Numeracy across Science,   
Levels 7–10

Linking the Numeracy Learning Progressions   
and the Victorian Curriculum

Numeracy underpins learning across the Victorian Curriculum F–10. While much of the explicit teaching of numeracy occurs in the Mathematics learning area, it is strengthened, made specific and extended in other learning areas as students engage in a range of learning activities with significant numeracy demands. The Numeracy Learning Progressions are designed to assist schools and teachers in all learning areas to support their students to successfully engage with the numeracy demands of the Victorian Curriculum F–10.

**The Numeracy Learning Progressions are provided as advisory material only and are not mandated as part of the Victorian Curriculum F–10. To view the Science curriculum, visit the** [**Victorian Curriculum F–10 website**](https://victoriancurriculum.vcaa.vic.edu.au/science/curriculum/f-10)**.**

In the Victorian Curriculum F–10, Science provides opportunities for students to develop an understanding of important scientific concepts and processes, the practices used to develop scientific knowledge, the contribution of science to our culture and society, and its applications in our lives. The curriculum supports students to develop the scientific knowledge, understandings and skills to make informed decisions about local, national and global issues and to participate, if they so wish, in science-related careers.

The most relevant Numeracy Learning Progressions for Science Levels 7–10 are Quantifying numbers, Operating with decimals, Operating with percentages, Number patterns and algebraic thinking, Comparing units, Positioning and locating, Understanding units of measurement, Understanding chance and Interpreting and representing data.

**Quantifying numbers** Quantification enables observations to be more easily compared. In Science students are required to quantify physical properties of objects, time, distance and scale. They learn to assign physical properties such as mass, temperature and density a numerical value. This could involve comparing heights of bean plants grown in different soil conditions or measuring the electric current in a circuit. Students often find it difficult to work with scales that are outside their everyday experience – these include the huge distances in space, the incredibly small size of atoms and the slow processes that occur over geological time. Dealing with very small and very large numbers, including associated prefixes for units, and how they are represented is essential to the study of Science as students explore and make sense of the world around them. Students’ understanding of relative proportions and scale is developed when they consider how very small and very large quantities are measured, for example, using micrometres (µm) for measuring the dimensions of microbes and light years for measuring distances in space. Scientific notation and the use of standard form is also used to represent very small and very large numbers, for example, the average size of an Ebola virus is 9.0 × 10–7 m while the distance from the Sun to Earth is 1.496 × 108 km. Working with numbers in Science will often involve whole numbers (for example, counting populations), fractions (for example, describing phases of the Moon), decimal quantities (for example, reading measurement scales) and negative numbers (for example, recording temperature readings). Students should understand decimal place value, realising that numbers after a decimal point are important in recording and processing quantitative data.

**Operating with decimals** In Science conversion between percentages and decimals may be required in handling data. Students should be able to estimate the size of decimals and understand when they should be rounded during calculations or reporting answers.

**Operating with percentages** In Science, understanding percentages is essential to interpreting information gathered from various sources and considering quantities in terms of being parts of a whole. Percentages can be used by students to express compositions, yields and efficiencies. Students identify percentages as relative amounts and can be used to express quantities, for example, hydrogen accounts for approximately 75% of matter in the Universe.

**Number patterns and algebraic thinking** Students become increasingly able to identify a pattern as something that is a discernible regularity in a group of numbers or shapes. Number patterns are evident, for example, in the organisation of elements in the rows and columns of the periodic table of elements. Students quantify change through measurement and look for patterns of change by representing and analysing data in tables or graphs. Students increasingly recognise that scale plays an important role in the observation of patterns; some patterns may be evident only at certain time and spatial scales, for example, the pattern of seasons is not evident over the timescale of an hour. As students become increasingly able to connect patterns with the structure of numbers, they create a foundation for algebraic thinking (that is, thinking about the relationships between quantities expressed as equations). Algebraic thinking is used to represent the relationship between quantities, particularly in real world applications, such as those involving the laws of motion, for example, the relationship between speed, distance travelled and time taken, as expressed in the formula. An understanding of ratios involving simple algebraic manipulations is required across all science disciplines, for example, students comparing the ratio *x*:0.06 with a 2:3 ratio should be able to calculate that the value for *x* is 0.04.

**Comparing units** Students compare units in ratios, rates and proportions. Proportional reasoning also includes numerical comparison tasks involving a comparison of different rates or ratios. For example, the ratio of hydrogen atoms to oxygen atoms in a water molecule (H2O) is 2:1 but that does not mean that hydrogen has twice the mass of oxygen, or occupies twice the space that oxygen will occupy, in a water molecule. Quantities involving ratios, such as density, rely on the appreciation and use of fractions.

Proportional reasoning is used extensively in science, particularly through equations, which serve as a tool for substitution to calculate a value and also as a description of a relationship or a way to explore how quantities vary with respect to each other. For Levels 7–10 Science, students should realise that ratios, proportions, percentages and associated mathematical conversions are based on the idea of equivalent fractions. Looking at patterns allows the making of generalisations, predictions and estimations, for example, understanding how eclipses can be predicted and recognising when an answer makes no sense in a practical context, such as an energy conversion of 110%.

**Positioning and locating** The description of the motion of objects relies on the concept of position, and change in position, with respect to a reference point. The observed shape of the Moon is explained by describing the position of the Moon relative to the Sun and Earth, while the breaking up of Pangaea and continental movement requires an understanding of changes in position of Earth’s tectonic plates. Food chains can be represented as a linear relationship while food webs require understanding relationships in two dimensions. Picturing the orientations of atoms and molecules in space requires students to visualise arrangements in three dimensions. In the physical sciences, students should understand the direction of forces, so they can determine the overall, or net, force on an object,

**Understanding units of measurement** Students become increasingly able to recognise attributes that can be measured and how units of measurement are used. Quantifying magnitudes, rates of change and comparisons using formal units of measurement are important in Science, including the use of fractions and decimals to represent non-whole number quantities. In Science, developing a sense of scale is important for measurement accuracy. Students should understand measurement as a human construct, appreciating that measurements are relative to scales that have been constructed by humans, for example, the determination of 1 kilogram. They should distinguish between SI units and SI derived units. SI units relevant to Levels 7–10 Science are the metre (for measuring length), the kilogram (for measuring mass), the second (for measuring time) and the ampere (for measuring electric current). SI derived units to measure other parameters include millilitres (mL) to measure volume, metres per second (m/s) to measure speed, grams per millilitre (g/mL) to measure concentration and degrees Celsius (°C) to measure temperature. Students should be able to convert between different units, for example, converting litres to millilitres and metres to kilometres, with decimal representations being connected to the metric system. Students should realise that 0.89 g/mL, for example, indicates that millilitres, rather than litres, has been used and that

**Understanding chance** Not everything in science is exact or able to be exactly determined. Examples include genetic inheritance and radioactive decay. While the average outcomes or behaviour of a group can be accurately predicted (for example, approximately 50% of births will be boys and 50% will be girls), the outcome of a single event cannot (for example, we cannot accurately predict the result of a single pregnancy). The act of measurement is itself not exact, giving rise to the concept of measurement uncertainty, and the need to repeat measurements to increase the probability that the measurement accurately represents the value of the quantity being measured.

