VICTORIAN CURRICULUM LEVELS 7–10

LEVELS 7 & 8

LEVEL BAND DESCRIPTION

In Levels 7 and 8, the curriculum focus is on explaining phenomena involving science and its applications. Students explain the role of classification in ordering and organising information about living and non-living things. They classify the diversity of life on Earth into major taxonomic groups and consider how the classification of renewable and non-renewable resources depends on the timescale considered. Students classify different forms of energy, and describe the role of energy in causing change in systems, including the role of heat and kinetic energy in the rock cycle. They use and develop models including food chains, food webs and the water cycle to represent and analyse the flow of energy and matter through ecosystems and explore the impact of changing components within these systems. Students investigate relationships in the Earth-Sun-Moon system and use models to predict and explain astronomical phenomena. They explain changes in an object's motion by considering the interaction between multiple forces. Students link form and function at a cellular level and explore the organisation and interconnectedness of body systems. Similarly, they explore changes in matter at a particle level, and distinguish between chemical and physical change. Students make accurate measurements and control variables in experiments to analyse relationships between system components and explore and explain these relationships using appropriate representations. They make predictions and propose explanations, drawing on evidence to support their views.

KEY CONCEPTS

PATTERNS, ORDER & ORGANISATION	An important aspect of science is recognising patterns in the world around us, and ordering and organising phenomena at different scales. Students observe and describe patterns at different scales, and develop and use classifications to organise events and phenomena and make predictions. Classifying objects and events into groups (such as solid/liquid/gas or living/non-living) and developing criteria for those groupings relies on making observations and identifying patterns of similarity and difference. Students identify and describe the relationships that underpin patterns, including cause and effect. Students recognise that scale plays an important role in the observation of patterns and that some patterns may only be evident at certain time and spatial scales. For example, the pattern of day and night is not evident over the time scale of an hour.
FORM AND FUNCTION	Many aspects of science are concerned with the relationships between form (the nature or make-up of an aspect of an object or organism) and function (the use of that aspect). Students learn that the functions of both living and non-living objects rely on their forms. Their understanding of forms, such as the features of living things or the nature of a range of materials, and their related functions or uses, is based on observable behaviours and physical properties. Students recognise that function frequently relies on form and that this relationship can be examined at many scales. They apply an understanding of microscopic and atomic structures, interactions of force and flows of energy and matter to describe relationships between form and function.
STABILITY & CHANGE	Many areas of science involve the recognition, description and prediction of stability and change. Students recognise from their observations of the world around them that some properties and phenomena appear to remain stable or constant over time, whereas others change. They also learn to recognise that phenomena (such as properties of objects and relationships between living things) can appear to be stable at one spatial or time scale, but at a larger or smaller scale may be seen to be changing. They appreciate that stability can be the result of competing but balanced forces. Students become adept at quantifying change through measurement and looking for patterns of change by representing and analysing data in tables or graphs.
SCALE & MEASUREMENT	Quantification of time and spatial scale is critical to the development of science understanding as it enables the comparison of observations. Students are challenged to work with scales that are outside their everyday experience, including distances in space, the size of atoms and the slow geological processes that occur over time. As students gain an understanding of relative sizes and rates of change, they are able to conceptualise events and phenomena at a wider range of scales.
MATTER & ENERGY	Many aspects of science involve identifying, describing and measuring transfers of energy and/or matter. Students become increasingly able to explain phenomena in terms of the flow of matter and energy. Initially, students focus on direct experience and observation of phenomena and materials. They are introduced to the ways in which objects and living things change and begin to recognise the role of energy and matter in these changes. In later levels, they are introduced to more abstract notions of particles, forces and energy transfer and transformation. They use these understandings to describe and model phenomena and processes involving matter and energy.
SYSTEMS	Science involves systems thinking, modelling and analysis in order to understand, explain and predict events and phenomena. Students explore, describe and analyse increasingly complex systems. Initially, students identify the observable components of a clearly identified 'whole' such as features of plants and animals and parts of mixtures. They identify and describe relationships between components within simple systems, and they begin to appreciate that components within living and non-living systems are interdependent. They are introduced to the processes and underlying phenomena that structure systems such as ecosystems, body systems and the carbon cycle. They recognise that within systems, interactions between components can involve forces and changes acting in opposing directions and that for a system to be in a steady state, these factors need to be in a state of balance or equilibrium. They are increasingly aware that systems can exist as components within larger systems, and that one important part of thinking about systems is identifying boundaries, inputs and outputs.

