

Science

Science

Energy matters

Atomic world and Eco-challenge

Atomic world and STEM Electricity

Chemistry - Chemical patterns

Biology - Genetics and evolution

Biology - Immunology and disease

Physics - Force, energy and motion

Psychology

Global Systems and the Universe

Forensic science

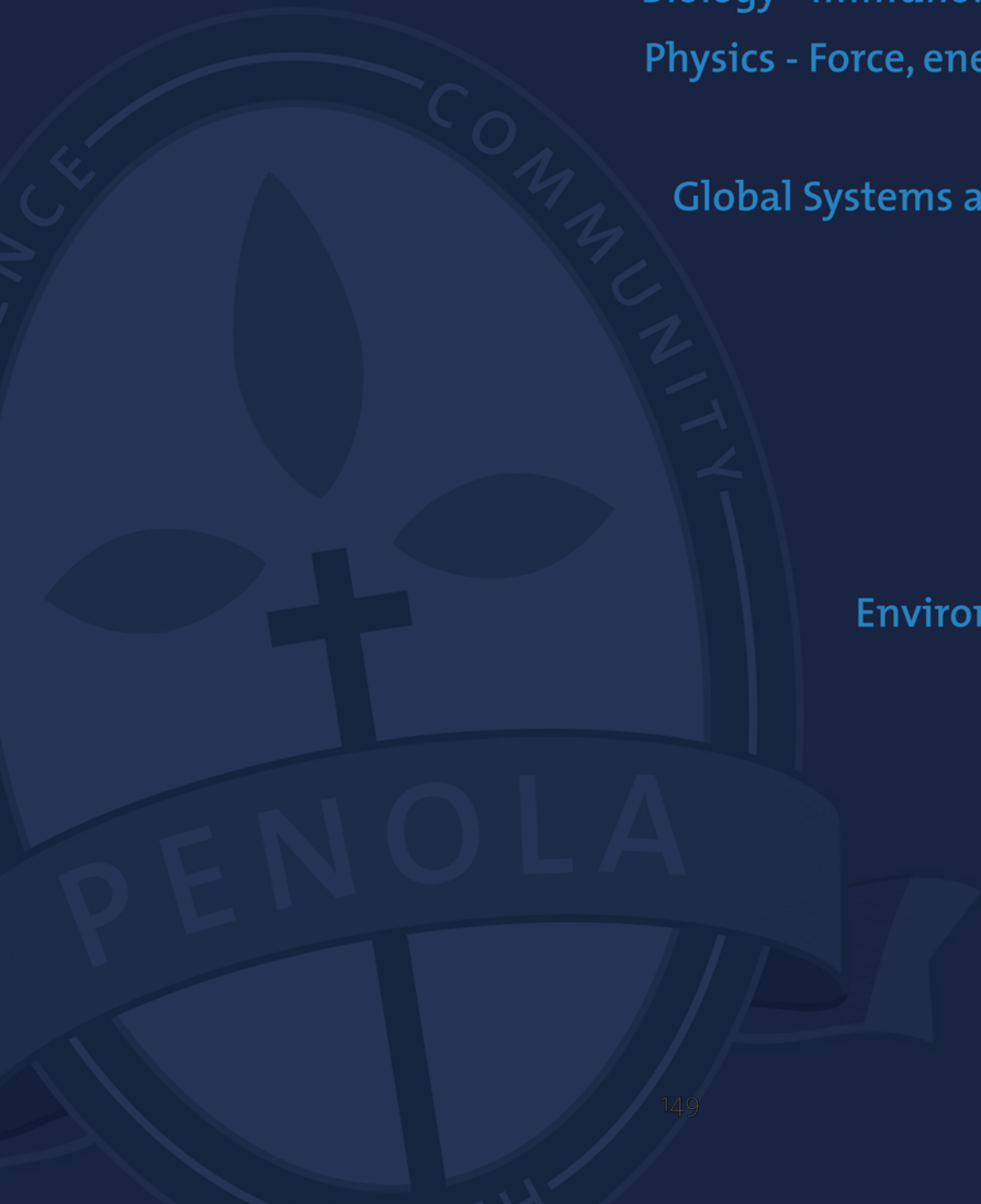
Chemistry

Biology

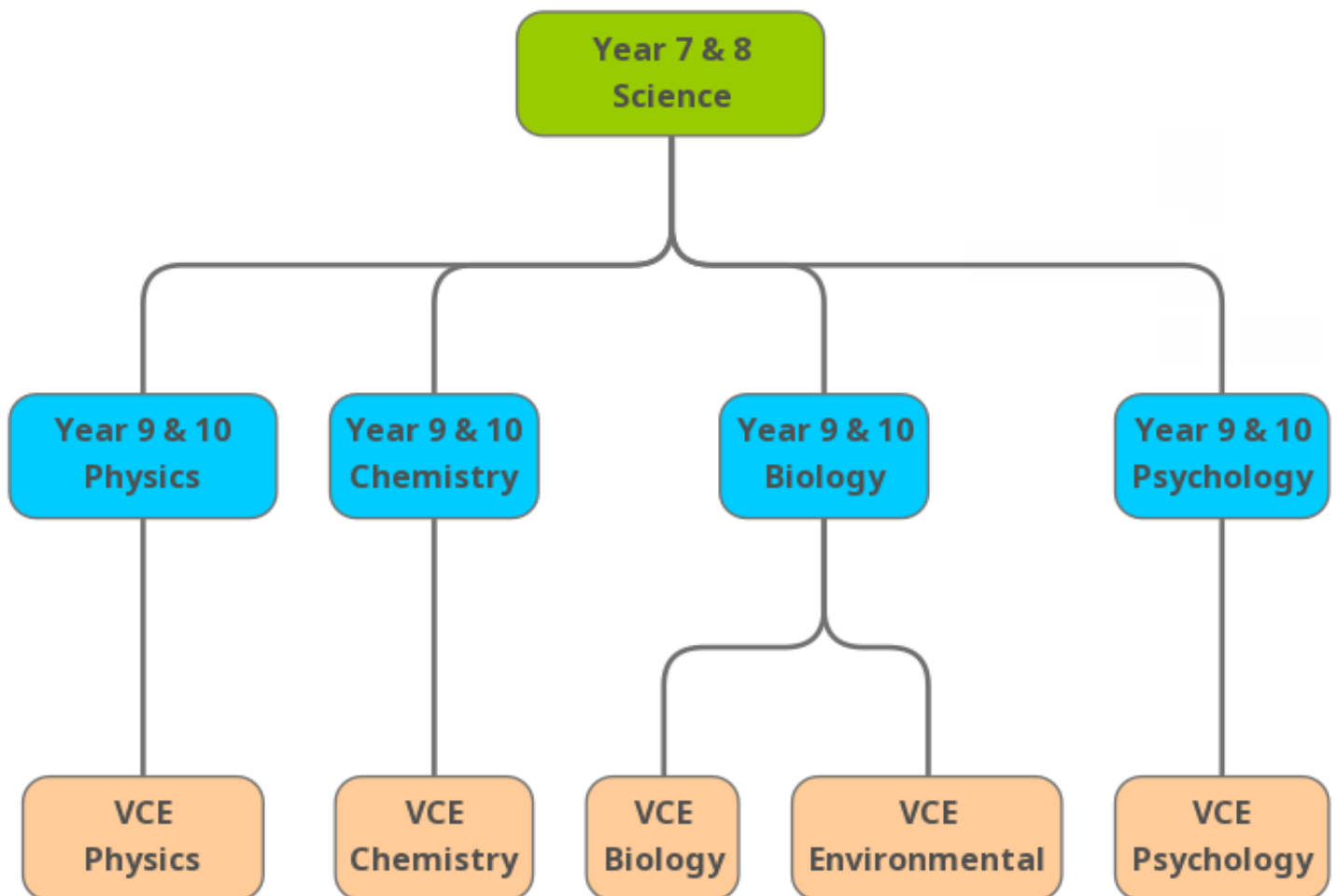
Physics

Psychology

Environmental Science



Science Pathways



Science

Year 7 - 8

At Penola Catholic College our science program provides opportunities for students to explore and explain the world around them.

