Bachelor of Applied Science (Environmental Science) (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 Robin Thwaites
Campus: Gardens Point

Overview
We rely on our natural environment to sustain our lives and our lifestyles. Do you want to help the earth’s natural environment to maintain its integrity while continuing our urban and rural development? Have you wanted to be part of the solution to our increasing environmental issues such as climate change, air, water and soil quality, soil erosion, dry land salinity or water resources? We continually need to improve our understanding and management of the natural environment to balance our development with wise management while minimising impacts and degradation.

The understanding of the mechanisms controlling environmental systems provides the skills required to undertake a great range of scientific environmental planning and management, and tackle problems such as local water quality and ecosystem impacts, soil erosion, catchment and groundwater use, or adaptation to global climate change.

Recommended Study
At least one of the sciences: either Chemistry, Physics, Biological Science, Earth Science or Maths C.

Why Choose this Course
The environmental science course at QUT is designed to provide hands-on practical skills and field experiences using real-world industry examples and methods to allow you to pursue a variety of careers as an environmental scientist. The program has particular strengths in the areas of land resources, hydrogeology, environmental geology, biogeochemistry, geographic information systems and field mapping, systems modelling and sustainable management.

The program also emphasises practical skills and experience, including day-long and extended field trips. You will learn from guest lecturers from relevant government agencies, industry and QUT staff who regularly provide advice for industry, government and community groups.

Career Outcomes
Environmental scientists are continually needed in a wide variety of planning, management, monitoring and research careers. These roles are usually found in government departments and agencies, in local councils, in consultancy, and in industrial and mining companies. As an environmental science graduate you could be working in urban, rural or remote settings depending on your interests.

Graduates are equipped to assess resources, implement environmental impact programs, analyse and interpret environmental data and formulate contingency plans in a wide variety of areas. These include strategic land-use planning, waste disposal, pollution measurement and control, coastal protection, environmental impact of mining, tourism and urban development, rehabilitation and reforestation of degraded sites, ground water assessment and modelling, flood plain planning, erosion control, and marine science.

Professional Recognition
Graduates are eligible for membership of the Environment Institute of Australia and New Zealand (EIANZ) and a variety of other scientific societies, including the Soil Science Society of Australia (SSSA) and the Ecological Society of Australia (ESA).

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. You will be provided with...
a good introduction to environmental science issues and scientific problem solving as well as a basic knowledge about the natural systems that exist on planet earth and the way these systems interact. Following these introductory studies you should be in a position to confirm your choice of major area of study.

**Year 2**
You will learn fundamental concepts and gain practical experience in understanding and investigating earth surface systems and processes both in the laboratory and in the field. At the same time, you will be introduced to the design of field and laboratory experiments and you will have the option to pursue a more ecologically or geologically oriented direction. You will then be introduced to elements of environmental chemistry in air, water and soil, including a number of field trips.

**Year 3**
You will receive more advanced training in the essential areas of environmental systems and how we can model them, and you will survey and map natural resources during field trips. You will be introduced to the use of spatial science to assess and map environmental systems using geographic information systems and remote sensing. Case studies and problem-solving methods are used to introduce you to a wide variety of issues in sustainable management.

**Environmental Science Full-time Course Structure: First Semester Entry**

<table>
<thead>
<tr>
<th>Year 1, Semester 1</th>
<th>SCB110 Science Concepts and Global Systems</th>
<th>MAB101 Statistical Data Analysis 1</th>
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<tbody>
<tr>
<td></td>
<td>SCB111 Chemistry 1</td>
<td>MAB105 Preparatory Mathematics</td>
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<td>SCB112 Cellular Basis of Life</td>
<td>MAB120 Algebra and Calculus</td>
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<td></td>
<td>Plus ONE of:</td>
<td>MAB121 Calculus and Differential Equations</td>
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<tr>
<td>NOTE:</td>
<td>1. Students with a Sound Achievement (4 semesters) in Maths A should enrol in MAB105.</td>
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<td>2. Students with a Sound Achievement in Maths B and NOT wishing to major in Physics should enrol in MAB101.</td>
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<td>3. Students with a Sound Achievement in Maths C and wishing to major in Physics should enrol in MAB121.</td>
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<td>4. Students without a Sound Achievement in Maths C and wishing to major in Physics should enrol in MAB120.</td>
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<tr>
<td>Year 1, Semester 2</td>
<td>NQB201 Planet Earth</td>
<td>NQB302 Earth Surface Systems</td>
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<td>NQB202 History of Life on Earth</td>
<td>NQB321 Ecology</td>
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<td></td>
<td>SCB120 Plant and Animal Physiology</td>
<td>Plus TWO other units selected according to the second major requirements</td>
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<td>SCB121 Chemistry 2</td>
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<td>SCB122 Cell and Molecular Biology</td>
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<td></td>
<td>SCB123 Physical Science Applications</td>
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<tr>
<td>Year 2, Semester 1</td>
<td>NQB302 Earth Surface Systems</td>
<td>NQB501 Environmental Modelling</td>
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<td>NQB321 Ecology</td>
<td>Plus either</td>
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<td>Plus TWO other units selected according to the second major requirements</td>
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<td>Year 2, Semester 2 *</td>
<td>NQB403 Soils and the Environment</td>
<td>NQB502 Field Methods in Natural Resource Sciences</td>
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<td>NQB421 Experimental Design</td>
<td>Or</td>
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<td>Plus TWO other units selected according to the second major requirements</td>
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<tr>
<td>Year 3, Semester 1 *</td>
<td>NQB502 Field Methods in Natural Resource Sciences</td>
<td>NQB503 Spatial Analysis of Environmental Systems</td>
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<td>Plus either</td>
<td>Plus TWO other units selected according to the second major requirements</td>
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<td>Year 3, Semester 2 *</td>
<td>NQB601 Sustainable Environmental Management</td>
<td>NQB602 Environmental Chemistry</td>
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<td>Plus ONE of</td>
<td>NQB614 Groundwater Systems</td>
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<td>NQB603 Sustainable Environmental Management</td>
<td>NQB623 Ecological Systems</td>
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<td>Plus TWO other units selected according to the second major requirements</td>
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**Recommended Second Majors:**
- Biodiversity, Ecology, Geoscience
* Elective Unit for 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.