SCIENCE UNDERSTANDING

SCIENCE AS A HUMAN ENDEAVOUR	BIOLOGICAL SCIENCES	CHEMICAL SCIENCES	EARTH & SPACE SCIENCES	PHYSICAL SCIENCES
• Scientific knowledge and understanding of the world changes as new evidence becomes available; science knowledge can develop through collaboration and connecting ideas across the disciplines and practice of science across the disciplines **(VCSSU089)** • Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations **(VCSSU090)**	• There are differences within and between groups of organisms; classification helps organise this diversity **(VCSSU091)** • Cells are the basic units of living things and have specialised structures and functions **(VCSSU092)** • Interactions between organisms can be described in terms of food chains and food webs and can be affected by human activity **(VCSSU093)** • Multicellular organisms contain systems of organs that carry out specialised functions that enable them to survive and reproduce **(VCSSU094)**	• Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques **(VCSSU095)** • The properties of the different states of matter can be explained in terms of the motion and arrangement of particles **(VCSSU096)** • Differences between elements, compounds and mixtures can be described by using a particle model **(VCSSU097)** • Chemical change involves substances reacting to form new substances **(VCSSU098)**	• Predictable phenomena on Earth, including seasons and eclipses, are caused by the relative positions of the Sun, Earth and the Moon **(VCSSU099)** • Some of Earth's resources are renewable, but others are non-renewable **(VCSSU100)** • Water is an important resource that cycles through the environment **(VCSSU101)** • Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales **(VCSSU102)**	• Change to an object's motion is caused by unbalanced forces acting on the object; Earth's gravity pulls objects towards the centre of Earth **(VCSSU103)** • Energy appears in different forms including movement (kinetic energy), heat, light, chemical energy and potential energy; devices can change energy from one form to another **(VCSSU104)** • Light can form images using the reflective feature of curved mirrors and the refractive feature of lenses, and can disperse to produce a spectrum which is part of a larger spectrum of radiation **(VCSSU105)** • The properties of sound can be explained by a wave model **(VCSSU106)**

SCIENCE INQUIRY SKILLS

QUESTIONING & PREDICTING	• Identify questions, problems and claims that can be investigated scientifically and make predictions based on scientific knowledge **(VCSIS107)**
PLANNING & CONDUCTING	• Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed **(VCSIS108)** • In fair tests, measure and control variables, and select equipment to collect data with accuracy appropriate to the task **(VCSIS109)**
RECORDING & PROCESSING	• Construct and use a range of representations including graphs, keys and models to record and summarise data from students' own investigations and secondary sources, and to represent and analyse patterns and relationships **(VCSIS110)**
ANALYSING & EVALUATING	• Use scientific knowledge and findings from investigations to identify relationships, evaluate claims and draw conclusions **(VCSIS111)** • Reflect on the method used to investigate a question or solve a problem, including evaluating the quality of the data collected, and identify improvements to the method **(VCSIS112)**
COMMUNICATING	• Communicate ideas, findings and solutions to problems including identifying impacts and limitations of conclusions and using appropriate scientific language and representations **(VCSIS113)**