Through a variety of science activities, students develop and apply scientific knowledge. Students use evidence to explain and predict events in the physical and biological world. Students apply the skills of scientific investigation and analysis and learn to use appropriate scientific language for a range of audiences. Students generate knowledge, refine solutions, ask questions and communicate scientific understanding through a range of activities.

Through the study of science students gain an understanding of the importance of Science and the work of scientists in the community.

This will assist students when making decisions about careers and further study.

Year 7 Science

- Chemical Science
- Biological Science
- Earth and Space Science
- Physical Science
- Topic Tests
- Practical Activities
- STEM Project

Year 8 Science

- Biological Science
- Chemical Science
- Earth and Space Science
- Physical Science
- Topic Tests
- Practical Activities
- STEM Project



Science

Year 9

Year 9 Science is semester based with the first semester being compulsory for all students. There are two elective subjects for Semester 2: Atomic world and Eco-challenge and Atomic world and Stem electricity.

Semester 1 covers the concept of energy through the three core science subjects of Physics, Chemistry and Biology. Students investigate how electrons orbit an atom, how these electrons can flow to create electricity through conductive materials and finally look at how energy flows through neurons sending signals to carry out functions in the body.

Semester 2 students will explore ions, isotopes and various types of chemical reactions followed by either an Eco- challenge or STEM unit. Eco-challenge explores the relationships between organisms and their ecosystems followed by a project-based learning task where students investigate ways to reduce human impact on these ecosystems. In the STEM unit students investigate battery power and they use explore microbial batteries in the project-based learning task.

Semester 1 - Energy Matters (Compulsory unit):

Exploration of energy through the three core sciences of Chemistry, Physics and Biology.

- Chemistry - Atoms are the basis of all matter. Exploration into the structure of atoms helps explain their properties and follows onto the formation of the periodic table.
- Physics - The outer electrons found in the atom can flow. Exploring the movement of these electrons in electric circuits allows students to respect the power of electricity.
- Biology - Electricity flows inside of us. Signals are sent throughout the body to keep it functioning and to help protect it. Exploration into how these electrical signals are sent and received will help students understand what reaction times are and how they play a part in things like driving a car.

Semester 2 - Atomic world:

Students will continue to investigate atoms, this time focussing on different versions of these atoms. Beginning with charged atoms (ions) and isotopes which explores radio-activity and why the nucleus of an atom is unstable. They will learn how to identify when a chemical reaction is taking place specifically focussing on heat and pH. Students will conduct many experiments including an extended practical investigation.

Eco-challenge:

Students will study ecosystem and how all living things are dependent on each other and their ecosystems. They will learn and model how energy enters the ecosystem through photosynthesis and the cycles of nature. They will explore how relationship between organisms are beneficial or detrimental and how introduced species can have an impact on the ecosystem. They will investigate how natural disasters and human activity can disrupt the ecosystem and how oil spills can damage our water ecosystems. Students will have an opportunity to design a campaign to tell people about how humans affect the environment around us and what we can do to make things better.

STEM electricity

Students will revisit electric circuits from first semester focussing on different types of batteries. They will explore and appreciate how advances in scientific understanding often rely on developments in technology and how technological advances are often linked to scientific discoveries. Students will revisit electric circuits focussing on a variety of power sources. They will investigate the different types of batteries including metal-air batteries and lead-acid batteries. Students will build their own electroscopes which detects electric charge. They will then use their knowledge of batteries to explore microbial fuel cells. They will present a project based on fuel cells at the Project based learning night.