**Interpreting and representing data** Both qualitative and quantitative data may be generated and/or collated in scientific investigations. Making sense of this data, presented in tables and graphs, is foundational to studying Science. Developing skills in graphing helps students to understand and interpret data. Students become increasingly able to recognise and use visual and numerical displays to describe, analyse, interpret and explain trends in primary data generated and recorded when undertaking and designing their own scientific investigations, including experimental trials, and to critically evaluate secondary data and investigations undertaken by others. Students work with both discrete and continuous data to plot graphs and select appropriate displays (for example, XY-scatter plots, bar graphs, line graphs) to explore patterns of continuity and change. For data sets, students may be expected to determine counts and percentages (as a measure of frequency), calculate mean (as a measure of central tendency), and identify the range (as a measure of dispersion or variation). They identify direct and indirect relationships between variables and recognise outliers in experimental data. They interpret representations of data to support their own conclusions and to think critically about claims made by others, to question or confirm them, or to generate further questions.

Numeracy in the context of Science

The tables in this document make explicit the links between content descriptions in the Numeracy Learning Progressions and both strands of the Science curriculum. Relevant extracts of the achievement standards for Science are also included.

In addition to these Numeracy Learning Progression links, the approximate relation to the Victorian Curriculum F–10 Mathematics levels has been included. For further information on the alignment of the Numeracy Learning Progressions and the Victorian Curriculum F–10 Mathematics, please refer to the [Numeracy Learning Progressions map on the VCAA website](https://www.vcaa.vic.edu.au/curriculum/foundation-10/crosscurriculumresources/Pages/Numeracy.aspx).

The ‘Numeracy in context’ section of the table provides examples of learning that connect to the Numeracy Learning Progressions, allowing for a deeper understanding of numeracy demands.

Links to Science Inquiry Skills

Science inquiry involves identifying and posing questions, planning, conducting and reflecting on investigations, processing, analysing and interpreting evidence, and communicating findings. This strand is concerned with asking questions, evaluating claims, investigating ideas, solving problems, drawing valid conclusions and developing evidence-based arguments.

Science Inquiry Skills sub-strands, Levels 7 and 8

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| **Relevant Victorian Curriculum achievement standard extract** | **Relevant Victorian Curriculum content descriptions** | **Numeracy Learning Progression links  (plus approximate relation to Victorian Curriculum F–10 Mathematics levels)** |
| **Science Levels 7 and 8** | | |
| **Questioning and predicting** | | **Quantifying numbers**   * Understanding place value (3–6) * Understanding decimal place value (3–5) * Representing place value (6)   **Number patterns and algebraic thinking**   * Generalising patterns   **Operating with percentages**   * Find percentage as part of a whole (7–8)   **Comparing units**   * Building ratios (7) * Ratios (8) * Rates (8)   **Positioning and locating**   * Position to self (F) * Position to other (1)   **Understanding units of measurement**   * Using formal units (3–5) * Converting units (6–7)   **Understanding chance**   * Comparing chance (2–3) * Fairness (4)   **Interpreting and representing data**   * Collecting and displaying data (4–5) * Shape of data displays (7) |
| * … identify and construct questions and problems that they can investigate scientifically and make predictions based on scientific knowledge | Identify questions, problems and claims that can be investigated scientifically and make predictions based on scientific knowledge [(VCSIS107)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS107) |
| **Planning and conducting** | |
| * … plan experiments, identifying variables to be changed, measured and controlled | Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed [(VCSIS108)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS108) |
| * … consider accuracy and ethics when planning investigations, including designing field or experimental methods. | In fair tests, measure and control variables, and select equipment to collect data with accuracy appropriate to the task [(VCSIS109)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS109) |
| **Recording and processing** | |
| * … 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. | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS110) |
| **Analysing and evaluating** | |
| * … construct representations of their data to reveal and analyse patterns and relationships, and use these when justifying their conclusions | Use scientific knowledge and findings from investigations to identify relationships, evaluate claims and draw conclusions [(VCSIS111)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS111) |
| * … apply their scientific knowledge and investigation findings to evaluate claims made by others | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS112) |
| **Communicating** | |
| * … use appropriate scientific language, representations and simple word equations to communicate science ideas, methods and findings | Communicate ideas, findings and solutions to problems including identifying impacts and limitations of conclusions and using appropriate scientific language and representations [(VCSIS113)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS113) |
| **Numeracy in context – Science, Levels 7 and 8** | | |
| **Science Levels 7 and 8** | | |
| **Quantifying numbers**  Working with numbers in Science will involve whole numbers, fractions, decimal quantities and negative numbers. Students become increasingly able to recognise, read, estimate and interpret large and small numbers. They order negative numbers and recognise that −10 °C is colder than −2.5 °C. They work with decimals in reading measurement scales and recognise that is smaller than . Students understand that numbers after a decimal point are important in recording and processing quantitative data. They record an appropriate number of decimal points when taking measurements.  **Operating with percentages**  Students use percentages to express compositions, yields and efficiencies and to gather quantitative evidence as part of an inquiry process.  **Number patterns and algebraic thinking**  Students look for patterns in qualitative and quantitative data as a basis for further inquiry involving making predictions or generalisations, or drawing conclusions, about scientific representations or phenomena.  **Comparing units**  Students compare units in ratios, rates and proportions. Students use rates to determine how quantities change.  **Positioning and locating**  The description and representation of many science phenomena rely on the concept of position, and change in position, with respect to a reference point, such as the motion of objects. Visualisation of position and space is important for students to understand relationships and interactions related to scientific phenomena and systems.  **Understanding units of measurement**  In Science, understanding units of measurement provides an important foundation for generating accurate measurements and for developing a sense of scale. Students are able to measure, compare and estimate length, area, mass, volume and capacity, using and converting between different units of measurement. They understand that units may be accompanied by prefixes that modify the unit magnitude, for example, kilo-, deci-, centi-, milli- and micro-. Formal units of measurement include SI units and SI derived units. Students understand that measurement units are a human construct, based around the International System of Units (SI) that specifies seven measurement parameters, three of which are relevant at Levels 7 and 8: length (metre), mass (kilogram) and time (second). SI derived units may be more relevant to investigations undertaken by students in generating primary data.  Students convert between units, for example, using an understanding of decimals to convert from centimetres to metres.  **Understanding chance**  Students use their understanding of predictions to qualitatively describe the likelihood of an event occurring. They compare expected and actual results of a chance event, suggesting possible reasons for differences.  Students identify possible outcomes and identify elements that may impact the outcome. They compare expected and actual results of an event, providing possible explanations for differences.  **Interpreting and representing data**  Students pose questions, generate data and justify data generation and collection methods to allow for the development of predictions in a scientific context. They develop and interpret qualitative and quantitative data in a range of table formats and make comparisons between data. They construct and use a range of representations, including tables, graphs, keys, models and flow charts, to record and summarise primary and secondary data.  Students use simple descriptive statistics as measures to represent typical values of a distribution; for example, students may be expected to determine counts and percentages (as a measure of frequency) and calculate arithmetic mean (as a measure of central tendency).  Students work with data to plot and analyse graphs. They select appropriate displays (for example, XY-scatter plots, pie charts, bar graphs, line graphs) to explore patterns and relationships. They interpret data displayed using a multi-unit scale, reading values between the marked units (interpolation).  Students apply an understanding of distributions to draw conclusions from primary and secondary data. They appreciate that repeating experiments increases the reliability of the conclusions that can be drawn from the data. | | |

