

# Essential Secondary Science Assessment 2010 framework

## Prescribed focus areas (Outcomes 4.1–4.5)

This strand assesses students' capacity to use knowledge and understandings of the history, nature, practice and applications of science as well as their understanding of the impact of science on society, on technology and on the environment.

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
Outcomes 4.1 to 4.5	Describe science	Compare experiences and events that have a scientific component with those that do not	Explain that a model is a representation of a concrete object or an idea	Outline the historical development of a model or theory	Describe examples where scientific understanding has changed	Use evidence to support or criticise a scientific model, theory or law
	Describe technology		Explain a link between technology and science	Identify an impact of science/technology on society or the environment	Discuss the choices people make regarding science, technology and society	Relate an application of science and its impact on society or the environment
	Identify that scientific explanations have changed over time			Describe a model or theory that has been considered in science and then modified/rejected based on further evidence	Compare a modified/rejected model with its replacement	Explain how the new evidence no longer supports the previous scientific thinking/model
	Identify a natural event		Tell a story that explains a natural event but that is not a scientific explanation	Describe scientific ideas contributed by other cultures	Discuss different perspectives about issues with a significant scientific component	Explain choices made by scientists when considering scientific advances
	Identify a scientific discovery	Compare scientific discovery to other types of discovery	Link a scientific discovery to its effect on humans	Describe a development in science that has led to new developments in technology	Compare the methods of the scientist to the design model of the engineer and architect	Explain the role of scientific thinking on society
	Identify that a community includes many different groups	Describe that different groups in the community have different points of view	Discuss an issue where different groups have different points of view	Describe an example where a societal value has had an impact on scientific developments	Compare the negative and positive impacts of recent developments in science	Discuss examples where societal (or other) values have impacted on scientific development/s
	Identify a possible career path in science	Identify a science context in a career	Link a career in science to knowledge and skills required	Identify science as a human activity	Discuss why society should support scientific research	

## Knowledge and understanding strand (Outcomes 4.6–4.12)

This strand assesses students' capacity to use knowledge and understandings of the fundamental concepts and processes of science. Here are some major concepts.

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
Generalised statements	Identify an observable structure/process of our world or space	Describe observable structures/processes of our world or space	Relate observable structures/processes of our world or space	Describe a complex structure/process of our world or space using a model, theory or law	Compare complex structures/processes of our world or space	Explain physical phenomena using a model, theory or law
				Identify an interaction of systems or within a system	Describe interactions of systems or within systems	Explain the interaction of complex systems
Outcomes 4.7 and 4.9	Describe the visible composition of materials	Compare the visible composition of materials	Explain that the composition of materials is related to their properties	Identify that there is a limited number of different kinds of particles	Distinguish between elements and compounds	Explain the term 'pure substance' as having a constant composition
				Identify that an element is made up of one kind of particle		
				Identify that compounds are two or more elements combined with constant composition	Compare the properties of compounds and mixtures	Explain chemical change as an event that produces a new substance
	Describe objects as metallic		Link the use of metallic objects to their properties	Classify elements as metals or non-metals according to their common characteristics	Distinguish between metals and non-metals	Explain the appropriate use of metals based on their characteristics
	Identify rivers, oceans and mountains as landforms		Explain that landforms change over time	Describe the origins of sedimentary, igneous and metamorphic rocks	Distinguish between the different processes of rock formation	
	Identify useful materials that come from rocks	Classify materials according to everyday use		Identify minerals as elements or compounds	Compare the processes of weathering, erosion and deposition	Relate the formation of landforms to weathering, erosion and deposition
Identify sieving and sedimentation as everyday processes for separating mixtures			Explain that sieving relies on separating materials of different sizes	Identify some common mixtures	Distinguish between solute, solvent and solution in reference to aqueous mixtures	Relate the process of separation to the properties of components of an aqueous mixture and the desired product/s
			Explain that sedimentation relies on separating materials of different weight	Describe another separation process, such as distillation, chromatography or crystallisation	Distinguish between different processes for separating aqueous mixtures	

