



**Penola**  
CATHOLIC COLLEGE  
EST. 1995

# SCIENCE

Biology  
Chemistry  
Physics  
Psychology  
Environmental Science



# SCIENCE PATHWAYS

Year 10	Year 11	Year 12	Tertiary/TAFE/ Careers
<p><b>Physics</b> Force and Energy</p> <p><b>Physics</b> Light, Electricity and sound</p>	<p>→ <b>Physics 1 &amp; 2</b> Unit 1: What ideas explain the physical world? Unit 2: What do experiments reveal about the physical world?</p>	<p>→ <b>Physics 3 &amp; 4</b> Unit 3: How do fields explain motion and electricity? Unit 4: How can two contradictory models explain both light and matter?</p>	<p><b>Bachelor In:</b> Engineering Architecture Property and Construction Interior Design Biomedical Engineering Medical Radiology Space Science</p>
<p><b>Chemistry</b> Chemical Patterns</p>	<p>→ <b>Chemistry 1 &amp; 2</b> Unit 1: How can the diversity of materials be explained? Unit 2: What makes water such a unique chemical?</p>	<p>→ <b>Chemistry 3 &amp; 4</b> Unit 3: How can chemical processes be designed to optimise efficiency? Unit 4: How are organic compounds categorised, analysed and used?</p>	<p><b>Bachelor In:</b> Education Medicine Vet Sciences Food Technology Pharmacy Nursing Exercise Science Dentistry Forensic Science Sports and Outdoor Education Agricultural Science Horticulture Environmental Science Health Science Occupational Therapy Food Science and Nutrition Biotechnology Biomedical Science Marine Biology Physiotherapy Microbiology Biochemistry Animal Science Laboratory Medicine Orthoptic and Ophthalmic</p>
<p><b>Biology</b> Genetics and Evolution</p> <p><b>Biology</b> Immunology and Diseases</p>	<p>→ <b>Biology 1 &amp; 2</b> Unit 1: How do living things stay alive? Unit 2: How is continuity of life maintained?</p> <p><b>Environmental Science 1 &amp; 2</b> Unit 1: The Environment Unit 2: Monitoring the Environment</p>	<p>→ <b>Biology 3 &amp; 4</b> Unit 3: How do cellular processes work? Unit 4: How do cells communicate?</p> <p>→ <b>Environmental Science 3 &amp; 4</b> Unit 3: Ecological issues-energy and Biodiversity Unit 4: Ecological Sustainability</p>	<p><b>Bachelor In:</b> Education General Psychology Sports Psychology Clinical Psychology Forensic Psychology Behavioural Science</p>
<p><b>Psychology</b></p>	<p>→ <b>Psychology 1 &amp; 2</b> Unit 1: How are behaviour and mental processes shaped? Unit 2: How do external factors influence behaviour and mental processes?</p>	<p>→ <b>Psychology 3 &amp; 4</b> Unit 3: How does experience affect behaviour and mental processes? Unit 4: How is well being developed and maintained?</p>	<p><b>Bachelor In:</b> Education General Psychology Sports Psychology Clinical Psychology Forensic Psychology Behavioural Science</p>



# BIOLOGY

Biology is a diverse and evolving science discipline that seeks to understand and explore the nature of life, past and present. The study explores the dynamic relationships between organisms and their interactions with the non-living environment. It also explores the processes of life, from the molecular world of the cell to that of the whole organism, that maintain life and ensure its continuity. An important feature of undertaking a VCE Biology is the opportunity for students to engage in a range of inquiry tasks that may be self-designed, develop key science skills and interrogate the links between theory, knowledge and practice. VCE Biology provides for continuing study pathways within the discipline and leads to a range of careers. Branches of biology include botany, genetics, immunology, microbiology, pharmacology and zoology.

In addition, biology is applied in many fields of endeavour including biotechnology, dentistry, ecology, education, food science, forestry, health care, horticulture, medicine, optometry, physiotherapy and veterinary science. It is strongly recommended students complete Units 1 and 2 before attempting Units 3 and 4 as it provides the basis for Units 3 and 4.

## Unit 1: How do living things stay alive?

In this unit students are introduced to some of the challenges to an organism in sustaining life. Students examine the cell as the structural and functional unit of life, from the single celled to the multicellular organism, and the requirements for sustaining cellular processes in terms of inputs and outputs. They analyse types of adaptations that enhance the organisms survival in a particular environment and consider the role homeostatic mechanisms play in maintaining the internal environment.