ACHIEVEMENT STANDARD

By the end of Level 8, students explain how evidence has led to an improved understanding of a scientific idea. They discuss how science knowledge can be applied to generate solutions to contemporary problems and explain how these solutions may impact on society. They investigate different forms of energy and explain how energy transfers and transformations cause change in simple systems. They use examples to illustrate how light forms images. They use a wave model to explain the properties of sound. They use the particle model to predict, compare and explain the physical and chemical properties and behaviours of substances. They describe and apply techniques to separate pure substances from mixtures. They provide evidence for observed chemical changes in terms of colour change, heat change, gas production and precipitate formation. They analyse the relationship between structure and function at cell, organ and body system levels. They identify and classify living things. They explain how living organisms can be classified into major taxonomic groups based on observable similarities and differences. They predict the effect of environmental changes on feeding relationships between organisms in a food web. They distinguish between different types of simple machines and predict, represent and analyse the effects of unbalanced forces, including Earth's gravity, on motion. They compare processes of rock formation, including the time scales involved, and analyse how the sustainable use of resources depends on the way they are formed and cycle through Earth systems. They model how the relative positions of Earth, the Sun and the Moon affect phenomena on Earth.

Students identify and construct questions and problems that they can investigate scientifically and make predictions based on scientific knowledge. They plan experiments, identifying variables to be changed, measured and controlled. They consider accuracy and ethics when planning investigations, including designing field or experimental methods. Students summarise data from different sources and construct representations of their data to reveal and analyse patterns and relationships, and use these when justifying their conclusions. They explain how modifications to methods could improve the quality of their data and apply their scientific knowledge and investigation findings to evaluate claims made by others. They use appropriate scientific language, representations and simple word equations to communicate science ideas, methods and findings.

LEVELS 9 & 10

LEVEL BAND DESCRIPTION

In Levels 9 and 10, the curriculum focus is on explaining phenomena involving science and its applications. Students consider both classic and contemporary science contexts to explain the operation of systems at a range of scales. At a microscopic scale, they consider the atom as a system of protons, electrons and neutrons, and understand how this system can change through nuclear decay. They learn that matter can be rearranged through chemical change and that these changes play an important role in many systems. At a macroscopic scale, they explore ways in which the human body as a system responds to its external environment, and investigate the interdependencies between biotic and abiotic components of ecosystems. They develop a more sophisticated view of energy transfer by applying the concept of the conservation of matter in a variety of contexts. They apply their understanding of energy and forces to global systems including continental movement. Students explore the biological, chemical, geological and physical evidence for different theories, including the theories of natural selection and the Big Bang theory. Atomic theory is used to understand relationships within the periodic table of elements. Students understand that motion and forces are related by applying physical laws. Relationships between aspects of the living, physical and chemical world are applied to systems on a local and global scale enabling students to predict how changes will affect equilibrium within these systems.

