build the major functional group classes; and the use of protecting and activating groups.

**Prerequisites:** PQB401, PQB442  
**Antirequisites:** PCB554  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1

**PQB631 ADVANCED INORGANIC CHEMISTRY**

Major topics covered are as follows: organometallic chemistry, including metal-carbon bonding, main group and transition metal organometallics and applications of organometallic compounds in synthetic chemistry; bioinorganic chemistry; physical methods of structure determination, such as single crystal X-ray diffraction; chemical applications of group theory.

**Prerequisites:** PQB331  
**Equivalents:** PCB634  
**Credit points:** 12  
**Contact hours:** 5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-2

**PQB642 CHEMICAL RESEARCH**

This unit addresses a selection of topics in advanced chemistry from a range of evolving areas of relevance in modern chemistry and chemical technology such as nanotechnology, drug design, free-radical chemistry and trace metal speciation in environmental and biological systems. It includes the important issue of the societal and ethical implications of the profession of chemistry.

**Prerequisites:** 4 Advanced Level Chemistry units  
**Assumed knowledge:** Completion of any advanced Chemistry units is assumed knowledge  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-2

**SCB110 SCIENCE CONCEPTS AND GLOBAL SYSTEMS**

You will undertake interdisciplinary study of the physical, geological and biological concepts relating to the origins of life; from the creation of matter and planets, to the emergence of life in all its complexity, culminating in evolution of earth ecosystems. Human influences, overlaid upon earth's complex systems, will be examined as to their type, extent, and impact. In counterpoint, you will explore the breadth of philosophical developments underlying our search for knowledge; fundamental thoughts and ideas that span the last 2,500 years of human history. Ultimately, these concepts evolved through the development of a scientific method and we explore its workings in relation to the ongoing enterprise of human understanding.

**Credit points:** 12  
**Contact hours:** 4.5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1

**SCB111 CHEMISTRY 1**

This unit covers the fundamentals of general and physical chemistry. Topics include atomic and molecular structure, introduction to chemical bonding, reaction stoichiometry, thermochemistry, gas phase chemistry, reaction kinetics, equilibrium, acids, bases, buffers, oxidation, reduction and electrochemistry. The practical program involves experiments illustrating a range of chemical reaction types including precipitation reactions, acid-base chemistry and redox chemistry using analytical experimental methods. A comprehensive tutorial program (CHELP) complements the lectures and is designed to assist students to develop the problem solving skills required for further study in chemistry and related sciences.

**Antirequisites:** SCB113  
**Credit points:** 12  
**Contact hours:** 4.5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1 and 2010 SEM-2

**SCB112 CELLULAR BASIS OF LIFE**

A study of life processes in all five groups of living organisms (bacteria, protists, fungi, plants and animals). Traditional topics in biology are integrated with recent research advances in molecular and cellular biology to provide a comprehensive foundation for later units in the medical, biotechnological and ecological sciences. The unit begins by constructing cells from the four quantitatively important groups of biological molecules (proteins, lipids, carbohydrates and nucleic acids). Molecular and evolutionary aspects of genetics are then introduced, with
the great diversity of reproductive strategies found among organisms being emphasised. Finally, bioenergetics (photosynthesis and respiration) and its relevance to environmental issues is outlined.

Antirequisites: LSB118  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2010 SEM-1 and 2010 SEM-2

SCB121 CHEMISTRY 2
Chemistry is the central science. This is a unit of fundamental importance as it covers the background and general principles that underpin understanding in many Science and Health related disciplines, particularly in regards to the chemistry of life. In this unit students will be introduced to fundamental aspects of chemistry including the electronic structure of atoms, chemical bonding and molecular structure. From this basis students will develop an understanding of the fundamentals of organic chemistry including chirality, functional groups and organic reactions which will lead to important bio-inorganic molecules and coordination complexes.

Prerequisites: (SCB111 or PCB142)  SCB111 can be studied in the same teaching period  Antirequisites: SCB113  Credit points: 12  Contact hours: 4.5 per week  Campus: Gardens Point  Teaching period: 2010 SEM-1 and 2010 SEM-2

SCB122 CELL AND MOLECULAR BIOLOGY
SCB122 Cell and Molecular Biology 1 equips students with a comprehensive understanding of the molecular basis of the cell. This unit expands on the basic principles and concepts relating to cell structure, function, perpetuation and specialisation introduced in SCB112 and introduces students to fundamental molecular mechanisms central to the organisation of the cell. Students will be shown how macromolecular interactions are crucial to information flow and heredity. Students are taught the relationships between chromosomes, genes and cellular function and ultimately how these may determine an organism's phenotype. This unit underpins cell biology and molecular biology units that are offered in second year Life Science units. SCB122 is also ideal for interfaculty students (eg Education, Business, Arts) who will undertake no further life science studies.

Prerequisites: SCB112  Antirequisites: LSB238  Credit points: 12  Contact hours: 4.5 per week  Campus: Gardens Point  Teaching period: 2010 SEM-2

SCB123 PHYSICAL SCIENCE APPLICATIONS
Physics principles underpin all of the sciences and 'new technologies'. This unit adopts an investigative team-based approach to provide students with an appreciation of fundamental concepts in physical science, together with experience in the application of these concepts to a range of 'real world' problems. The unit should be taken in the first year of study as the fundamental principles introduced here will be built upon in later units in the context of each science student's major discipline area. Employers in cutting-edge industries expect science graduates to have effective strategies for problem solving, skills for collaborative work and scientific communication and research skills. This unit aims to develop these skills by applying the fundamental concepts of physical science to problems in a team environment.

Credit points: 12  Contact hours: 4.5 per week  Campus: Gardens Point  Teaching period: 2010 SEM-2

SCB131 EXPERIMENTAL CHEMISTRY
A study of chemistry and related disciplines such as medical science, biochemistry, molecular biology and pharmacy requires the development of practical laboratory skills used in synthesis and chemical analysis. This unit is a laboratory-based unit which is designed for students who intend to continue with experimental science units. The lectures complement the weekly practical sessions and teach the theory required to interpret experimental results.

Prerequisites: SCB111 or SCB113  Corequisites: SCB121 unless SCB113 has been successfully completed  Credit points: 12  Campus: Gardens Point  Teaching period: 2010 SEM-2

SCB500 INDUSTRY PROJECT
In this unit students will apply scientific methods and quantitative techniques to real work issues. Students will develop an appropriate plan for analysing and resolving an industry issue under the guidance of both a QUT supervisor and an associate supervisor from an industry partner. At the end of the unit students will present both an oral seminar relating to cell structure, function, perpetuation and coordination complexes.

Credit points: 12  Contact hours: 52  Campus: Gardens Point  Teaching period: 2010 SEM-1, 2010 SEM-2 and 2010 SUM