Science at Penola Catholic College develops students’ abilities to pose questions and provide answers about the physical and biological world.

Science develops the students’ ability to apply scientific knowledge, theories, principles and ideas to explain and predict events in the physical and biological world. It enables students to use the skills of scientific investigation and analysis to generate knowledge, refine solutions, ask questions and to communicate scientific understanding using appropriate scientific language to a range of audiences.

Study in this area gives students an understanding of the way Science and scientists work in the community. This will assist students when making decisions about careers and further study.

Year 7 Topics
- Chemical Science
- Biological Science
- Earth and Space Science
- Physical Science

Year 8 Topics
- Biological Science
- Chemical Science
- Earth and Space Science
- Physical Science

Assessments in Years 7 & 8:
- Topic Tests
- Practical Activities
- STEM Project
Science in Semester one is a compulsory subject for all Year 9 students.

Term 1 - Psychology (The Brain)
Students will study the structure of the brain and will build the skill, in modelling a 2D brain and identifying the parts. Students will also research what are the impact of drugs, alcohol and smoking on the brain and how that can affect memory.

Term 2 - Earth and Space Science
Students will study the theory of plate tectonics and then explain how global patterns of geological activity and continental movement are related. They will study how volcanoes, earthquakes and tsunamis are caused in both oceans and land. They will do various activities to demonstrate volcanoes and movement of tectonic plates.

Assessment Tasks:
- Research Task
- The Project (Brain)
- Topic Tests
- Practical Reports
- Examinations

In Semester two, Science is an elective subject, which means that students can choose to do Science. It is recommended that those students who want to pursue Science in VCE should take one of the following electives:

Elective 1
Our Atomic World & Eco-Challengeable Planet

Term 3 - Chemistry Our Atomic World
Students will study the periodic table, organisation of atoms in a periodic table, symbols and electron configuration. They will learn the atomic structure and properties of elements on the periodic table and what radio-activity is, and why the nucleus of an atom is unstable. Students will conduct many experiments including an extended practical investigation.

Term 4 - Biology Eco-Challengeable Planet
Students will study about 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 is 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. They will investigate 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. For this they will do various practical investigations and research.

Assessment Tasks:
- Practical Reports
- Eco-Challenge Project
- Topic Test
- Examination
- Extended Practical Investigation

The Year 9 Science Curriculum is integrated with the Project Based Learning topics each term. A component of the Science assessment is completed at each of the Year 9 PBL presentation nights. Attendance at these events each term is compulsory.

Term 3 - Chemistry Our Atomic World
Students will study the periodic table, organisation of atoms in a periodic table, symbols and electron configuration. They will learn the atomic structure and properties of elements on the periodic table and what radio-activity is, and why the nucleus of an atom is unstable. Students will conduct many experiments including an extended practical investigation.

Term 4 - Physics STEM Electricity
Students will study how Electric circuits can be designed for diverse purposes using different components; and how the operation of circuits can be explained by the concepts of voltage and current. 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 gain a better understanding of atomic structure, be able to identify type of batteries, electric currents, electric charges, conductors and insulators and the type of components in an electric circuit. They will learn to draw simple circuit diagrams and symbols. Students will be able to research and design Electric cars. They will find out the effect of different electrolyte and electrodes on the voltage of cell batteries.

Assessment Tasks:
- Practical Reports
- STEM Project
- Topic Test
- Examination
Students in Year 10 will select a Science for at least one semester unit from the seven strands. When listing preferences please keep in mind possible career choices and personal academic ability.

1. Biology - 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, first hand & second-hand data and interpret graphs.

2. Biology - Immunology and Diseases
A more challenging Biology unit, not essential for VCE Biology. Students will study how Multicellular Organisms rely on coordinated and interdependent internal body systems to respond to changes to their environment. They will investigate the response of the body to change as a result of the presence of pathogens invading our body.

3. Chemistry - 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, first hand & second-hand data and interpret graphs.

4. Physics - 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.

Students will learn the skills to analyse, first hand & second-hand data and interpret graphs.

5. Physics - Heat, Magnetism and Thermodynamics
Highly recommended for students who wish to continue with VCE Physics. Suitable for students who want to be Electricians or working in an Electrical field. Students understand the processes underlying convection, conduction and radiation and sound in terms of the particle model. They develop skills in terms of scale and measurement using ammeters, voltmeters, power supplies etc. They learn different types of energy and laws of Thermodynamics. They understand the connection between Physics and the real world in the classroom. Students will need to describe the effect of electronic and electrical components in the operation of electromagnetic devices. A good level of competency in Mathematics is required in Physics subjects.

Students will learn the skills to analyse, handle data and interpret graphs.

6. Earth & Space Science and The Universe
Highly recommended for students who wish to develop field investigation skills. This unit has less focus on mathematical applications and formulas.

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 study the Electromagnetic Spectrum and how it is used to gain information about the Universe. 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’. Students automatically get membership into the ‘Astronomy Club’ where they get to see the stars using a telescope. This may also include a trip to the “Space Centre” at Strathmore.
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:

**Psychology as a Science:**
- Understanding what psychology is and what psychologists do.
- Investigate and understand how research into human behaviour is undertaken through the scientific method.

**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.

**Brain, Personality and Criminal Behaviour:**
- Understanding of the role of the brain (genetics) and personality in criminal behaviour.
- Investigating the role of psychology in solving crimes.
- Studying the mental state of offenders.

**Assessments will be based on the following:**
- Practical work
- Written tests
- Problem-solving assignments
- Mid-year and end-of-year examinations
- Use of ICT in science
- Research projects
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 endeavor 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 organism’s 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 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.

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.

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 4
School Assessed Coursework (24% of study score).
Two tasks 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 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 motion to circular and projectile motion, calculations related to experimental and 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
VCE Psychology enables students to explore how people, think, feel and behave through the use of a biopsychosocial 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.
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

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

**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
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