KEY CONCEPTS

PATTERNS, ORDER & ORGANISATION	An important aspect of science is recognising patterns in the world around us, and ordering and organising phenomena at different scales. Students observe and describe patterns at different scales, and develop and use classifications to organise events and phenomena and make predictions. Classifying objects and events into groups (such as solid/liquid/gas or living/non-living) and developing criteria for those groupings relies on making observations and identifying patterns of similarity and difference. Students identify and describe the relationships that underpin patterns, including cause and effect. Students recognise that scale plays an important role in the observation of patterns and that some patterns may only be evident at certain time and spatial scales. For example, the pattern of day and night is not evident over the time scale of an hour.
FORM AND FUNCTION	Many aspects of science are concerned with the relationships between form (the nature or make-up of an aspect of an object or organism) and function (the use of that aspect). Students learn that the functions of both living and non-living objects rely on their forms. Their understanding of forms, such as the features of living things or the nature of a range of materials, and their related functions or uses, is based on observable behaviours and physical properties. Students recognise that function frequently relies on form and that this relationship can be examined at many scales. They apply an understanding of microscopic and atomic structures, interactions of force and flows of energy and matter to describe relationships between form and function.
STABILITY & CHANGE	Many areas of science involve the recognition, description and prediction of stability and change. Students recognise from their observations of the world around them that some properties and phenomena appear to remain stable or constant over time, whereas others change. They also learn to recognise that phenomena (such as properties of objects and relationships between living things) can appear to be stable at one spatial or time scale, but at a larger or smaller scale may be seen to be changing. They appreciate that stability can be the result of competing but balanced forces. Students become adept at quantifying change through measurement and looking for patterns of change by representing and analysing data in tables or graphs.
SCALE & MEASUREMENT	Quantification of time and spatial scale is critical to the development of science understanding as it enables the comparison of observations. Students are challenged to work with scales that are outside their everyday experience, including distances in space, the size of atoms and the slow geological processes that occur over time. As students gain an understanding of relative sizes and rates of change, they are able to conceptualise events and phenomena at a wider range of scales.
MATTER & ENERGY	Many aspects of science involve identifying, describing and measuring transfers of energy and/or matter. Students become increasingly able to explain phenomena in terms of the flow of matter and energy. Initially, students focus on direct experience and observation of phenomena and materials. They are introduced to the ways in which objects and living things change and begin to recognise the role of energy and matter in these changes. In later levels, they are introduced to more abstract notions of particles, forces and energy transfer and transformation. They use these understandings to describe and model phenomena and processes involving matter and energy.
SYSTEMS	Science involves systems thinking, modelling and analysis in order to understand, explain and predict events and phenomena. Students explore, describe and analyse increasingly complex systems. Initially, students identify the observable components of a clearly identified 'whole' such as features of plants and animals and parts of mixtures. They identify and describe relationships between components within simple systems, and they begin to appreciate that components within living and non-living systems are interdependent. They are introduced to the processes and underlying phenomena that structure systems such as ecosystems, body systems and the carbon cycle. They recognise that within systems, interactions between components can involve forces and changes acting in opposing directions and that for a system to be in a steady state, these factors need to be in a state of balance or equilibrium. They are increasingly aware that systems can exist as components within larger systems, and that one important part of thinking about systems is identifying boundaries, inputs and outputs.

SCIENCE UNDERSTANDING

SCIENCE AS A HUMAN ENDEAVOUR	BIOLOGICAL SCIENCES	CHEMICAL SCIENCES	EARTH & SPACE SCIENCES	PHYSICAL SCIENCES
• Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community **(VCSSU114)** • Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries **(VCSSU115)** • The values and needs of contemporary society can influence the focus of scientific research **(VCSSU116)**	Multicellular organisms rely on coordinated and interdependent internal systems to respond to changes to their environment **(VCSSU117)** • An animal's response to a stimulus is coordinated by its central nervous system (brain and spinal cord); neurons transmit electrical impulses and are connected by synapses **(VCSSU118)** • The transmission of heritable characteristics from one generation to the next involves DNA and genes **(VCSSU119)** • The theory of evolution by natural selection explains the diversity of living things and is supported by a range of scientific evidence **(VCSSU120)** • Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems **(VCSSU121)**	• All matter is made of atoms which are composed of protons, neutrons and electrons; natural radioactivity arises from the decay of nuclei in atoms **(VCSSU122)** • The atomic structure and properties of elements are used to organise them in the periodic table **(VCSSU123)** • Chemical reactions involve rearranging atoms to form new substances; during a chemical reaction mass is not created or destroyed **(VCSSU124)** • Different types of chemical reactions are used to produce a range of products and can occur at different rates; chemical reactions may be represented by balanced chemical equations **(VCSSU125)** • Chemical reactions, including combustion and the reactions of acids, are important in both non-living and living systems and involve energy transfer **(VCSSU126)**	• The theory of plate tectonics explains global patterns of geological activity and continental movement **(VCSSU127)** • Global systems, including the carbon cycle, rely on interactions involving the atmosphere, biosphere, hydrosphere and lithosphere **(VCSSU128)** • The Universe contains features including galaxies, stars and solar systems; the Big Bang theory can be used to explain the origin of the Universe **(VCSSU129)**	• Electric circuits can be designed for diverse purposes using different components; the operation of circuits can be explained by the concepts of voltage and current **(VCSSU130)** • The interaction of magnets can be explained by a field model; magnets are used in the generation of electricity and the operation of motors **(VCSSU131)** • Energy flow in Earth's atmosphere can be explained by the processes of heat transfer **(VCSSU132)** • The explanation of the motion of objects involves the interaction of forces and the exchange of energy and can be described and predicted using the laws of physics **(VCSSU133)**