Environmental Science 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 be 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.

Environmental Science Part-time Course Structure

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

UNIT SYNOPSIS

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.

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

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**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

**Credit points:** 12

**Contact hours:** 4 per week

**Campus:** Gardens Point

**Teaching period:** 2010 SEM-1, 2010 SEM-2 and 2010 SUM

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**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

**Credit points:** 12

**Contact hours:** 4 per week

**Campus:** Gardens Point

**Teaching period:** 2010 SEM-1, 2010 SEM-2 and 2010 SUM

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**NQB201 PLANET EARTH**

Earth Science impacts every aspect of modern life. Hence, the concepts of Earth Science are fundamental not only to the field of Geology, but also to Environmental Science, natural resource management, civil engineering and society at large. Planet Earth provides an introduction to Earth Science, including earth materials, geologic history, geological process at the Earth’s surface, and the complex interplay between the lithosphere, atmosphere, hydrosphere and biosphere through geologic time. Thus, Planet Earth is a foundation unit for further studies in Geology and Environmental Science and also serves as a broad introduction to the world we live on.

**Assumed knowledge:** NQB201 is assumed knowledge

**Credit points:** 12

**Contact hours:** 4 per week

**Campus:** Gardens Point

**Teaching period:** 2010 SEM-1

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**NQB202 HISTORY OF LIFE ON EARTH**

This unit provides an introduction to the history and development of life on Earth with an emphasis on fundamental biological and ecological principles as they have operated through geological time. The unit provides the student with an understanding of the processes of evolution, extinction and the changing environmental conditions through Earth's history. The unit provides the student with practical experience in fossil identification, classification and morphological interpretation. It provides the student with a "deep-time" perspective of climate and other environmental changes affecting modern ecosystems. Hence, History of Life on Earth is a foundation unit for the Earth and Environmental Sciences as well as Ecology, Biological Sciences and Education.

**Assumed knowledge:** NQB201 is assumed knowledge

**Credit points:** 12

**Contact hours:** 4 per week

**Campus:** Gardens Point

**Teaching period:** 2010 SEM-2

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**NQB302 EARTH SURFACE SYSTEMS**

Understanding long and short term climate and environmental change is now recognised as crucial to the interpretation of our biotic, geomorphic and cultural landscapes. To fully understand environment change it is important to recognise the interconnectedness between the atmosphere, hydrosphere, lithosphere, biosphere and humanity’s place within these spheres over various temporal and spatial scales. Developing knowledge of past and present climate change and landscaping processes helps to predict future process pathways for natural resource management, civil engineering, risk analysis, and impact assessment in the context of both natural and anthropogenic induced change.

**Assumed knowledge:** NQB201 is assumed knowledge

**Credit points:** 12

**Contact hours:** 4 per week

**Campus:** Gardens Point

**Teaching period:** 2010 SEM-1

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**NQB321 ECOLOGY**

Ecology is the study of the factors that influence the distribution and abundance of organisms. Ecology deals with basic properties of individuals and the emergent properties of collections of individuals that form populations and the dynamics of these populations and their interactions with populations of other species. An understanding of basic ecological principles is central to managing species and...
ecosystems. This unit provides a broad theoretical background in the major concepts of plant and animal ecology. It serves the dual role of providing a thorough grounding in ecology for students from all faculties; and laying the conceptual foundation for later subjects in the ecology and environmental science. Prerequisites: SCB110 or SCB112 Equivalents: NRB311 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2010 SEM-1

