CANBERRA COLLEGE
Caring for your future

Science

Vision

Science at Canberra College is specifically designed to develop a high level of skills and knowledge to transition seamlessly into University. At Canberra College students are strongly encouraged to work independently and are given many experiences to develop essential skills in scientific method and the opportunity to apply knowledge in practical open-ended investigations that have real world application. The courses prepare students for the real world and to meet the recognised prerequisites for study in Science-based professions as diverse as Marine Biology, Engineering, Medicine and Astrophysics.

What Subject Should I Choose?

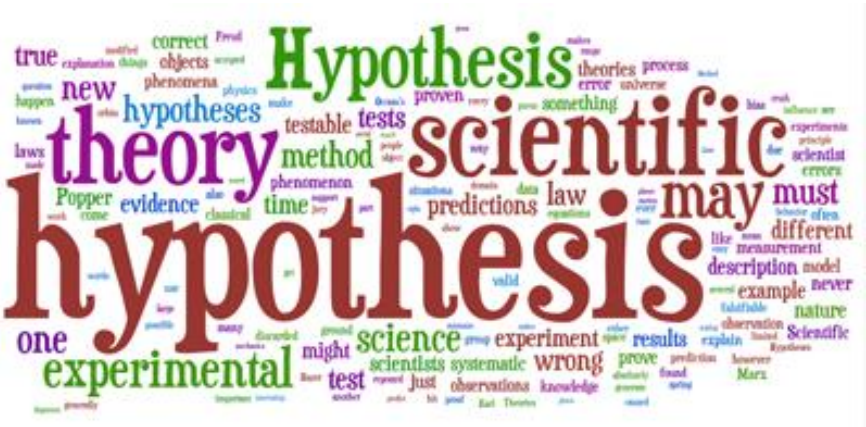
Students planning careers in science-based professions should seek early advice to ensure that they have an appropriate enrolment package. Students, who intend studying Science at University, should enrol in at least one T Science course such as Chemistry, Physics, Biology or Human Biology. You may enrol in up to three.

Curriculum

All science courses at Canberra College incorporate the Australian Curriculum for all students and provide robust training in preparation for university. Accredited students are catered for in Biology and Human Biology in combined classes with tertiary students. Assessment for accredited students is focussed more on real world applications but still provides sufficient skill for later tertiary studies.

Extra-Curricular Program

Students are actively encouraged to participate in our strong extra-curricular program. This program provides opportunities to open the world of science in ways not possible in college classes alone. These activities stimulate passion in their chosen area of interest. All major activities are credited as R units and provide points for students on their Senior Certificate. For example, Pre-Med is offered as an R unit for students who are interested in pursuing medical related careers and provides stunning opportunities to gain a broad view of an extensive field of careers available in the health care area. Students can choose to complete independent projects as a part of the Interdisciplinary Science course. The projects are done in the partnership with the Science mentors ACT and provide flexibility, self-direction, opportunities to work with scientists and participate in the CSIRO Crest and BHP Billiton awards. For more information on these activities see the last pages of this document.



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ACT Government Education

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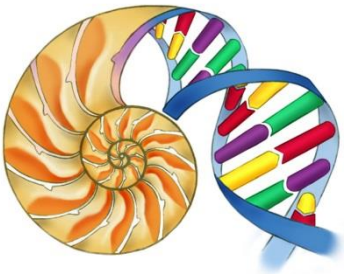
Biology (T/A)



This course covers physiology, genetics and gene technology, ecology and evolution as provided by the Australian Curriculum. Students have the opportunity to complete a minor or major. Students gain skills for further education in a carefully devised program of development in understanding scientific method and science writing as well as an intense program of experimental and practical activities. ICT is used extensively as a tool for statistical analysis, presentation of data, researching and formal writing.

Biodiversity and Connectedness

In this unit students will investigate and describe a number of diverse ecosystems, exploring the range of biotic and abiotic components to understand the dynamics, diversity and underlying unity of these systems. Students use classification keys to identify organisms, describe the biodiversity in ecosystems and investigate patterns in relationships between organisms. Students will be introduced to simple statistical analysis, learn to cite and write reference lists and learn the essentials of scientific method. The development of critical thinking skills begins here.

Cells and Organisms

In this unit, students examine inputs and outputs of cells to develop an understanding of the chemical nature of cellular systems, both structurally and functionally, and the processes required for cell survival. Students examine the structure and function of plant and animal systems at cell and tissue levels in order to describe how they facilitate the efficient provision or removal of materials to and from all cells of the organism. Students continue the development of critical thinking, statistics and scientific methodology.