Science

Year 10

The aim of year 10 is to provide a solid foundation of knowledge of the biological, chemical, physical, Earth and space sciences, including being able to select and integrate the scientific knowledge and methods needed to explain and predict phenomena, to apply that understanding to new situations and events, and to appreciate the dynamic nature of science knowledge. Five of the seven units will introduce students to the content covered in VCE subjects. These are:

- Biology - Immunology and Disease,
- Biology - Genetics and Evolution
- Chemistry - Chemical Patterns
- Physics - Force, Energy and motion
- Psychology

Students in Year 10 will select a Science for at least one semester from the seven strands. When listing preferences please keep in mind possible career choices and personal academic ability.

Immunology and Disease

This topic is a great subject to assist student wishing to study VCE Biology. Students will study how Multicellular Organisms rely on coordinated and interdependent internal body systems to respond to changes to their environment. Students will learn about pathogens; how they enter the body, how they cause disease and how our bodies fight these pathogens. They will investigate the response of the body to change as a result of the presence of pathogens invading our body.

Genetics and Evolution

Highly recommended for students who wish to continue with VCE Biology. In this unit, the students will study the transmission of inheritable characteristics from one generation to the next which involves Genes and DNA. They study the theory of evolution by natural selection which explains the diversity of things and is supported by a range of scientific skills. Students will learn the skills to analyse, firsthand & second-hand data and interpret graphs.

Force, Energy and Motion

Highly recommended for students who wish to continue with VCE Physics. Students learn the concept of energy conservation and represent energy transfers and transformation within systems. They apply relationships between force, mass and acceleration to predict changes in the motion of objects. Students will gather data to analyse everyday motions produced by forces, such as measurements of distance and time, speed, force, mass and acceleration.

Chemical Patterns

Highly recommended for students who wish to continue with VCE Chemistry. Students will study how atomic structure and properties of elements are used to organize the Modern Periodic Table. They will study groups of elements with similar properties and electronic structure in relation to their position on the Periodic table and investigate the chemical activity of some metals. Students will investigate a range of chemical reactions which produce useful everyday substances and the factors involved in different types of chemical reactions using chemical symbols to represent them. Students will learn the skills to analyse, firsthand & second-hand data and interpret graphs.

Psychology

Psychology is the scientific study of how people behave, think and feel. Psychologists study everything about the human experience from the basic workings of the human brain to consciousness, memory, reasoning and language to personality and mental health.

In this subject you will investigate the following topics:

What is psychology

- Understanding what psychology is and what psychologists do.
- Investigate and understand how research into human behaviour is undertaken through the scientific method.

What influences behaviour

- Identifying patterns of behaviour
- Exploring the psychology of lying and deception

What is mental health

- Understanding of the different approaches to describing what is considered to be normal behaviour.
- Exploring the terms mental health, mental health problems and mental disorders.
- Understanding the symptoms and treatment of major categories of mental disorders: mood disorders, psychotic disorders and anxiety disorders.

Global System and The Universe

Students learn about Rocks and minerals found on earth and how we use these in our daily lives. They explore the Earth's cycles (nitrogen, carbon, oxygen, phosphorus and water) and how these cycles work within the layers of the atmosphere. Students study the universe and the changing nature of features including galaxies, stars and solar systems with a focus on night skies. In learning how the Big Bang Theory can explain the origin of the Universe, they understand how scientific theories develop over time and must be supported by evidence. They also learn about space technology such as artificial satellites carrying space telescopes and how they are used to discover aspects of distant universe and explore whether there is 'other life out there'.

Forensics

Discover the underlying principles in chemistry, physics and biology associated with the intriguing world of Crime Scene Investigation. Explore how scientific principles reveal the hidden secrets of the criminal atrocities occurring in modern society. Throughout this course you will develop an understanding of topics such as Crime Scene Protocol (searching for evidence) Human Identification (fingerprint identification, DNA, blood analysis, anthropology, dental analysis) and Evidence Analysis (Fibres, hair, toxicology). This course endeavours to relate all theory to practical applications, exploring criminal case studies, allowing you to develop a sound understanding of the methods of forensic science.