Science Inquiry Skills sub-strands, Levels 9 and 10

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| **Relevant Victorian Curriculum achievement standard extract** | **Relevant Victorian Curriculum content descriptions** | **Numeracy Learning Progression links  (plus approximate relation to Victorian Curriculum F–10 Mathematics levels)** |
| **Science Levels 9 and 10** | | |
| **Questioning and predicting** | | **Quantifying numbers**   * Understanding place value (3–6) * Understanding decimal place value (3–5) * Representing place value (6)   **Number patterns and algebraic thinking**   * Algebraic relationships (9)   **Comparing units**   * Ratios (8) * Rates (8) * Applying proportion (9)   **Positioning and locating**   * Position to self (F) * Position to other (1)   **Understanding units of measurement**   * Using formal units (3–5) * Converting units (6–7) * Calculating measurements (8)   **Understanding chance**   * Fairness (4) * Probabilities (5) * Calculating probabilities (6–8)   **Interpreting and representing data**   * Collecting and displaying data (4–5) * Interpreting data scales (6) * Shape of data displays (7) * Graphical representations of data (8) * Recognising bias (9–10) |
| * … develop questions and hypotheses that can be investigated using a range of inquiry skills * … explain how they have considered … fairness … in their methods | Formulate questions or hypotheses that can be investigated scientifically, including identification of independent, dependent and controlled variables [(VCSIS134)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS134) |
| **Planning and conducting** | |
| * … independently design and improve appropriate methods of investigation including the control and accurate measurement of variables and systematic collection of data * … explain how they have considered reliability, … safety … and ethics in their methods | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS135) |
| * … explain how they have considered reliability, precision, … fairness … in their methods and identify where digital technologies can be used to enhance the quality of data | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS136) |
| **Recording and processing** | |
| * … use appropriate scientific language, representations and balanced chemical equations when communicating their findings and ideas for specific purposes | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS137) |
| **Analysing and evaluating** | |
| * … 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 | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS138) |
| * … identify where digital technologies can be used to enhance the quality of data * … 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 | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS139) |
| **Communicating** | |
| * … construct evidence-based arguments and use appropriate scientific language, representations and balanced chemical equations when communicating their findings and ideas for specific purposes | Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations [(VCSIS140)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSIS140) |
| **Numeracy in context – Science, Levels 9 and 10** | | |
| **Science Levels 9 and 10** | | |
| **Quantifying numbers**  Working with numbers in Science will involve whole numbers, fractions, decimal quantities and negative numbers. Students become increasingly able to recognise, read, estimate and interpret large and small numbers. They use scientific notation and standard form to represent very large and very small numbers. They work with decimals in reading measurement scales and can calculate that is smaller than .  **Number patterns and algebraic thinking**  Students use formulae and algebraic representations that describe relationships in various contexts when communicating science ideas. An understanding of ratios involving simple algebraic manipulations requires proportional reasoning, for example, students comparing the ratio *x*:0.06 with a 2:3 ratio should be able to calculate that the value for *x* is 0.04.  **Comparing units**  Students compare units in ratios, rates and proportions. They express a ratio as equivalent fractions or percentages and use ratio to increase or decrease quantities to maintain a given consistency. Students use rates to determine how quantities change.  **Positioning and locating**  The description and representation of many science phenomena rely on the concept of position, and change in position, with respect to a reference point, such as the motion of objects. Visualisation of position and space is important for students to understand relationships and interactions related to scientific phenomena and systems, and to formulate hypotheses, make predictions and generalisations, and draw conclusions about these phenomena and systems.  **Understanding units of measurement**  In Science, understanding units of measurement provides an important foundation for generating accurate measurements and for developing a sense of scale. Students are able to measure, compare and estimate length, area, mass, volume and capacity using and converting between different units of measurement. They understand that units may be accompanied by prefixes that modify the unit magnitude, for example, giga-, mega-, kilo-, deci-, centi-, milli- and micro-. Formal units of measurement include SI units and SI derived units. Students understand that measurement units are a human construct, based around the International System of Units (SI) that specifies seven measurement parameters, four of which are relevant at Levels 9 and 10: length (metre), mass (kilogram), time (second) and electric current (ampere). SI derived units may be more relevant to investigations undertaken by students in generating primary data.  Students understand that numbers after a decimal point are important in recording and processing quantitative data. They record an appropriate number of decimal points when taking measurements, and round off numbers appropriately in calculations and when reporting answers.  Students convert between units, for example, using an understanding of decimals to convert from litres to millilitres or substituting values into formulas, for example, converting temperatures from degrees Fahrenheit to degrees Celsius.  **Understanding chance**  Students use their understanding of predictions to quantitatively describe likelihood as a fraction or a percentage. They can interpret the odds of an event occurring and compare expected and actual results of a chance event.  Students identify possible outcomes and identify elements that may impact the outcome. They compare expected and actual results of an event, accounting for differences.  **Interpreting and representing data**  Students justify data collection methods to suit the scientific context. They determine how much data is needed to obtain reliable measurements. Students use this data to formulate hypotheses, make predictions, interpret results and draw conclusions.  They use spreadsheets to present data in tables and graphs and to carry out mathematical analysis of data. They use simple descriptive statistics as measures to represent typical values of a distribution; for example, students may be expected to determine counts and percentages (as a measure of frequency), calculate arithmetic mean (as a measure of central tendency) and identify the range (as a measure of dispersion or variation).  Students work with both discrete and continuous data to plot and analyse graphs. In working with continuous data, they may use XY scatter plots to initially recognise any patterns or trends in data. They recognise that continuous variables depicting growth or change often vary over time (growth charts, temperature charts).  They use graphical representations relevant to the purpose of the collection of the data in exploring patterns of continuity and change, such as selecting bar graphs for discrete and categorical variables, and a line graph for continuous variables. They interpret data displayed using a multi-unit scale, reading values between the marked units (interpolation). They identify direct and indirect relationships between variables and recognise outliers in experimental data.  Students develop strategies and techniques for effective research using secondary sources. Students apply an understanding of distributions to evaluate claims based on primary and/or secondary data. They appreciate that repeating experiments, or increasing the number of readings taken, increases the reliability of the conclusions that can be drawn from the data.  They interpret the impact of outliers in data and make reasonable justified statements based on evidence. Students recognise and explain bias as a possible source of error in media reports or survey data, and justify criticisms of data sources that include biased statistical elements (inappropriate sampling from populations). | | |