### Assessment: Unit 1

For this unit students are required to demonstrate achievement of three outcomes.

## Unit 2: How is continuity of life maintained?

In this unit students focus on cell reproduction and the transmission of biological information from generation to generation. They examine the process of DNA replication and compare cell division in both prokaryotic and eukaryotic organisms. The role of stem cells in the differentiation, growth, repair and replacement of cells in humans is examined, and their potential use in medical therapies is considered. Students explore the relationship between genes, the environment and the regulation of genes in giving rise to phenotypes. They consider the role of genetic knowledge in decision making about the inheritance of autosomal dominant, autosomal recessive and sex-linked genetic conditions. In this context the uses of genetic screening and its social and ethical issues are examined.

A student-directed research investigation into, and communication of, an issue related to genetics and/or reproductive science is to be undertaken in Area of Study 3. The investigation draws on content from Area of Study 1 and/or Area of Study 2.

### Assessment: Unit 2

For this unit students are required to demonstrate achievement of three outcomes.

## Unit 3: How do cellular processes work?

In this unit students examine the chemical nature of the plasma membrane and compare how hydrophilic and hydrophobic substances move across it. They model the formation of DNA and proteins from their respective subunits. The expression of the information encoded in a sequence of DNA to form a protein is explored and the nature of the genetic code outlined. Students use the lac operon to explain prokaryotic gene regulation in terms of the 'switching on' and 'switching off' of genes.

Students learn why the chemistry of the cell usually takes place at relatively low, and within a narrow range of,

temperatures. They examine how reactions, including photosynthesis and cellular respiration, are made up of many steps that are controlled by enzymes and assisted by coenzymes. They can explain the mode of action of enzymes and the role of coenzymes in the reactions of the cell and investigate the factors that affect the rate of cellular reactions.

### Assessment: Unit 3

School Assessed Coursework (16% of study score). Two tasks:

#### Outcome:

- A report related to at least two practical activities from a logbook of practical activities. (approximately 50 minutes or not exceeding 1000 words)
- A response to a set of structured questions.

## Unit 4: How do cells communicate?

In this unit students investigate the relatedness between species and the impact of various change events on a population's gene pool. Students examine change in life forms using evidence from palaeontology, biogeography, developmental biology and structural morphology. They explore how technological developments in the fields of comparative genomics, molecular homology and bioinformatics have resulted in evidence of change through measurements of relatedness between species. The biological consequences, and social and ethical implications, of manipulating the DNA molecule and applying biotechnologies is explored for both the individual and the species.

### Assessment: Unit 4

School Assessed Course work

- A written report using primary or secondary data.
- A report of a laboratory investigation
- A structured scientific poster according to the VCAA template

Unit 4 SACs will contribute 24% to the study score.

The end of year Examination will contribute 60% to the study score.



# CHEMISTRY

Chemistry explores and explains the composition and behaviour of matter and the chemical processes that occur on Earth and beyond. VCE Chemistry enables students to explore key processes related to matter and its behaviour. Students consider the relationship between materials and energy through four themes: the design and composition of useful materials, the reactions and analysis of chemicals in water, the efficient production and use of energy and materials, and the investigation of carbon-based compounds as important components of body tissues and materials used in society.

Successful completion of VCE Chemistry forms the basis for tertiary studies in quite a large number of courses such as Medicine, Dentistry, Pharmacy, Chemical Engineering, Nursing, Laboratory Technician and many more. In VCE Chemistry students develop a range of inquiry skills involving practical experimentation and research specific to the knowledge of the discipline, analytical skills including critical and creative thinking, and communication skills. Students use scientific and cognitive skills and understanding to analyse contemporary chemistry-related issues, and communicate their views from an informed position.

## Unit 1: How can the Diversity of Materials be explained?

This unit examines the development and structure of the Periodic Table, which provides a unifying framework for studying the chemistry of the elements. The configuration of an element and the internal structure of the atom can all be linked to the position of an element in the Periodic Table. Different models of bonding between atoms and molecules are explored. These models are used to explain the different properties and uses of various materials.

A research investigation is undertaken in Area of Study 3 related to one of ten options that draw upon and extend the content from Area of Study 1 and/or Area of Study 2.