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Outcome 4.11	Identify a resource as a useful substance/material	Compare a common resource from the oceans or the earth with one from living things	Link a commonly used resource to its source		Distinguish between natural and made resources	Relate the use of natural resources to an impact on society
	Identify common materials that come from the earth		Explain that materials from the earth take millions of years to form	Describe some resources that provide energy	Compare fossil fuels and renewable sources of energy	Explain why fossil fuels are not renewable sources of energy
Outcome 4.6	Describe energy as the ability to do things		Explain that humans' capacity for work and play depends on the energy in food they eat	Describe different forms of energy using models	Distinguish between potential and kinetic energy	Explain the relationship between kinetic and potential energy for a falling object
	Identify types of energy	Compare the observable properties of light and sound		Describe the propagation of sound, light, heat and electrical energy	Compare the propagation of light and sound energy	
	Identify sources of energy	Identify processes involved in using and changing energy	Devise systems that use energy	Describe the transfer of electrical energy using electric circuits	Compare transfer of energy and energy transformations	Use the law of conservation of energy to explain the transfer of energy and energy transformations
Outcome 4.8	Identify examples of living things		Explain the concept of a living thing in simple terms	Identify that all living things are made of cells	Distinguish between unicellular and multicellular organisms	Explain why multicellular organisms require specialised organs and systems
				Identify structures in cells		
				Describe the functions of structures in cells		
	Identify some of the organs in the human body	Identify two or more organs that work together	Link an organ to its function in the human body	Describe organs, tissues and systems as levels of cell organisation	Distinguish between the roles of different body systems in humans	Explain how body systems maintain humans as functioning organisms
Describe some structures of plants	Compare the food-making ability of plants and animals	Link food-making ability with food chains	Identify that respiration and photosynthesis are chemical processes	Describe the materials required for photosynthesis and respiration	Explain how the root, stem and leaf maintain plants as functioning organisms	
				Identify that respiration and photosynthesis occur in all cells but photosynthesis only occurs in plant cells		Link the products of photosynthesis with the materials required for respiration

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
	Identify common grouping names for plants and/or animals		Justify the inclusion of a plant or animal in a common group of plants or animals	Classify a range of plants and animals based on structural features		Explain, using examples, why structural features are used for classification
<b>Outcome 4.10</b>	Identify the basic needs of living things	Compare the basic needs of plants and animals	Explain a relationship between living things	Describe the relationship between organisms in a food chain	Describe a food web as showing a number of related food chains between organisms that live together in a particular place	Explain the link between the processes of photosynthesis and respiration in terms of energy
	Describe the observable features/behaviours of some living things	Describe differences in the features/behaviours of some living things	Link observable features to behaviours in living things	Identify structural features of organisms	Identify an adaptation together with its role in the organism's survival	Explain adaptations as a characteristic of living things that increase the chance of survival in that environment
	Identify a physical feature in the environment		Describe a relationship between a living thing and its physical environment	Describe the physical and chemical components of an environment	Describe an ecosystem as a complex system of feeding relationships between organisms and their interactions with the non-living factors in an environment	Discuss natural disasters in terms of their effect on ecosystems
	Identify food as a source of energy	Compare ways that plants and animals obtain energy	Explain that the Sun is the source of energy on Earth	Describe the links in a food chain as a flow of potential energy	Compare producers, consumers and decomposers in terms of their sources of energy	Explain the link between the processes of photosynthesis and respiration in terms of energy
Describe decomposers in terms of nutrient recycling				Explain the relationship between consumers, producers and decomposers in a food web		