Links to Science Understanding

Science understanding refers to facts, concepts, principles, laws, theories and models that have been established by scientists over time. Science understanding is evident when a person selects and integrates appropriate science knowledge to explain and predict phenomena, and applies that knowledge to new situations.

Science as a human endeavour

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| **Relevant Victorian Curriculum achievement standard extract** | **Relevant Victorian Curriculum content descriptions** | **Numeracy Learning Progression links  (plus approximate relation to Victorian Curriculum F–10 Mathematics levels)** |
| **Science Levels 7 and 8** | | |
| * … explain how evidence has led to an improved understanding of a scientific idea | 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 [(VCSSU089)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU089) | **Operating with percentages**   * Understanding percentages and relative size (6) * Find percentage as part of a whole (7–8)   **Understanding chance**   * Fairness (4) * Probabilities (5)   **Interpreting and representing data**   * Collecting and displaying data (4–5) |
| * … discuss how science knowledge can be applied to generate solutions to contemporary problems and explain how these solutions may impact on society | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU090) |
| **Science Levels 9 and 10** | |  |
| * … analyse how models and theories have developed over time and discuss the factors that prompted their review | Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community [(VCSSU114)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU114)  Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries [(VCSSU115)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU115) | **Operating with percentages**   * Find percentage as part of a whole (7–8)   **Understanding chance**   * Fairness (4) * Probabilities (5) * Calculating probabilities (6–8)   **Interpreting and representing data**   * Collecting and displaying data (4–5) * Graphical representations of data (8) * Recognising bias (9–10) |
| * … predict how future applications of science and technology may affect people’s lives | The values and needs of contemporary society can influence the focus of scientific research [(VCSSU116)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU116) |
| **Numeracy in context – Science, Levels 7–10** | | |
| **Science Levels 7 and 8** | | |
| **Operating with percentages**  Students in Science interpret graphical representations of data where an underpinning knowledge of percentages is often required. Many calculations are plotted as percentages in activities such as surveys, or as percentage increases or decreases in measurable parameters related to contemporary issues in society such as mining, water management and organ transplantation.  **Understanding chance**  Students use their understanding of predictions to qualitatively describe the likelihood of an event occurring, or to analyse the possibility of a reported event having occurred. They compare expected and actual results of a chance event, suggesting possible reasons for differences.  Students suggest possible outcomes from suggested solutions to a problem, and identify elements that may impact the outcomes. They compare expected and actual results of an event or a trial solution to a problem, providing possible explanations for differences.  **Interpreting and representing data**  Students develop and interpret qualitative and quantitative data in a range of table formats and make comparisons between data. They construct and use a range of representations, including tables, graphs, keys, models and flow charts, to record and summarise primary and secondary data.  Students work with data to plot and analyse graphs. They select appropriate displays (for example, XY scatter plots, pie charts, bar graphs and line graphs) to explore patterns and relationships.  Students apply an understanding of distributions to draw conclusions from primary and secondary data. They appreciate that repeating experiments increases the reliability of the conclusions that can be drawn from the data. | | |
| **Science Levels 9 and 10** | | |
| **Operating with percentages**  Students rely on an understanding of percentages while exploring statistics represented in scientific research related to contemporary issues such as climate change, pollution, medical treatments and energy options. Surveys conducted to determine research priorities for the general population could also be reported as percentages so that relative importance of different priorities can be gauged.  **Understanding chance**  Students identify possible outcomes and identify elements that may impact the outcomes. They compare expected and actual results of an event, accounting for differences.  **Interpreting and representing data**  Students justify data collection methods to suit the scientific context. They determine how much data is needed to obtain reliable measurements. Students use this data to formulate hypotheses, make predictions, interpret results and draw conclusions.  They use spreadsheets to present data in tables and graphs and to carry out mathematical analyses of data.  Students develop strategies and techniques for effective research using secondary sources. Students apply an understanding of distributions to evaluate claims based on primary and/or secondary data. They appreciate that repeating experiments, or increasing the number of readings taken, increases the reliability of the conclusions that can be drawn from the data.  They interpret the impact of outliers in data and make reasonable justified statements based on evidence. Students recognise and explain bias as a possible source of error in media reports or survey data, and justify criticisms of data sources that include biased statistical elements (inappropriate sampling from populations). | | |