SCIENCE INQUIRY SKILLS

QUESTIONING & PREDICTING	• Formulate questions or hypotheses that can be investigated scientifically, including identification of independent, dependent and controlled variables **(VCSIS134)**
PLANNING & CONDUCTING	• Independently plan, select and use appropriate investigation types, including fieldwork and laboratory experimentation, to collect reliable data, assess risk and address ethical issues associated with these investigation types **(VCSIS135)** • Select and use appropriate equipment and technologies to systematically collect and record accurate and reliable data, and use repeat trials to improve accuracy, precision and reliability **(VCSIS136)**
RECORDING & PROCESSING	• Construct and use a range of representations, including graphs, keys, models and formulas, to record and summarise data from students' own investigations and secondary sources, to represent qualitative and quantitative patterns or relationships, and distinguish between discrete and continuous data **(VCSIS137)**
ANALYSING & EVALUATING	• Analyse patterns and trends in data, including describing relationships between variables, identifying inconsistencies in data and sources of uncertainty, and drawing conclusions that are consistent with evidence **(VCSIS138)** • Use knowledge of scientific concepts to evaluate investigation conclusions, including assessing the approaches used to solve problems, critically analysing the validity of information obtained from primary and secondary sources, suggesting possible alternative explanations and describing specific ways to improve the quality of data **(VCSIS139)**
COMMUNICATING	• Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations **(VCSIS140)**

ACHIEVEMENT STANDARD

By the end of Level 10, students analyse how models and theories have developed over time and discuss the factors that prompted their review. They predict how future applications of science and technology may affect people's lives. They explain the concept of energy conservation and model energy transfer and transformation within systems. They analyse how biological systems function and respond to external changes with reference to the interdependencies between individual components, energy transfers and flows of matter. They evaluate the evidence for scientific theories that explain the origin of the Universe and the diversity of life on Earth. They explain the role of DNA and genes in cell division and genetic inheritance. They apply geological timescales to elaborate their explanations of both natural selection and evolution. They explain how similarities in the chemical behaviour of elements and their compounds and their atomic structures are represented in the way the periodic table has been constructed. They compare the properties of a range of elements representative of the major groups and periods in the periodic table. They use atomic symbols and balanced chemical equations to summarise chemical reactions, including neutralisation and combustion. They explain natural radioactivity in terms of atoms and energy change. They explain how different factors influence the rate of reactions. They explain global features and events in terms of geological processes and timescales, and describe and analyse interactions and cycles within and between Earth's spheres. They give both qualitative and quantitative explanations of the relationships between distance, speed, acceleration, mass and force to predict and explain motion. They use the concepts of voltage and current to explain the operation of electric circuits and use a field model to explain interactions between magnets.

Students develop questions and hypotheses that can be investigated using a range of inquiry skills. They independently design and improve appropriate methods of investigation including the control and accurate measurement of variables and systematic collection of data. They explain how they have considered reliability, precision, safety, fairness and ethics in their methods and identify where digital technologies can be used to enhance the quality of data. They analyse trends in data, explain relationships between variables and identify sources of uncertainty. When selecting evidence and developing and justifying conclusions, they account for inconsistencies in results and identify alternative explanations for findings. Students evaluate the validity and reliability of claims made in secondary sources with reference to currently held scientific views, the quality of the methodology and the evidence cited. They construct evidence-based arguments and use appropriate scientific language, representations and balanced chemical equations when communicating their findings and ideas for specific purposes.