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<b>Outcome 4.7</b>	Identify an object/substance as a solid, liquid or gas	Describe objects/substances as solids, liquids and gases	Explain that all objects/substances are either solids, liquids or gases	Describe characteristics (mass, shape, volume) of one state of matter	Describe characteristics (mass, shape, volume) of states of matter	Relate characteristics of matter and the states of matter to the arrangement, movement and interactions of particles
	Identify an observable feature (hard, like water, like air) of solids, liquids or gases	Compare observable features (hard, like water, like air) of solids, liquids and gases	Explain that observable features of materials are linked to composition	Describe that matter/material is made of particles	Compare the arrangement of particles in different states of matter	
	Identify an observable feature in melting, freezing, condensation, evaporation or boiling	Describe observable features in melting, freezing, condensation, evaporation and boiling	Explain that, when substances melt, freeze, condense, evaporate and boil, they are still made of the same stuff	Identify that particles are continuously moving and interacting	Compare movement and interaction of particles in different states	Explain change of state in terms of rearrangements of particles
				Identify that as particles are heated they gain energy	Identify that as particles are heated they gain energy and move further apart	Relate changes of state to the motion of particles as energy is removed or added
		Identify that objects/substances take up space and/or have mass/weight	Explain that materials are held together differently in solids, liquids and gases			Explain density in terms of a simple particle model
<b>Outcome 4.6</b>	Identify that a push or pull makes things move or stop		Link the friction between two materials to the type of surface	Identify forces acting in a particular situation	Compare situations where friction is an advantage to where it is a disadvantage	Explain the effect of air pressure as a force
	Identify materials attracted by a magnet	Compare the observable effects when magnets are placed end to end	Link the observable effects when two magnets are placed end to end with their position	Describe a magnetic field as producing a force that attracts particular metals	Describe the poles of a magnet as the area/ends where the magnet's field is most intense	Explain the behaviour of magnetic poles using the term field
	Describe the observable (electric) effect when two materials are rubbed together		Link commonly observed (electric) phenomena to the friction between materials	Identify electrostatic charge as produced by the transfer of charged particles	Describe electrostatic charges as either positive or negative	Explain the behaviour of electrostatic charges using the term field
	Identify that gravity is a pull		Link gravity to the movement of things in our solar system	Identify that all objects exert a force of gravity on all other objects in the universe	Compare the force of gravity of Earth, the Moon and the Sun	Explain the relative movements of Earth, the Moon and the Sun using gravity

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<b>Outcome 4.9</b>	Identify that Earth orbits the Sun	Identify components of the solar system, such as the Sun and planets	Link day and night to the turning of Earth	Describe that Earth rotates on its axis each 24 hours	Compare the relative sizes, distances and movements of components of our solar system	
		Describe the motion of Earth, the Moon and the Sun	Link the time taken for Earth to travel around the Sun and a calendar year	Describe the tilt of Earth's axis		Explain seasons on Earth
	Describe the observable changes to the appearance of the Moon over time	Describe the shape, position and size of Earth, the Sun and the Moon		Describe the major features of our universe	Use appropriate scales to describe differences in sizes of and distance between structures of our universe	
	Describe the observable rise and fall of the oceans			Describe the variety of tides on Earth	Describe the forces of gravity due to the Sun and the Moon that act on Earth's hydrosphere	Explain the phenomenon of tides on Earth
	Describe our planet as air, earth and water		Link the physical environment of living things to Earth's crust, oceans and atmosphere	Describe the structure of Earth	Compare the ratio of the gases in our atmosphere to their importance for life	Explain the difference between Earth's atmosphere and space
			Describe the water cycle	Describe the changes of state as they occur in the water cycle		
				Describe the composition of Earth's atmosphere	Compare the effect of ozone and greenhouse gases for life on Earth	Explain the role of Earth's atmosphere in maintaining life on Earth

## Planning and conducting investigations strand (Outcomes 4.13–4.15)

This strand assesses students' capacity to formulate or identify questions and hypotheses, plan investigations and collect evidence.

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
. Outcomes 4.13 to 4.15	Identify one factor that must be kept the same when testing scientifically		Explain why some factors must be kept the same when testing scientifically	Identify the variables that must be held constant for a controlled investigation		Explain that some variables must be held constant to ensure validity
	Identify the factor to be intentionally changed when testing scientifically		Link the factor that is changed to the result of the scientific test	Identify the dependent or independent variables of a controlled investigation	Distinguish between dependent and independent variables	Explain what constitutes a controlled investigation
		Identify features of a scientific test	Identify the purpose of testing scientifically	Identify a prediction, inference, conclusion, aim or hypothesis in a scientific context	Distinguish between a prediction and a hypothesis	Justify whether evidence can be used to support or refute a hypothesis
	Identify a question that can be tested scientifically	Distinguish between questions that can be tested scientifically and those that cannot		Describe one way to improve the reliability of a controlled investigation	Identify ways to improve the reliability and accuracy of controlled investigations	Evaluate and modify experimental procedures
	Make a simple observation	Compare observations made by different people	Explain strategies to increase accuracy of observation	Correctly sequence steps in a scientific procedure	Accurately and systematically record observations and data	Discuss the relationship between accuracy and reliability
	Identify one appropriate piece of equipment for a task	Distinguish between items of equipment for a simple task	Relate equipment and appropriate use for a simple task	Select appropriate scientific equipment and/or resources to perform an investigation	Compare digital and other forms of measuring devices	Justify selection of equipment
	Identify an unsafe activity in the classroom or playground	Compare the level of safety in different environments	Relate safety procedures to dangers	Identify a potential hazard of an investigation	Compare a number of solutions to a safety issue in the laboratory/testing environment	Relate hazards to the nature of materials or situations
	Identify a familiar unit	Identify units of fundamental quantities	Record measurements including units			Explain the selection of an appropriate unit