VCE 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.

Unit 1 - How do living things stay alive?

Areas of Study include:

AOS 1 – How do organisms function?

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.

AOS 2 - How do living systems sustain life?

They analyse types of adaptations that enhance the organism's survival in a particular environment and consider the role homeostatic mechanisms play in maintaining the internal environment.

AOS 3 – Practical investigation

The investigation requires the student to develop a question, plan a course of action to answer the question, undertake an investigation to collect the appropriate primary qualitative and/or quantitative data, organise and interpret the data and reach a conclusion in response to the question.

Unit 2 How is continuity of life maintained?

Areas of Study include:

AOS 1 – How does reproduction maintain the continuity of life?

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.

AOS 2 – How is inheritance explained?

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.

AOS 3 – Investigation of an issue

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.

Unit 3 how do cells maintain life?

Areas of Study include:

AOS 1 – How do cellular processes work?

In this unit, students examine the chemical nature of the plasma membrane. 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.

AOS 2 – How do cells communicate?

Students explore how cellular signals are sent and received throughout the body and across a species to communicate. They will look at invading pathogens, how the body detects them and the subsequent events that occur within the human body to combat them. They also learn about the importance of vaccinations on herd immunity and how developments in modern technology has allowed scientists to treat cancer.

Unit 4 How does life change and respond to challenges over time?

Areas of Study include:

AOS 1 – How are species related?

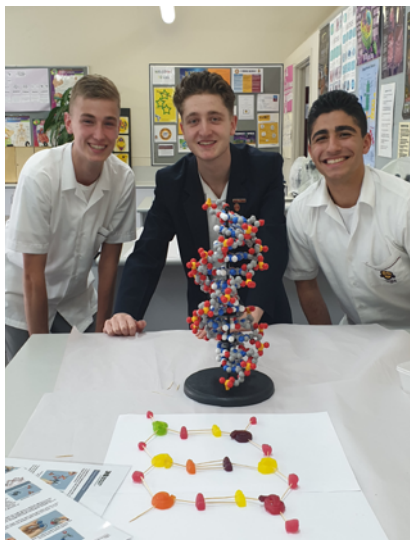
In this unit, students investigate the relatedness between species and the impact of various change events on a population's gene pool. Students examine change in life forms using evidence from palaeontology, biogeography, developmental biology and structural morphology. They explore how technological developments in the fields of comparative genomics, molecular homology and bioinformatics have resulted in evidence of change through measurements of relatedness between species.

AOS 2 – How do humans impact on biological processes?

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.

AOS 3 – Practical Investigation

The investigation requires the student to identify an aim, develop a question, formulate a hypothesis and plan a course of action to answer the question and that complies with safety and ethical guidelines. The student then undertakes an experiment that involves the collection of primary qualitative and/or quantitative data, analyses and evaluates the data, identifies limitations of data and methods, links experimental results to science ideas, reaches a conclusion in response to the question and suggests further investigations which may be undertaken. The results of the investigation are presented in a scientific poster format.



VCE 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 many courses such as Medicine, Dentistry, Pharmacy, Chemical Engineering, Nursing, Laboratory Technician and many more.

Unit 1 How can the diversity of materials be explained?

Areas of Study include:

AOS 1 – How can knowledge of elements explain the properties of matter?

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.

AOS 2 – How can the versatility of non-metals be explained?

Students investigate and explain the properties of carbon lattices and molecular substances with reference to their structures and bonding, use systematic nomenclature to name organic compounds, and explain how polymers can be designed for a purpose.

AOS 3 – Research investigation.

Students undertake a research investigation relevant to one of the following ten options. A question from the list under each option may be selected or students may develop their own research question relevant to Area of Study 1 and/or Area of Study 2 in conjunction with their teacher. For the selected question, students outline, analyse and evaluate relevant evidence to support their conclusions.

Unit 2 What makes water such a unique chemical?