NQB403 SOILS AND THE ENVIRONMENT
Soils are the most dynamic component of Earth surface processes, being the interface of the lithosphere and the atmosphere and a key system within the biosphere and the hydrosphere. It is, therefore, one of the most critical resources to consider within the context of climate change. This unit will provide you with grounding in soil science by emphasising pedological principles, their application to environmental soil analysis and management, and knowledge of ecosystem function of soils in a changing environment. The unit would provide experience in describing and classifying soils and soil materials as well as field experience in the investigation of soil processes and the assessment of resource potential and environmental hazard.
Prerequisites: NQB302 or NRB301 or (ENB272 and ENB274) Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2010 SEM-2

NQB421 EXPERIMENTAL DESIGN
An understanding of experimental design is essential for students and professionals in the ecological and environmental sciences as many biological systems are characterised by high levels of variability. This unit emphasises practical considerations of field and laboratory-based experimentation in ecology and environmental science, and provides experience in problem assessment, definition, formulation of testable hypotheses and experimental design.
Prerequisites: MAB101 or MAB104 or MAB105, and NQB321 or NRB311 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2010 SEM-2

NQB501 ENVIRONMENTAL MODELLING
The capacity for management of complex environmental problems such as climate change, now and in the future, will rely on the capacity of environmental managers to create, interpret and critically analyse models of environmental systems. Mathematical model building promotes the capacity to understand the interdependent relationships that characterise environmental systems and also provides a quantitative foundation for informed environmental management.
Prerequisites: NQB412 or NQB421 Assumed knowledge: 48 credit points of second level science units is assumed knowledge. Equivalents: NRB500 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2010 SEM-1

NQB502 FIELD METHODS IN NATURAL RESOURCE SCIENCES
Field experience is an essential part of the professional training of geologists, environmental scientists, ecologists, and natural resource specialists in general. The theory and practice of methods to interpret, measure, map, and monitor important natural resource features and characteristics are essential to the study of geological, ecological and environmental systems. Methods of survey, mapping and interpretation are necessary skills for resource assessment, geo-exploration, environmental impact assessment, land evaluation, baseline studies, and ecological investigations. There are varying emphases on these outcomes depending on the type of field survey you undertake in this unit.
Prerequisites: (NQB321 or NQB411) and (NQB302 or NQB412) Assumed knowledge: 36 credit points of second level science units in selected major is assumed knowledge. NQB302 and NQB403 for Env Sc, NQB321 for EcoL, NQB411 and NQB412 for Geosc Equivalents: NRB601 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2010 SEM-1

NQB503 SPATIAL ANALYSIS OF ENVIRONMENTAL SYSTEMS TBA
Equivalents: NRB501 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2010 SEM-1

NQB601 SUSTAINABLE ENVIRONMENTAL MANAGEMENT
Sustainable environmental management requires a multidisciplinary approach to decision-making. This approach must be founded on scientific knowledge about the environment, but to be effective, the science must also be integrated with social, economic, political and technological policies. This unit explores contemporary environmental management issues: the science behind them, linkages between them, their cultural settings and sustainable solutions.
Assumed knowledge: 48 credit points of second level science units is assumed knowledge. Equivalents: NRB600 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2010 SEM-2

NQB602 ENVIRONMENTAL CHEMISTRY
This unit includes the following: design and quality control of physicochemical monitoring programs; fundamentals of data analysis; methodologies of monitoring (variables, instruments, sampling strategies including location and
frequency of observation, analytical protocols); introduction to biogeochemical cycles; the relationships between molecular structures and environmental properties; hazardous substances in the environment; chemistry of natural water bodies, including solutes and equilibria; chemistry of water pollutants; indicators of water quality; the atmosphere - structure and energy balance; air pollutants.

**Prerequisites:** PCB140 or PCB142 or SCB111 or SCB121

**Assumed knowledge:** 72 credit points of Science and/or Health units is assumed knowledge

**Equivalents:** NRBB440

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

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**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

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**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

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**SCB120 PLANT AND ANIMAL PHYSIOLOGY**

Regardless of which area of biology you decide to specialise in, you will need to understand the complex interactions between cells, tissues, organs and organ systems that comprise multi-cellular organisms.
many living processes can be explained at the levels of biochemistry, biophysics and cell biology, a true understanding of complex, multicellular organisms requires integration of knowledge drawn from all of these areas, combined with the more complex physiological and structural levels you will learn about in this unit. The knowledge gained in this and other first level units provides you with the conceptual framework necessary to understand processes occurring from the cellular to the whole organism level and to higher levels of organisation.

**Prerequisites:** SCB112  
**Equivalents:** NRB270  
**Credit points:** 12  
**Contact hours:** 4.5 per week  
**Campus:** Gardens Point  
**Teaching period:** 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)  
**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