Biological sciences

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| **Relevant Victorian Curriculum achievement standard extract** | **Relevant Victorian Curriculum content descriptions** | **Numeracy Learning Progression links  (plus approximate relation to Victorian Curriculum F–10 Mathematics levels)** |
| **Science Levels 7 and 8** | | |
| * … identify and classify living things * … explain how living organisms can be classified into major taxonomic groups based on observable similarities and differences | There are differences within and between groups of organisms; classification helps organise this diversity [(VCSSU091)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU091) | **Quantifying numbers**   * Understanding place value (3–6) * Representing place value (6)   **Positioning and locating**   * Position to self (F) * Position to other (1)   **Understanding units of measurement**   * Using formal units (3–5) * Converting units (6–7)   **Interpreting and representing data**   * Collecting and displaying data (4–5) * Interpreting Data Scales (6) |
| * … analyse the relationship between structure and function at cell [level] | Cells are the basic units of living things and have specialised structures and functions [(VCSSU092)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU092) |
| * … predict the effect of environmental changes on feeding relationships between organisms in a food web | Interactions between organisms can be described in terms of food chains and food webs and can be affected by human activity [(VCSSU093)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU093) |
| * … analyse the relationship between structure and function at cell, organ and body system levels | Multicellular organisms contain systems of organs that carry out specialised functions that enable them to survive and reproduce [(VCSSU094)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU094) |
| **Science Levels 9 and 10** | | |
| * … analyse how biological systems function and respond to external changes with reference to the interdependencies between individual components | Multicellular organisms rely on coordinated and interdependent internal systems to respond to changes to their environment [(VCSSU117)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU117) | **Operating with percentages**   * Find percentage as part of a whole (7–8)   **Positioning and Locating**   * Position to self (F) * Position to other (1) * Interpreting maps and plans (4–5)   **Measuring time**   * Relating units of time (4–5) * Time Zones (6–8)   **Understanding units of measurement**   * Using formal units (3–5) * Converting units (6–7) * Calculating measurements (8)   **Interpreting and representing data**   * Collecting and displaying data (4–5) * Shape of data display (8) * Graphical representations of data (8–10) |
| * … analyse how biological systems function and respond to external changes with reference to the interdependencies between individual components, energy transfers … | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU118) |
| * … explain the role of DNA and genes in cell division and genetic inheritance | The transmission of heritable characteristics from one generation to the next involves DNA and genes [(VCSSU119)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU119) |
| * … apply geological timescales to elaborate their explanations of both natural selection and evolution * … evaluate the evidence for scientific theories that explain … the diversity of life on Earth | The theory of evolution by natural selection explains the diversity of living things and is supported by a range of scientific evidence [(VCSSU120)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU120) |
| * … analyse how biological systems function and respond to external changes with reference to the interdependencies between individual components, energy transfers and flows of matter | Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems [(VCSSU121)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU121) |
| **Numeracy in context – Science, Levels 7–10** | | |
| **Science Levels 7 and 8** | | |
| **Quantifying numbers**  Students become increasingly able to recognise, read, estimate and interpret large and small numbers. They understand scale as they compare the functions of related cells, organs and systems. They consider very small numbers as they explore the dimensions of cells, viruses and bacteria. They apply concepts related to relative proportion and scale in determining the magnification of objects observed under a light microscope and when examining published micrographs.  **Positioning and locating**  The concept of location, and change in location, impacts on relationships between organisms. Food chains can be represented as a linear relationship between organisms while food webs require understanding relationships in two dimensions, but changing environmental conditions resulting from human activity, such as clearing land for agriculture or development, can affect these relationships and alter dependencies and affect survival.  **Understanding units of measurement**  Students understand the importance of using formal units of measurement. They are able to measure, compare and estimate length, area, mass, volume and capacity, using and converting between different units of measurement. Students use the SI units of the kilogram (kg) to measure mass, the metre (m) to measure length and the second (s) to measure time. SI derived units, including millimetres (mm), centimetres (cm) and kilometres (km) to measure length, grams (g) to measure mass and °C to measure temperature, may be more practical units for students to use in generating their own investigation data. In looking at microscopic organisms, students should become familiar with the micrometre (µm) as a unit of measurement, understanding the significance of the unit prefix micro-.  **Interpreting and representing data**  Students implement knowledge of different representations, including graphs, models and classification keys, to predict the effects of environmental changes due to human activity and to explain how living things can be sorted and classified. | | |
| **Science Levels 9 and 10** | | |
| **Operating with percentages**  Energy efficiencies, expressed as percentages, can be used to show the relative efficiencies of system components. For example, students make use of percentages in constructing or analysing food chains, food webs and food pyramids, as a visual and quantitative representation that shows how energy flows through ecosystems.  **Positioning and locating**  The concept of location, and change in location, impacts on relationships between organisms. Changing environmental conditions may affect the distribution of different species and may impact on their capacity to adapt and survive. Students may use simulations to make and test their predictions related to the long-term effects of changing species distribution on survival.  **Measuring time**  Students explore geological timescales in considering the evidence for evolution.  **Understanding units of measurement**  In Biological sciences, understanding units of measurement provides an important foundation for generating accurate measurements and for developing a sense of scale. Students are able to measure, compare and estimate length, area, mass, volume and capacity, using and converting between different units of measurement. Students will use the SI units of the kilogram (kg) to measure mass, the metre (m) to measure length and the second (s) to measure time. SI derived units, including millimetres (mm), centimetres (cm) and kilometres (km) to measure length, grams (g) to measure mass, millilitres (mL) to measure volume and °C to measure temperature, may be more practical units for students to deal with in generating their own experimental data and using simulations related to the functioning of organisms and ecosystems.  **Interpreting and representing data**  Students analyse and compare a range of biological systems. They generate, collect and present data in a range of displays and determine and calculate the most appropriate statistic to describe the data. They compare and make decisions about the usefulness of different representations of the same data, for example, discrete data related to the lung capacities of different students in the class. They create models, diagrams, keys and flow charts to represent the relationship between different components of biological systems. | | |