Areas of Study include:

AOS 1 – How do substances interact with water?

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.

AOS 2 – How are substances in water measured and analysed?

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.

AOS 3 – Practical investigation

The investigation requires the student to develop a question, plan a course of action that attempts to answer the question, undertake an investigation to collect the appropriate primary qualitative and/or quantitative data (which may include collecting water samples), organise and interpret the data and reach a conclusion in response to the question.

Unit 3 How can chemical processes be designed to optimise efficiency?

Areas of Study include:

AOS 1 – What are the options for energy production?

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.

AOS 2 – How can the yield of a chemical product be optimised?

In this area of study students explore the factors that increase the efficiency and percentage yield of a chemical manufacturing process while reducing the energy demand and associated costs.

Unit 4 How are organic compounds categorised, analysed and used?

Areas of Study include:

AOS 1 – How can diversity of carbon compounds be explained and categorised?

In this unit, students investigate the structural features, bonding, typical reactions and uses of the major families of 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.

AOS 2 – What is the chemistry of food?

In this area of study students explore the importance of food from a chemical perspective.

AOS 3 – Practical investigation

The investigation requires the student to identify an aim, develop a question, formulate a hypothesis and plan a course of action to answer the question and that complies with safety and ethical requirements. The student then undertakes an experiment that involves the collection of primary qualitative and/or quantitative data, analyses and evaluates the data, identifies limitations of data and methods, links experimental results to science ideas, reaches a conclusion in response to the question and suggests further investigations which may be undertaken. Findings are communicated in a scientific poster.



VCE 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.

Unit 1 What ideas explain the physical world?

Areas of Study include:

AOS 1 – How can thermal effects be explained?

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. Students study and apply the thermodynamic principles related to heating processes.

AOS 2 – How do electric circuits work?

Students investigate and apply circuit models to DC devices and analyse how household electrical system can be made safe and efficient.

AOS 3 – What is matter and how is it formed?

In this area of study students explore the nature of matter, and consider the origins of atoms, time and space. They examine the currently accepted theory of what constitutes the nucleus, the forces within the nucleus and how energy is derived from the nucleus.

Unit 2 What do experiments reveal about the physical world?

Areas of Study include:

AOS 1 – How can motion be described and explained?

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.

AOS 2 - How can AC electricity charge a DC device?

Students investigate the processes involved in transforming the alternating current delivered by the electrical supplier into low voltage direct current for use with small current electrical devices.

AOS 3 – Practical investigation

The investigation requires the student to develop a question, plan a course of action that attempts to answer the question, undertake an investigation to collect the appropriate primary qualitative and/or quantitative data, organise and interpret the data, and reach a conclusion in response to the question.

Unit 3 How do fields explain motion and electricity?

Areas of Study include:

AOS 1 – How do things move without contact?

In this area of study students examine the similarities and differences between three fields: gravitational, electric and magnetic. Field models are used to explain the motion of objects when there is no apparent contact. Students explore how positions in fields determine the potential energy of an object and the force on an object. They investigate how concepts related to field models can be applied to construct motors, maintain satellite orbits and to accelerate particles.

AOS 2 – How are fields used to move electrical energy?

In this area of study students use empirical evidence and models of electric, magnetic and electromagnetic effects to explain how electricity is produced and delivered to homes. They explore magnetic fields and the transformer as critical to the performance of electrical distribution systems.

AOS 3 – How fast can things go?

In this area of study students use Newton's laws of motion to analyse relative motion, circular motion and projectile motion.

Unit 4 How are fields used to move electrical energy?

Areas of Study include:

AOS 1 – How can waves explain the behaviour of light?

Students 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.

AOS 2 – How are light and matter similar?

This unit focuses on light and matter. Students investigate properties of light, which was previously described as an electromagnetic wave, as they appear to exhibit both wave-like and particle-like properties.