### Assessment: Unit 1

For this unit students are required to demonstrate achievement of three outcomes.

## Unit 2 : What makes Water such a Unique Chemical?

In this unit students explore the physical and chemical properties of water, the reactions that occur in water and various methods of water analysis. Students examine the polar nature of a water molecule and the intermolecular forces between water molecules. They examine the properties of water and the gases of the atmosphere, and their importance in sustaining life on Earth. It investigates how chemistry is used to respond to the effects of human activities on our environment, including Algae blooms, salinity, acid rain, depletion of photochemical smog and global warming. This unit introduces new, cleaner and more efficient chemical processes that have been designed using green chemistry principles. Students explore the solvent properties of water in a variety of contexts and analyse selected issues associated with substances dissolved in water. A practical investigation into an aspect of water quality is undertaken in Area of Study 3. The investigation draws on content from Area of Study 1 and/or Area of Study 2.

### Assessment: Unit 2

For this unit students are required to demonstrate achievement of three outcomes

## Unit 3 : How can Chemical Processes be Designed to Optimise Efficiency?

In this unit students explore energy options and the chemical production of materials with reference to efficiencies, renewability and the minimisation of their impact on the environment. Students compare and evaluate different chemical energy resources, investigate the combustion of fuels, energy transformations, and use stoichiometry

to calculate the amounts of reactants and products and the amount of energy released.

### Assessment: Unit 3

School Assessed Coursework (16% of study score).

Two tasks chosen from:

- Analysis and evaluation of stimulus material
- A report on a laboratory investigation
- A report of a student investigation
- Media analysis
- A response to a set of structured questions

## Unit 4 : How are Organic Compound Categorised, Analysed and Used?

In this unit students investigate the structural features, bonding, typical reactions and uses of the major families or organic compounds including those found in food. They process data from instrumental analyses of organic compounds to confirm or deduce organic structures and investigate key food molecules.

### Assessment: Unit 4

School Assessed Coursework (24% of study score).

Two task chosen from:

- A report of a student investigation
- Media analysis/response
- A response to a set of structured questions
- Response to stimulus material
- A report of a laboratory investigation

And the third task is a structured scientific poster presenting the methodologies, findings and conclusions of a practical investigation.

The end of year examination will contribute 60% of the study score.



# PHYSICS

Physics seeks to understand and explain the physical world. It examines models and ideas used to make sense of the world and which are sometimes challenged as new knowledge develops. By looking at the way matter and energy interact through observations, measurements and experiments, physicists gain a better understanding of the underlying laws of nature.

VCE Physics provides students with opportunities to explore questions related to the natural and constructed world. The study provides a contextual approach to exploring selected areas within the discipline including atomic physics, electricity, fields, mechanics, thermodynamics, quantum physics and waves. VCE Physics provides for continuing study pathways within the discipline and leads to a range of careers. Physicists may undertake research and development in specialist areas including acoustics, astrophysics and cosmology, atmospheric physics, computational physics, education, energy research, engineering, instrumentation, lasers and photonics, medical physics, nuclear science, optics, pyrotechnics and radiography. Physicists also work in cross-disciplinary areas

## Unit 1: What ideas explain the physical World?

Core Topics: Thermodynamics, Electricity and Energy from the atom

In this unit students explore how physics explains phenomena, at various scales, which are not always visible to the unaided human eye. They examine some of the fundamental ideas and models used by physicists in an attempt to understand and explain the world. Students consider thermal concepts by investigating heat, probe common analogies used to explain electricity and consider the origins and formation of matter.

In this unit students study and apply the thermodynamic principles related to heating processes. Students investigate and apply circuit models to DC devices and analyse how household electrical system can be made safe and efficient.

Students explore the nature of matter and consider the origins of atoms, time and space.

### Assessment: Unit 1

Three school assessed coursework tasks for each of the three outcomes

## Unit 2: What do experiments reveal about the physical world?

Core Topics: Motion, AC electricity to low voltage DC and Practical investigation

In this unit students study the laws of motion. They apply and analyse these laws to real life situations. Students investigate the processes in transforming the 240V AC into low voltage regulated DC power supply. Students to conduct Practical investigation related to knowledge and skills developed in this unit.

Students choose one of twelve options related to astrophysics, astrophysics, bioelectricity, biomechanics, electronics, flight, medical physics, nuclear energy, nuclear physics, optics, and sound and sports science. The option enables students to pursue an area of interest by investigating a selected question.