Chemical sciences

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| **Relevant Victorian Curriculum achievement standard extract** | **Relevant Victorian Curriculum content descriptions** | **Numeracy Learning Progression links  (plus approximate relation to Victorian Curriculum F–10 Mathematics levels)** |
| **Science Levels 7 and 8** | | |
| * … describe and apply techniques to separate pure substances from mixtures | Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques [(VCSSU095)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU095) | **Quantifying numbers**   * Understanding place value (3–6)   **Operating with percentages**   * Understanding percentages and relative size (6) * Find percentage as part of a whole (7–8)   **Number patterns and algebraic thinking**   * Generalising patterns (5–7)   **Comparing units**   * Building ratios (7) * Ratios (8) * Rates (8)   **Positioning and locating**   * Position to self (F) * Position to other (1)   **Understanding units of measurement**   * Using the structure of units (4–6) * Converting units (6–8) * Calculating measurements (7–8)   **Interpreting and representing data**   * Collecting and displaying data (4–5) * Interpreting data scales (6) |
| * … use the particle model to predict, compare and explain the physical and chemical properties and behaviours of substances | The properties of the different states of matter can be explained in terms of the motion and arrangement of particles [(VCSSU096)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU096)  Differences between elements, compounds and mixtures can be described by using a particle model [(VCSSU097)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU097) |
| * … provide evidence for observed chemical changes in terms of colour change, heat change, gas production and precipitate formation | Chemical change involves substances reacting to form new substances [(VCSSU098)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU098) |
| **Science Levels 9 and 10** | | |
| * … explain natural radioactivity in terms of atoms and energy change | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU122) | **Quantifying numbers**   * Understanding place value (3–6)   **Operating with percentages**   * Finding percentage as part of a whole (6–8)   **Number patterns and algebraic thinking**   * Algebraic expressions (8) * Algebraic relationships (9)   **Comparing units**   * Ratio (7–8) * Rates (7–9) * Applying proportion (9)   **Positioning and locating**   * Position to self (F) * Position to other (1)   **Understanding units of measurement**   * Using units of measurement * Using the structure of units (4–6) * Converting units (6–8) * Calculating measurements (7–8)   **Interpreting and representing data**   * Collecting and displaying data (4–5) * Interpreting data scales (6) * Shape of data displays (7) * Graphical representations of data (8) |
| * … compare the properties of a range of elements representative of the major groups and periods in the periodic table * … 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 | The atomic structure and properties of elements are used to organise them in the periodic table [(VCSSU123)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU123) |
| * … use atomic symbols and balanced chemical equations to summarise chemical reactions | Chemical reactions involve rearranging atoms to form new substances; during a chemical reaction mass is not created or destroyed [(VCSSU124)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU124) |
| * … explain how different factors influence the rate of reactions | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU125) |
| * … use atomic symbols and balanced chemical equations to summarise chemical reactions, including neutralisation and combustion * … explain the concept of energy conservation | Chemical reactions, including combustion and the reactions of acids, are important in both non-living and living systems and involve energy transfer [(VCSSU126)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU126) |
| **Numeracy in context – Science, Levels 7–10** | | |
| **Science Levels 7 and 8** | | |
| **Quantifying numbers**  Students become increasingly able to recognise, read, estimate and interpret large and small numbers. They can place the melting and boiling points of different substances in rank order so that patterns can be investigated.  **Operating with percentages**  Students use percentages in the Chemical sciences to represent quantities. This is particularly useful for developing an understanding of the representation of relative amounts, for example, in determining the % composition of a mixture or in calculating the % efficiency of a separation technique.  **Number patterns and algebraic thinking**  Students explore the formulas of chemical and physical properties and recognise that elements and simple compounds can be represented by symbols and formulas, answering questions such as what do all the symbols mean in Na2SO4 and what is the difference between H2O and H2O2?  **Comparing units**  Students are introduced to chemical formulas as a way of representing ratios between numbers of atoms in a molecule. The ratio of hydrogen atoms to oxygen atoms in a water molecule (H2O) is 2:1; students should recognise that this ratio does not extend to the ratio of masses or volumes.  **Positioning and locating**  Visualisation of position and space is important for students to understand and explain chemical phenomena that are not visible to the unaided eye, for example, using the particle theory of matter to explain the physical properties of solids, liquids and gases.  **Understanding units of measurement**  Students understand the importance of using formal units of measurement. They are able to measure, compare and estimate length, area, mass, volume and capacity, using and converting between different units of measurement. Students use the SI units of the kilogram (kg) to measure mass, the metre (m) to measure length and the second (s) to measure time. SI derived units, including millimetres (mm), centimetres (cm) and kilometres (km) to measure length, grams (g) to measure mass and °C to measure temperature, may be more practical units for students to use in generating their own investigation data. Calculation of the densities of solids, liquids and gases builds an understanding of proportion as students apply the formula using appropriate units of measurement.  **Interpreting and representing data**  Students generate and present data in a range of displays. They compare and make decisions about the usefulness of different representations of the same data generated from their own investigations, for example, considering how to present results for the solubilities of different substances in water. They construct flow charts to illustrate chemical process, such as the sequence of steps in the separation of the components of a mixture. | | |
| **Science Levels 9 and 10** | | |
| **Quantifying numbers**  Students become increasingly able to recognise, read, estimate and interpret large and small numbers. They consider the use of negative and positive numbers in terms of the charge on protons (positive), electrons (negative) and neutrons (neutral). Students consider why the atomic number of an element is a whole number while the atomic mass (amu) is expressed as a non-whole number decimal.  **Operating with percentages**  Students use percentages in the Chemical sciences to represent quantities. Percentages are particularly useful for developing an understanding of the representation of relative amounts. Energy efficiencies, expressed as percentages, can illustrate the Law of Conservation of Energy by showing the relative efficiencies of the combustion of different fuels.  **Number patterns and algebraic thinking**  Number patterns are evident in the organisation of elements in the rows and columns of periodic table of elements. Students create algebraic expressions from word problems involving one operation (for example, finding the number of neutrons given the atomic mass and number of protons).  They write balanced chemical equations for simple reactions such as neutralisation reactions.  **Comparing units**  Students interpret ratios between the same units of measure; for example, the ratio of hydrogen atoms to oxygen atoms in water (H2O) is 2:1. They rely on an understanding of increasing proportion during experiments to maintain a given consistency and perform operations with negative integers involving rates, such as a rate of descent or cooling. Relative quantities are also considered in comparing the atomic masses of protons, electrons and neutrons. Different units for measuring pressure should be discussed in examining the properties of gases.  Students interpret rates as a relationship between two different types of quantities (change in concentration of reactants over time) and use rates to explain how quantities change.  **Positioning and locating**  Visualisation of position and space is important for students to understand and explain chemical phenomena that are not visible to the unaided eye, for example, modelling of reactants and products in chemical reactions to illustrate the Law of Conservation of Mass.  **Understanding units of measurement**  In Chemical sciences, understanding units of measurement provides an important foundation for generating accurate measurements and for developing a sense of scale. Students are able to measure, compare and estimate length, area, mass, volume and capacity, and convert between different units of measurement. Students use the SI units of the kilogram (kg) to measure mass, the metre (m) to measure length and the second (s) to measure time. SI derived units, including millimetres (mm), centimetres (cm) and kilometres (km) to measure length, grams (g) to measure mass, millilitres (mL) to measure volume and °C to measure temperature, may be more practical units for students to deal with in generating their own experimental data. Students consider appropriate units for measuring reaction rates, such as measuring the volume of gas produced over time during a chemical reaction involving the production of gases. The small sizes of atoms could be quantified in terms of nanometres (nm) as well as considered in terms of relative size. Students understand that there are different ways of expressing a very small or a very large number, and that very small numbers can be written in standard form involving negative indices, for example, 6.0 × 10-6 g is equivalent to 6.0 µg.  **Interpreting and representing data**  Students generate and present data in a range of displays and determine and calculate the most appropriate statistic to describe the data. They compare and make decisions about the usefulness of different representations of the same data generated from their own investigations, for example, experiments related to reaction rates, and from data collated from secondary sources. They create models and diagrams to illustrate chemicals and chemical interactions. | | |