AOS 3 – Practical investigation

Students complete an investigation to develop a question, formulate a hypothesis and plan a course of action to answer the question and that complies with safety and ethical guidelines. Students then undertake an experiment that involves the collection of primary quantitative data, analyse and evaluate the data, identify limitations of data and methods, link experimental results to science ideas, reach a conclusion in response to the question.



VCE 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.

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?

Areas of Study include:

AOS 1 – How does the brain function?

In this area of study students examine how our understanding of brain structure and function has changed over time and how the brain enables us to interact with the external world around us. They analyse the roles of specific areas of the brain and the interactions between different areas of the brain that enable complex cognitive tasks to be performed. Students explore how brain plasticity and brain damage can affect a person's functioning.

AOS 2 – What influences psychological development?

In this area of study students explore how these factors influence different aspects of a person's psychological development. They consider the interactive nature of hereditary and environmental factors and investigate specific factors that may lead to development of typical or atypical psychological development in individuals, including a person's emotional, cognitive and social development and the development of psychological disorders.

AOS 3 – Student-directed research investigation

Students analyse the scientific evidence that underpins the research in response to a question of interest. They then communicate the findings of their research investigation and explain the psychological concepts, outline contemporary research and present conclusions based on the evidence.

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

Areas of Study include:

AOS 1 – What influences a person's perception of the world?

In this area of study students explore two aspects of human perception – vision and taste – and analyse the relationship between sensation and perception of stimuli. They consider how biological, psychological and social factors can influence a person's perception of visual and taste stimuli, and explore circumstances where perceptual distortions of vision and taste may occur.

AOS 2 – How are people influenced to behave in particular ways?

In this area of study students explore the interplay of biological, psychological and social factors that shape the behaviour of individuals and groups. They consider how these factors can be used to explain the cause and dynamics of particular individual and group behaviours, including attitude formation, prejudice, discrimination, helping behaviour and bullying.

AOS 3 - Student-directed practical investigation

In this area of study students design and conduct a practical investigation related to external influences on behaviour. The investigation requires the student to develop a question, plan a course of action to answer the question, undertake an investigation to collect the appropriate primary data, organise and interpret the data and reach a conclusion in response to the question.

Unit 3 How does experience affect behaviour and mental processes?

Areas of Study include:

AOS 1 – How does the nervous system enable psychological functioning?

In this area of study, students explore the role of different branches of the nervous system in enabling a person to integrate, coordinate and respond to internal and external sensory stimuli. They explore the specialised structures and functioning of neurons that allow the nervous system to transmit neural information.

AOS 2 – How do people learn and remember?

In this area of study students study the neural basis of memory and learning and examine factors that influence the learning of new behaviours and the storage and retention of information in memory. They consider the influence of biological, psychological and social factors on the fallibility of memory.

Unit 4 How is wellbeing developed and maintained?

Areas of Study include:

AOS 1 – How do levels of consciousness affect mental processes and behaviour?

In this area of study students focus on states of consciousness and the relationship between consciousness and thoughts, feelings and behaviours. Students consider the nature and importance of sleep and apply biological, psychological and social factors to analyse the effects of sleep disturbances on psychological functioning, including mood, cognition and behaviour.

AOS 2 – What influences mental wellbeing?

In this area of study, students examine what it means to be mentally healthy. They explore the concept of a mental health continuum and factors that influence this over time. Students apply a biopsychosocial approach to analyse mental health and mental disorder, and evaluate the factors that contribute to a person's mental state.

AOS 3 – Practical investigation

Students undertake an experiment that involves the collection of primary data, analyse and evaluate the data, identify limitations of data and methods, link experimental results to science ideas, reach a conclusion in response to the question and suggest further investigations which may be undertaken. Results are communicated in a scientific poster format.



VCE Environmental Science

Environmental science is an interdisciplinary science that explores the interactions and interconnectedness between humans and their environments and analyses the functions of both living and non-living elements that sustain Earth systems. In VCE Environmental Science, Earth is understood as a set of four interdependent systems: the atmosphere, biosphere, hydrosphere and lithosphere. The study explores how the relationships between these systems produce environmental change over a variety of time scales. Students investigate the extent to which humans modify their environments and the consequences of these changes in local and global contexts with a focus on pollution, biodiversity, energy use and climate change; they explore the conceptual, behavioural, ethical and technological responses to these changes.