Heredity & Continuity of Life

In this unit, students investigate the biochemical and cellular systems and processes involved in the transmission of genetic material to the next generation of cells and to offspring. They consider different patterns of inheritance by analysing the possible genotypes and phenotypes of offspring. Students investigate the genetic basis for the theory of evolution by natural selection through constructing, using and evaluating explanatory and predictive models for gene pool diversity of populations. They explore genetic variation in gene pools, selection pressures and isolation effects in order to explain speciation and extinction events and to make predictions about future changes to populations. The development of investigative skills and their application continues with emphasis on critical thinking and thesis essay writing.

The Internal Environment

In this unit, students investigate how homeostatic response systems control organisms' responses to environmental change – internal and external – in order to survive in a variety of environments, as long as the conditions are within their tolerance limits. Students study how the invasion of an organism's internal environment by pathogens challenges the effective functioning of cells, tissues and body systems, and triggers a series of responses or events in the short- and long-term in order to maintain system function. They consider the factors that contribute to the spread of infectious disease and how outbreaks of infectious disease can be predicted, monitored and contained. Students complete an open-ended investigation and full scientific report.

The usual sequence of units is shown below.

	Typical Order of Units	
	SEM 1	SEM 2
Year 11	Biodiversity and Connectedness	Cells and Organisms
Year 12	Heredity and Continuity of Life	The Internal Environment

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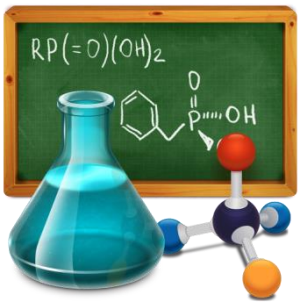
Chemistry (T)



This course is designed to provide an excellent background in Chemistry that enables students to appreciate the contribution that the science of chemistry makes to a technological society. This course will also provide the necessary prerequisite for those students intending to study a science-based discipline at a tertiary (T) level, or to enter a science-based occupation. Students develop skills in chemical analysis, problem solving, handling uncertainties and chemical methodologies in a carefully design program of practical activities including open ended investigations.

Chemical Fundamentals: Structure, Properties and Reactions

In this unit students use materials they encounter in their lives as a context for investigating the relationship between structure and properties of atoms and molecules. The concept of a mole as a means of quantifying matter in chemical reactions is introduced. Students relate matter and energy in chemical reactions, as they consider the breaking and reforming of bonds as new substances are produced.

Molecules: Interactions and Reactions

In this unit, students explore the characteristic properties of water, gases, aqueous solutions, acids and bases. They learn how rates of reaction can be measured and altered to meet particular needs and use models of energy transfer and the structure of matter to explain and predict changes to rates of reaction. Students investigate the behaviour of gases with respect to volume, pressure and temperature.

Equilibrium, Acids and Redox

In this unit, students investigate reversible reactions and factors affecting the dynamic equilibrium, in particular acid-base equilibria. Students investigate the principles of oxidation and reduction reactions and the production of electricity from electrochemical cells.

Structure, Synthesis and Design

In this unit, students focus on the principles and applications of chemical synthesis, particularly in organic chemistry. This involves considering where and how functional groups can be incorporated into already existing carbon compounds in order to generate new substances with properties that enable them to be used in a range of contexts. Students select and use data from instrumental analysis to determine the identity and structure of a range of organic materials.

The usual sequence of units is shown below.

Year 11	
SEM 1	**SEM 2**
Chemical Fundamentals	Molecules
Year 12	
SEM 1	**SEM 2**
Equilibrium and Redox	Structure, Synthesis and Design

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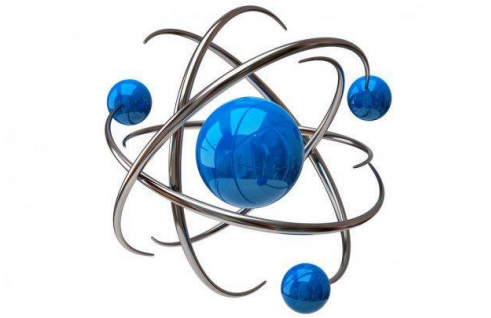
Physics (T)



The course will provide an excellent basis for students who intend to study a science-based discipline at a tertiary level or to take on a science-based occupation. Students taking this course are advised to select a tertiary Mathematics (minimum Maths Methods) course and to be achieving good grades in Mathematics. The study of Physics provides skills for the 21st Century. Students are encouraged to construct conceptual and mathematical models of physical phenomenon through experimental investigation and problem solving. Critical evaluation of experimental procedures and results is a focus of our practical work. Students gain skills in experimental design and the rigorous treatment of uncertainties. Students develop communication, questioning and co-operative problem-solving skills through regular, informal presentations to their classmates, related discussion and small groups work. ICT is used extensively by students throughout the physics course as a tool in research, data analysis and presentation of ideas.