Earth and space sciences

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| **Relevant Victorian Curriculum achievement standard extract** | **Relevant Victorian Curriculum content descriptions** | **Numeracy Learning Progression links  (plus approximate relation to Victorian Curriculum F–10 Mathematics levels)** |
| **Science Levels 7 and 8** | | |
| * … model how the relative positions of Earth, the Sun and the Moon affect phenomena on Earth | Predictable phenomena on Earth, including seasons and eclipses, are caused by the relative positions of the Sun, Earth and the Moon [(VCSSU099)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU099) | **Quantifying numbers**   * Understanding place value (3–6)   **Operating with percentages**   * Understanding percentages and relative size (6–8)   **Measuring time**   * Sequencing time (F–2) * Telling time (2–6) * Units of time (2–6) * Relating units of time (6–8) * Time zones (7–8)   **Comparing units**   * Building ratios (7)   **Positioning and locating**   * Position to self (F) * Position to other (1) * Interpreting maps and plans (4–5)   **Understanding units of measurement**   * Using formal units (3–5)   **Interpreting and representing data**   * Collecting and displaying data (4–5) * Interpreting data scales (6) |
| * … analyse how the sustainable use of resources depends on the way they are formed and cycle through Earth systems | Some of Earth’s resources are renewable, but others are non-renewable [(VCSSU100)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU100)  Water is an important resource that cycles through the environment [(VCSSU101)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU101) |
| * … compare processes of rock formation, including the time scales involved | Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales [(VCSSU102)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU102) |
| **Science Levels 9 and 10** | | |
| * … explain global features and events in terms of geological processes and timescales | The theory of plate tectonics explains global patterns of geological activity and continental movement [(VCSSU127)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU127) | **Quantifying numbers**   * Understanding place value (6)   **Operating with percentages**   * Understanding percentages and relative size (6) * Find percentage as part of a whole (7–8) * Find a whole from a percentage and a part (8)   **Positioning and locating**   * Position to self (F) * Position to other (1) * Interpreting maps and plans (4–5)   **Measuring time**   * Units of time (2-6) * Relating units of time (6–8)   **Understanding units of measurement**   * Using formal units (3–5) * Converting units (6–7) * Calculating measurements (8)   **Interpreting and representing data**   * Collecting and displaying data (4–5) * Graphical representations of data (8) |
| * … describe and analyse interactions and cycles within and between Earth’s spheres | Global systems, including the carbon cycle, rely on interactions involving the atmosphere, biosphere, hydrosphere and lithosphere [(VCSSU128)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU128) |
| * … evaluate the evidence for scientific theories that explain the origin of the Universe … | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU129) |
| **Numeracy in context – Science, Levels 7–10** | | |
| **Science Levels 7 and 8** | | |
| **Quantifying numbers**  Students read, write and apply knowledge of place value of numbers including numbers beyond millions. They order large numbers when comparing features, resources and processes in Earth and space sciences so that predictions can be made and patterns investigated.  **Operating with percentages**  Students recognise that 100% is a complete whole and use percentages to describe and compare relative size, composition and area. Students may use percentages in making comparisons, such as looking at the abundance of different elements in Earth’s crust in investigating possible renewable resources.  **Comparing units**  Students use rates to determine how quantities change, for example, when investigation cooling rates to produce crystals when investigating rock formation.  **Positioning and locating**  The description of the motion of objects relies on the concept of position, and change in position, with respect to a reference point. Phenomena such as the phases of the Moon, eclipses and seasons can be explained by modelling the relative positions of Earth, the Sun and the Moon, including a consideration of angles.  **Measuring time**  In Earth and space sciences, students compare times for the rotation of Earth, the Sun and the Moon, and compare the times for the orbits of Earth and the Moon. They document timescales for regeneration of resources. They understand and apply formal units to measure time. They use appropriate units for reporting both large and small durations of time (millennium, nanoseconds).  **Understanding units of measurement**  Students understand the importance of using formal units of measurement. They are able to measure, compare and estimate length, area, mass, volume and capacity, using and converting between different units of measurement. Students use the SI units of the kilogram (kg) to measure mass, the metre (m) to measure length and the second (s) to measure time. SI derived units, including millimetres (mm), centimetres (cm) and kilometres (km) to measure length, grams (g) to measure mass and °C to measure temperature, may be more practical units for students to use in generating their own investigation data. Students use various scales such as Moh’s scale of mineral hardness (a qualitative ordinal scale) to classify rock samples and an alcohol thermometer (a quantitative ratio scale) to measure temperature.  **Interpreting and representing data**  Students implement knowledge of different representations, including graphs, models and keys, to explain geological and astronomical processes and to classify objects such as minerals and stars in order to predict their behaviour. | | |
| **Science Levels 9 and 10** | | |
| **Quantifying numbers**  Relative size is important in considering the large distances in space and the sizes of objects such as planets and different types of stars. Sorting objects or geological processes found on Earth or in space using criteria such as size, distance and time taken for their formation enables exploration of interactions and relationships between them.  **Operating with percentages**  Students recognise that 100% is a complete whole and use percentages to describe and compare relative size, composition, area and volume, for example, 21% of the air is oxygen. Energy efficiencies, expressed as percentages, can illustrate the Law of Conservation of Energy by showing the relative efficiencies of system components.  **Measuring time**  Students document timescales for regeneration of resources. They understand and apply a variety of units to measure time and use appropriate units for reporting both large and small durations of time (millennia, nanoseconds). Students consider measurement units such as light years and compare different ways in which geological time is represented.  **Positioning and locating**  The description of the motion of objects relies on the concept of position, and change in position, with respect to a reference point. The breaking up of Pangaea and continental movement requires an understanding of changes in position of Earth’s tectonic plates.  **Understanding units of measurement**  In Earth and space sciences, understanding units of measurement provides an important foundation for generating accurate measurements and for developing a sense of scale, particularly when dealing with very small and very large numbers, such as large distances in space, the small size of atoms and long time periods for geological processes. Students are able to measure, compare and estimate length, area, mass, volume and capacity, using and converting between different units of measurement. Students use the SI units of the kilogram (kg) to measure mass, the metre (m) to measure length and the second (s) to measure time. SI derived units, including millimetres (mm), centimetres (cm) and kilometres (km) to measure length, grams (g) to measure mass, millilitres (mL) to measure volume, and °C to measure temperature, may be more practical units for students to deal with in generating their own experimental data.  **Interpreting and representing data**  Students generate and present data in a range of displays and determine and calculate the most appropriate statistic to describe the data. They compare and make decisions about the usefulness of different representations of the same data generated from their own investigations, for example, experiments related to carbon cycle processes such as photosynthesis and respiration. They apply knowledge of different representations, including graphs, models and keys, to explain geological and astronomical processes and to classify objects such as minerals and stars in order to make predictions about their behaviour. | | |