A student-designed practical investigation relates to content drawn from Area of Study 1 and/or Area of Study 2 and is undertaken in Area of Study 3.

### Assessment: Unit 2

Three school assessed coursework tasks for each of the three outcomes

## Unit 3: How do fields explain motion and electricity?

This unit focuses on fields and motion. Students will build understanding of physics concepts and scientific skills, for example, application of Newton's laws of motion to circular and projectile motion, calculations related to experimental data involving relationships between force, energy and mass, analysis of electric,

magnetic and gravitational fields, and calculations related to the generation and transmission of electricity.

### Assessment: Unit 3

School Assessed Course work

- A test
- A data analysis
- A response to structured questions

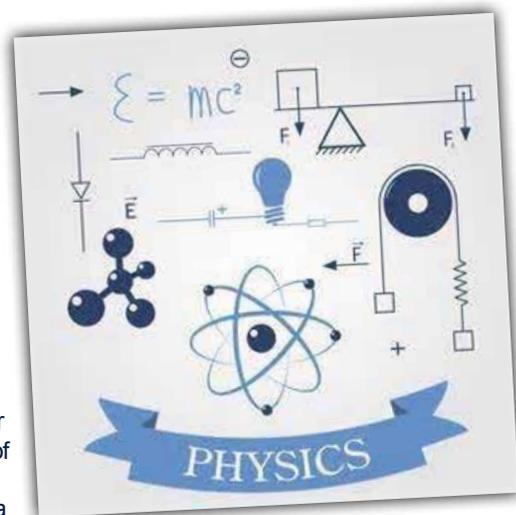
## Unit 4: How can two contradictory models explain both light and matter?

This unit focuses on light and matter. Students will build understanding of concepts of waves on the examples of sound and light in particular. They will learn wave equation and the laws of refraction perform analysis of interference/diffraction patterns, and graphical analysis related to the photoelectric effect. Students will familiarize with the concepts of quantum mechanics in application to the light and matter duality.

### Assessment: Unit 4

School Assessed Course work

- A short answer test
- A data analysis
- A student designed Practical investigation and Poster Report





# PSYCHOLOGY

VCE Psychology enables students to explore how people think, feel and behave through the use of a bio-psychosocial approach. As a scientific model, this approach considers biological, psychological and social factors and their complex interactions in the understanding of psychological phenomena. The study explores the connection between the brain and behaviour by focusing on several key interrelated aspects of the discipline: the interplay between genetics and environment, individual differences and group dynamics, sensory perception and awareness, memory and learning, and mental health.

Students pose questions, formulate research hypotheses, operationalise variables, and collect, analyse and critically interpret qualitative and quantitative data. They analyse the limitations of data, evaluate methodologies and results, justify conclusions, make recommendations and communicate their findings. VCE Psychology provides for continuing study pathways within the discipline and leads to a range of careers. Opportunities may involve working with children, adults, families and communities in a variety of settings such as academic and research institutions, management and human resources, and government, corporate and private enterprises. Fields of applied psychology include educational, environmental, forensic, health and sport.

## Unit 1: How are behaviour and mental processes shaped?

In this unit students investigate the structure and functioning of the human brain and the role it plays in the overall functioning of the human nervous system. Students explore brain plasticity and the influence that brain damage may have on a person's psychological functioning. Students examine the contribution that classical and contemporary studies have made to an understanding of the human brain and its functions, and to the development of different psychological models and theories used to predict and explain the development of thoughts, feelings and behaviours.

A student-directed research investigation related to brain function and/or development is undertaken in this unit.

The research investigation draws on content from Area of Study 1 and/or Area of Study 2.

Three school assessed coursework for each of the three outcomes.

### Assessment Unit 1

Refer to study design for range of assessment tasks.

## Unit 2: How do external factors influence behaviour and mental processes?

In this unit students investigate how perception of stimuli enables a person to interact with the world around them and how their perception of stimuli can be distorted. They evaluate the role social cognition plays in a person's attitudes, perception of themselves and relationships with others.

Students explore a variety of factors and contexts that can influence the behaviour of an individual and groups.

A student practical investigation related to internal and external influences on behaviour is undertaken in this unit. The investigation draws on content from Area of Study 1 and/or Area of Study 2.

Three school assessed coursework for each of the three outcomes.