Linear Motion and Waves

As well as providing an introduction to core practical investigation skills, this unit covers the foundation concepts of motion and waves. Students will analyse motion, momentum, energy and collisions using models and practical experience. Wave motion and properties with special reference to light is examined at depth.

Thermal, Nuclear and Electrical

Students investigate properties of heat, temperature and energy transfer. Nuclear energy is studied at depth with emphasis on radiation, fission and fusion highlighted. In the studies of electricity circuits and the physical principles that govern them investigation uses practical activities. Energy and conservation of energy is the uniting theme in this topic.

Gravity and Electromagnetism

Gravitational, electrical and magnetic fields and their applications are the focus of this unit. Vector analysis and motion in fields are studied at depth.

Revolutions in Modern Physics

This unit investigates relativity, the quantum light model and its applications and the standard model for the building blocks of matter.

The usual sequence of units is shown below.

	Typical Order of Units	
	SEM 1	SEM 2
Year 11	Linear Motion and Waves	Thermal, Nuclear and Electrical
Year 12	Gravity and Electromagnetism	Revolutions in Modern Physics

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Human Biology (T/A)

Human Biology is an excellent course for students planning a career in the medical or health care area such as medicine, nursing and physiotherapy and enriches the STEMM focus (Science, Technology, Engineering, Mathematics and Medicine). It is specifically designed to complement the Biology course so students can study Biology at the same time, or Human Biology can be studied on its own. Students have the opportunity to study Human Biology as a minor or major with the possibility of a major minor if a student undertakes a unit of negotiated study. It is ideal to team this course with the pre-med R unit which is more career oriented.

The Essentials of Human Life

Students learn about the stem cells from which tissue form in the embryo and which are the foundation for the growing therapeutic treatment of a number of degenerative diseases. Relationships between the tissue types are explored in order to develop an understanding of the intricate interconnectivity that produces the specialised organs of the human body, such as the heart and the liver, with a specialised function.

The Aging Human Body

Students learn about human reproduction and the complexity of growth and development of the human body through childhood, adolescence and adulthood. They will also focus on a range of illnesses that relate to age and tissue types so that they gain a deep understanding of how disease relates to tissue function in the body. Students will be exposed to a wide variety of cases studies to deepen their understanding of diseases through-out the life cycle.

Human Health and the Environment

This unit investigates the impact of environmental conditions upon the health of humans both at the individual and population level. The environmental causes of disease will be considered, based on the nature of the risk: biological, chemical, physical and social. Mental illness will be investigated as well as its causes, symptoms and treatment. Major mental health issues that affect teenagers will be considered in order to give the content real world relevance for the students.

Treating the Human Body

In this unit, students study the exponential growth of research and knowledge about the functioning of the human body that informs the Western mode of treating illness, and also consider alternative ways of treating illness in Australia. Student learning will be further enhanced through interaction with professional practitioners, wherever practical.

Negotiated Unit

Students may negotiate to undertake a major investigation or project in a specific area of interest in human biology. The unit may include study outside of the college (e.g., at universities, CSIRO, etc.). It may include a working relationship with a professional scientist in the chosen field or may take another form of investigation.

The usual sequence of units is shown below

	Typical Order of Units		**Negotiated unit can be done at any time in year 12. It is done offline and is counted as a unit of work for Human Biology**
	SEM 1	SEM 2	
Year 11	The Essentials of Human Life	The Ageing Human Body	
Year 12	Human Health and the Environment	Treating the Human Body	

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Pre-Med (R)

Preparing for Medical and related Careers

Pre-Med is designed to extend students' knowledge in human biology as well as helping prepare students for careers in the health professions. These include careers in Nursing, Medicine, Veterinary Science, Dentistry, Physiotherapy, Paramedics, medical research and many others. It is a perfect accompaniment to Human Biology and Biology courses and extends the STEMM focus in Science.