Physical sciences

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| **Relevant Victorian Curriculum achievement standard extract** | **Relevant Victorian Curriculum content descriptions** | **Numeracy Learning Progression links  (plus approximate relation to Victorian Curriculum F–10 Mathematics levels)** |
| **Science Levels 7 and 8** | | |
| * … predict, represent and analyse the effects of unbalanced forces, including Earth’s gravity, on motion | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU103) | **Quantifying numbers**   * Understanding place value (3–6)   **Operating with percentages**   * Understanding percentages and relative size (6)   **Number patterns and algebraic thinking**   * Algebraic expressions (7–8)   **Positioning and locating**   * Position to self (F) * Position to other (1)   **Understanding units of measurement**   * Using formal units (3–5) * Converting units (6–7) * Calculating measurements (8)   **Interpreting and representing data**   * Collecting and displaying data (3–7) |
| * … investigate different forms of energy and explain how energy transfers and transformations cause change in simple systems * … distinguish between different types of simple machines | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU104) |
| * … use examples to illustrate how light forms images | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU105) |
| * … use a wave model to explain the properties of sound | The properties of sound can be explained by a wave model (VCSSU106) |
| **Science Levels 9 and 10** | | |
| * … use the concepts of voltage and current to explain the operation of electric circuits | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU130) | **Quantifying numbers**   * Representing place value (6)   **Operating with percentages**   * Understanding percentages and relative size (6) * Find percentage as part of a whole (7–8) * Find a whole from a percentage and a part (8)   **Number patterns and algebraic thinking**   * Representing unknowns (7–8) * Algebraic relationships (9)   **Comparing units**   * Ratio (7–8) * Rates (7–9) * Applying proportions (9)   **Positioning and locating**   * Position to self (F) * Position to other (1)   **Understanding units of measurement**   * Using formal units (F-3) * Converting units (6–8) * Calculating measurements (7–8)   **Interpreting and representing data**   * Graphical representation of data (8–10) |
| * … use a field model to explain interactions between magnets | 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU131) |
| * … model energy transfer and transformation within systems | Energy flow in Earth’s atmosphere can be explained by the processes of heat transfer [(VCSSU132)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU132) |
| * … give both qualitative and quantitative explanations of the relationships between distance, speed, acceleration, mass and force to predict and explain motion * … explain the concept of energy conservation | The description and 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)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCSSU133) |
| **Numeracy in context – Science, Levels 7–10** | | |
| **Science Levels 7 and 8** | | |
| **Quantifying numbers**  Students become increasingly able to recognise, read, estimate and interpret large and small numbers as they explore how different quantities are measured. Students should be able to estimate the size of decimals and understand when they should be rounded during calculations or reporting answers. The quality of data analysis is affected by how carefully measurement scales are read and data is recorded.  **Operating with percentages**  Students recognise that 100% is a complete whole and use percentages to describe and compare relative size, composition and area. Energy efficiencies, expressed as percentages, can illustrate the Law of Conservation of Energy by showing the relative efficiencies of system components, for example, in quantifying the efficiencies of identified energy transformations in a system.  **Number patterns and algebraic thinking**  Students look for patterns in data as the basis for making predictions or generalisations, or drawing conclusions, for example, looking at how light is reflected by concave and convex mirrors, or how light travels through convex and concave lenses.  **Positioning and locating**  The description of the motion of objects relies on the concept of position, and change in position, with respect to a reference point. Students draw force diagrams to show balanced and unbalanced forces.  **Understanding units of measurement**  Students understand the importance of using formal units of measurement. They are able to measure, compare and estimate length, area, mass, volume and capacity, using and converting between different units of measurement. Students use the SI units of the kilogram (kg) to measure mass, the metre (m) to measure length and the second (s) to measure time. SI derived units, including millimetres (mm), centimetres (cm) and kilometres (km) to measure length, grams (g) to measure mass and °C to measure temperature, may be more practical units for students to use in generating their own investigation data. Students measure angles, in degrees, when ray tracing and exploring the reflection of light from mirrors and the passage of light through different lenses.  **Interpreting and representing data**  Students generate and present data in a range of displays. They compare and make decisions about the usefulness of different representations of the same data generated from their own investigations, for example, considering how to present results for investigations related to forces, energy, light and sound. They use models and draw diagrams to represent data, for example, ray tracing and force diagrams. | | |
| **Science Levels 9 and 10** | | |
| **Quantifying numbers**  Students become increasingly able to recognise, read, estimate and interpret large and small numbers as they explore how different quantities are measured. The quality of data analysis is affected by how carefully measurement scales are read and data is recorded. Skills of approximation and estimation are important in testing whether investigation findings are reasonable.  **Operating with percentages**  Students recognise that 100% is a complete whole and use percentages to describe and compare relative size, composition and area. Energy efficiencies, expressed as percentages, can illustrate the Law of Conservation of Energy by showing the relative efficiencies of system components, for example, energy flows in Earth’s atmosphere.  **Number patterns and algebraic thinking**  In Physical sciences, students use words or symbols (including letters) to express the relationship between distance, speed, acceleration and mass, to predict and explain motion. Students transpose formulae to determine the value of an unknown quantity, for example, finding the distance travelled when given speed and time for the formula or using in calculations involving resolved forces in one dimension, such as anything moving in a straight line along the ground (cars and balls rolling, pucks sliding, boxes being pushed and pulled) and anything dropped straight down (balls bouncing).  Students experimentally investigate the motion and forces involved in falling objects and consider how the data would be different if they had performed the experiments in different locations on Earth (or on different planets and moons).  **Comparing units**  Students explain and apply the difference between direct and indirect proportion. They interpret ratios as a comparison between the same units.  **Positioning and locating**  The description of the motion of objects relies on the concept of position, and change in position, with respect to a reference point. Students draw force diagrams to represent and resolve the forces acting on objects in considering Newton’s second law of motion, .  **Understanding units of measurement**  Students explore the concept of voltage as a formal unit of measurement. They explore force and motion and make predictions using the laws of physics.  In Physical sciences, understanding units of measurement provides an important foundation for generating accurate measurements and for developing a sense of scale. Students are able to measure, compare and estimate length, area, mass, volume and capacity, using and converting between different units of measurement. Students use the SI units of the kilogram (kg) to measure mass, the metre (m) to measure length, the second (s) to measure time and the ampere (A) to measure electric current. SI derived units, including millimetres (mm), centimetres (cm) and kilometres (km) to measure length, grams (g) to measure mass, millilitres (mL) to measure volume, °C to measure temperature, volts (V) to measure voltage and ohms (Ω) to measure electrical resistance, may be more practical units for students to deal with in generating their own experimental data. In applying the laws of physics to motion, students are required to convert from units such as metres per second to kilometres per hour.  **Interpreting and representing data**  Students generate and present data in a range of displays and determine and calculate the most appropriate statistic to describe the data. Both quantitative and qualitative data can be used to explain the relationships between distance, speed, acceleration, mass and force. Students use graphical representations such as distance–time or speed–time graphs to make predictions and explain the concept of motion, and construct their own distance–time and speed–time graphs from generated primary data. When exploring electric circuits, magnets and motion, students compare the usefulness of different representations of the same data. | | |