Diverse areas of employment range from design, including landscape or building architecture, engineering and urban planning, environmental consultancy and advocacy, which may involve employment in air, water and/or soil quality monitoring and control, agriculture, construction, mining and property management and water quality engineering.

Unit 1 How are Earth's systems connected?

Areas of Study include:

AOS 1 – How is life sustained on Earth?

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

AOS 2 – How is Earth a dynamic system?

In this area of study students explore changes in systems that can occur over different time scales (short, medium or long term), have cyclic or unpredictable patterns, and can be caused by natural- or human-induced factors. They examine the flow of matter and energy in selected environmental events and phenomena with reference to natural and unpredictable or abrupt environmental changes in Earth's four systems. Students learn how environmental changes may be monitored and measured.

AOS 3 - Practical Investigation

In this area of study students design and conduct a practical investigation into the monitoring of ecosystems or their components and/ or change in ecosystems.

Unit 2 How can pollution be managed?

Areas of Study include:

AOS 1 – When does pollution become a hazard?

In this area of study students examine biotic and abiotic indicators of pollution in various environments. Using selected examples, they distinguish between pollutants that result in bioaccumulation, and air- or water-borne pollutants. Students explore the chemical and physical characteristics, sources and transport mechanisms of pollutants and consider how levels of safety standards are set.

AOS 2 – What makes pollution management so complex?

In this area of study, students investigate three pollutants of national or global concern. They explain how pollutants move through, and affect, the atmosphere, biosphere, hydrosphere and lithosphere, and compare treatment and management options for each pollutant. Students also explore the limitations of the categorisation of pollution as air, water and soil pollution.

AOS 3 – Case study

In this area of study students apply and extend their knowledge and skills to investigate a case study involving the management of a selected pollutant of local interest. Students prepare a communication that explains the relevant scientific concepts, identifies different management options including social, economic, legal and ethical implications, and presents a justified position on a preferred solution.

Unit 3 How can biodiversity and development be sustained?

Areas of Study include:

AOS 1 – Is maintaining biodiversity worth a sustained effort?

In this area of study students examine the categories of biodiversity, the role of biodiversity in sustaining ecosystems, the provision of ecosystem services for human well-being and the strategies employed to counteract threats, both natural and human induced, so as to maintain biodiversity in the short, medium and long term. Students investigate through field and practical activities how biodiversity is measured. They examine the effectiveness of management strategies in the context of a selected threatened endemic species, based on scientific evidence, to ensure sustainability of biodiversity.

AOS 2 – Is development sustainable?

In this area of study students examine the application of environmental science to sustainability and environmental management. They explore definitions of sustainability and consider how these may be interpreted and applied in addressing environmental issues. Students select one environmental science case study to be studied in depth.

Unit 4 How can the impacts of human energy use be reduced?

Areas of Study include:

AOS 1 – What is a sustainable mix of energy sources?

In this area of study students examine the concepts associated with the use of different forms of energy by human societies. Focus moves from understanding the relationship between the uses of local sources of energy to examining the global impacts of these uses, including consideration of the consequences over short, medium and long time scales.

AOS 2 – Is climate predictable?

In this area of study students investigate the astronomical, solar, and Earth systems and human-based factors that have altered important relationships between the energy, water and nutrient cycles, resulting in the enhanced greenhouse effect and climate change. They compare natural and enhanced greenhouse effects and their significance for sustaining ecological integrity.

AOS 3 – Practical investigation

Students undertake an experiment or sampling exercise that involves the collection of primary data, analyse and evaluate the data, identify limitations of data and methods, link experimental results to science ideas, reach a conclusion in response to the question and suggest further investigations which may be undertaken. Results are communicated in a scientific poster format.