The program is less academic than Biology and Human Biology and aims to provide students with skills, information and experience to make informed decisions regarding post-college study options in medical and health science fields. It also aims to help them in their applications for University, CIT and employment, including UMAT and, in close association with the WEX and Careers team, can provide interview preparation where appropriate.

There is no formal assessment for R units and the completion of tasks is not competitive. A minimum of 11 hours provides students with 0.2 of a unit and students with demanding workloads do not have to complete all sessions to remain in the program.

Interdisciplinary Science (T/A)

The study of Interdisciplinary Science equips students with the skills to be independent thinkers and life-long learners who are confident to pursue a wide range of study pathways and careers. Students that undertake Interdisciplinary Science have a general interest in science as a subject and are looking to have a broad package without necessarily specialising in a particular field of science. This course is offered as a minor.

Unit 3: Science In Context

Students analyse contextual factors contributing to past discoveries and research such as culture, geography, economics, and other factors. These contextual factors will be applied in investigation of development and application of contemporary science. They learn how progress in science can be made through unexpected outcomes or applications of a field of research and improvements in technology. Science in context may be explored through investigation of one or more scientific issues, topics or case studies. Students will study the science in context that has significant interdisciplinary elements.

Unit 4: Science Innovations

Innovative science may be explored through investigation of one or more scientific issues, topics or case studies. Students will study the scientific innovation that has significant interdisciplinary elements. Students will examine and draw on theories, concepts and principles from different fields within the science disciplines to reach an informed conclusion(s). Students will work with scientists though the ACT Science mentors program to complete their individual research projects as a part of the Science Innovations unit.

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Extra-curricular Program and Community Partnerships

Students have the opportunity to participate in an extensive extra-curricular Science program. They will gain credit for these as R units. Further information on these activities is available by contacting staff in the Science faculty.

Typical activities conducted in recent years include the following:

National Youth Science Forum - Year 11 only (possibility to participate in extension activities and **International Youth Science Forum**). This is a specialty of Canberra College. Students are selected and advised on participation in the program. The program is two weeks of fun and fascination at an Australian University stimulating student interest in all fields of science and developing career pathways and leadership skills. Student may be invited to attend various Extension weekends or can be invited to attend the International Youth Science Forum which can be held in a number of venues overseas. Students from this college have attended the IYSF and found it a mind-blowing experience. Students are required to seek Rotary funding to attend the NYSF and to give a presentation to their Rotary club upon their return.

NATIONAL YOUTH SCIENCE FORUM
Inspiring young Australians to futures in science each year since 1984

ANU Extension – a complete minor taken out of normal class time at ANU. Offerings in science include Astrophysics, Conservation Biology, Chemistry, Physics and Engineering. Enrolments for this are in the first weeks of year 11. These units are credited as full academic units toward your senior certificate. **The satisfactory completion of this minor can lead to an early offer of entry to ANU and a unit credit toward your degree**. Students in science who take up this challenge find it a worthwhile and rewarding experience. Canberra College has a very high uptake and success rate for these courses.

Independent Projects – can be done as a part of Interdisciplinary Science course or as an R unit. The project can be done in association with the Science Mentors ACT program and may involve CSIRO crest program and may lead to selection for BHP Billiton Science Competition. The project needs to be sufficiently complex to fulfil the requirements of the R unit at college level. The choice of project is your own but you will be guided by teachers and scientists.

BHP Billiton Science & Engineering Awards

National Chemistry Titration Competition – requires learning the important analytical skill of titration in order to compete at ANU with students from all over Canberra. Canberra College students are often competing in the National finals of this prestigious competition.

Australian Science Olympiad – two-hour exams in Chemistry, Physics and Biology. Some top students can be eligible for the Australian Olympiad Summer School in January. This summer school is the equivalent of first year university studies in the chosen area and gives a large R unit credit. Canberra College Students have attended on a number of occasions in the past.

Science Competitions

- National Chemistry Quiz - a one Hour multiple choice test covering chemistry from your year.
- ICAS- a one-hour multiple choice test covering science concepts from all areas of science but the concepts are more challenging.

Questacon Schools Training Program - this is an extensive program provided by Questacon to train gallery presenters and workshop assistants. It requires 12 hours of training and 40 hours of hands-on work. There are 2 streams: in the gallery as a science communicator, or in the workshops, designing and building displays. Students completeing the training are eligible to volunteer at Questacon.

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