### Assessment: Unit 2

Refer to study design for range of assessment tasks.

## Unit 3: How does experience affect behaviour and mental processes?

In this unit students examine both macro-level and micro-level functioning of the nervous system to explain how the human nervous system enables a person to interact with the world around them. They explore how stress may affect a person's psychological functioning and consider the causes and management of stress.

Students investigate how mechanisms of memory and learning lead to the acquisition of knowledge, the development of new capacities and changed behaviours.

They consider the limitations and fallibility of memory and how memory can be improved. Students examine the contribution that classical and contemporary research has made to the understanding of the structure and function of the nervous system, and to the understanding of biological, psychological and social factors that influence learning and memory.

## Unit 4: How is wellbeing developed and maintained?

Consciousness and mental health are two of many psychological constructs that can be explored by studying the relationship between the mind, brain and behaviour. In this unit students examine the nature of consciousness

and how changes in levels of consciousness can affect mental processes and behaviour. They consider the role of sleep and the impact that sleep disturbances may have on a person's functioning. Students explore the concept of a mental health continuum and apply a biopsychosocial approach, as a scientific model, to analyse mental health and disorder. They use specific phobia to illustrate how the development and management of a mental disorder can be considered as an interaction between biological, psychological and social factors. Students examine the contribution that classical and contemporary research has made to the understanding of consciousness, including sleep, and the development of an individual's mental functioning and wellbeing.

### Assessment: Unit 4

- Unit 3 School-assessed Coursework tasks: 16% (study score)
- Unit 4 School-assessed Coursework tasks: 24% (study score)

The end of year Examination will contribute 60% to the study score.



# ENVIRONMENTAL SCIENCE

In this unit students examine Earth as a set of four interacting systems: the atmosphere, biosphere, hydrosphere, and lithosphere. They investigate the physical environment and its components, the function of local ecosystems and the interactions that occur in and between ecological components over different timescales. Students consider how the biotic and abiotic components of local ecosystems can be monitored and measured. A student practical investigation related to ecosystem monitoring and/or change is undertaken in this unit.

VCE Environmental Science enables students to explore the challenges that past and current human interactions with the environment presents for the future by considering how Earth's atmosphere, biosphere, hydrosphere and lithosphere function as interrelated systems.

## Unit 1: How are Earth's systems connected?

Life on Earth is dependent on four major inputs: energy, nutrients, air and water. In this area of study students examine the processes and interactions occurring within and between Earth's four systems - the atmosphere, biosphere, hydrosphere and lithosphere - that affect the availability, accessibility and usability of these inputs for life. They examine the outputs of processes and interactions occurring within and between the four systems, and distinguish between outputs that can be reused as inputs and those that require treatment as wastes.

### Assessment: Unit 1

For this unit students are required to demonstrate achievement of three outcomes.

## Unit 2: How can pollution be managed?

In this unit students explore the concept of pollution and associated impacts on Earth's four systems through global, national and local perspectives. They analyse the effects of pollutants on the health of humans and the environment over time. They explore the significance of technology, government initiatives, communities and individuals in redressing the effects of pollutants, and consider how values, beliefs and evidence affect environmental decision making. Students compare three pollutants of national and/or global significance with reference to their effects in the atmosphere, biosphere, hydrosphere and lithosphere, and discuss management options.

### Assessment: Unit 2

For this unit students are required to demonstrate achievement of three outcomes.

## Unit 3: Ecological Issues- energy and Biodiversity

This unit focuses on two major ecological issues which provide challenges for the present and the future. The consequences on the atmosphere of natural and enhanced greenhouse effects, and issues of biodiversity and its significance in sustaining ecological integrity, will be examined.

### Assessment: Unit 3

School Assessed Coursework Tasks (20% of Study Score)

- A written report of a practical activity
- A report in annotated poster or multimedia format
- A report on one selected endangered animal
- A report or presentation of environmental risk

## Unit 4: Ecological Sustainability

This unit focuses on pollution and its relationship to the health of humans and the environment. It advances further understanding of managing the environment to ensure development meets human needs while maintaining the ecological integrity of the environment.

### Assessment: Unit 4

School Assessed Coursework Tasks (20% of Study Score)

- A report on the findings of selected fieldwork
- An evaluation of management strategies
- A test or report
- An environmental management plan on sustainability

The end of year Examination will contribute 60% to the study score.