## Communication strand (Outcomes 4.16, 4.17a–d and 4.18)

This strand assesses students' skills in locating, referencing and organising data and information and the use of appropriate text for purpose and audience.

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
. Outcomes 4.16, 4.17a–d and 4.18	Locate one piece of information in a simple table, diagram, graph or text	Locate information in a simple table, diagram, graph or text	Reference information within a simple table, diagram, graph or text	Extract related information from tables, diagrams, graphs or texts	Distinguish between relevant and irrelevant scientific information	Collate scientific information from a number of sources
				Identify one piece of relevant scientific information	Compare two sets of scientific information	Justify the reliability of gathered scientific information
		Identify issues or themes in simple text	Explain the purpose of a simple text	Identify an issue or a theme in a complex text	Identify the varied purposes of a complex text	Explain the theme and function of a complex text
	Identify the audience for a simple text	Identify purpose and audience in a simple text	Use simple text to fit purpose and audience	Identify the intended audience for a complex text	Compare different complex texts in relation to the intended audience	Explain the features of a complex text in terms of the intended audience
	Identify the purpose of a simple text			Describe the features of a text type	Distinguish between different text types based on purpose	Select and use appropriately types of texts for different purposes and contexts
	Use a simple key or symbol to represent a concrete object or representation	Distinguish between different symbols	Complete diagrams and symbolic representations	Correctly sequence steps in a process described in a text	Distinguish between two related sets of data/information	Represent relationships using keys, symbols and flow charts
	Identify a type of graph	Draw column, bar and pie graphs with axes provided	Plot points correctly on axis supplied for a line graph	Draw a line graph from data provided	Distinguish between line graphs and other graphs in terms of continuous data	Justify the selection and draw appropriate graphs
		Place data to complete a provided table or scaffold	Organise a set of data using simple tables	Organise data using complex tables, spreadsheets and databases	Compare the use of tables to spreadsheets and databases to organise data	

## Critical thinking strand (Outcomes 4.17e–g, 4.19–4.21)

This strand assesses students' skills in identifying issues and problems, using critical thinking skills in drawing evidence-based conclusions, framing possible problem-solving processes and developing creative solutions.

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
	Use a simple mathematical operation	Distinguish between different simple mathematical operations	Select the correct mathematical operation to achieve a result	Use a mathematical model/symbol to show a relationship	Apply mathematical models/symbols to data to show relationships	Explain the use of a mathematical model/concept
	Identify an aspect of a trend in data	Compare the trends in two sets of simple data	Describe a trend in simple data	Identify trends and patterns in complex data	Identify contradictions in scientific data	Analyse complex data using mathematical concepts
	Identify a common unit of measurement	Identify the ratio of one unit to another	Complete a correct conversion of one unit to another	Create a simple scale	Compare the scale on two axes	Create an appropriate scale
				Identify a piece of evidence to support claims	Identify data which support or discount an hypothesis	Evaluate evidence and conclusions for reliability and validity
	Make an observation	Distinguish between a prediction and an observation	Use cause and effect to explain an observation and/or make an inference	Make generalisations in relation to a set of relevant observations	Distinguish between a predicted outcome and a plausible explanation	Critically analyse the credibility of scientific information
	Make a prediction		Draw a simple conclusion	Draw a conclusion based on scientific evidence	Distinguish between a scientific conclusion and an inference	Discuss the wider significance of conclusions
	Identify an aspect of a problem	Describe issues surrounding a problem	Explain that a particular problem might have more than one solution	Describe an effective solution to a problem with a science context	Discuss the cause/s and the solution/s to a problem with a science context	Evaluate solutions for a problem against predetermined criteria