

Year 10 standard elaborations — Australian Curriculum: Science

Purpose

The standard elaborations (SEs) provide additional clarity when using the Australian Curriculum achievement standard to make judgments on a five-point scale. They can be used as a tool for:

- making consistent and comparable judgments about the evidence of learning in a folio of student work
- developing task-specific standards for individual assessment tasks.

Structure

The SEs are developed using the **Australian Curriculum achievement standard**. The achievement standard for Science describes the learning expected of students at each year level. Teachers use the achievement standard during and at the end of a period of teaching to make on-balance judgments about the quality of learning students demonstrate.

In Queensland the achievement standard represents the **C standard** — a sound level of knowledge and understanding of the content, and application of skills. The SEs are presented in a matrix. The discernible differences or degrees of quality associated with the five-point scale are highlighted to identify the characteristics of student work on which teacher judgments are made. Terms are described in the Notes section following the matrix.

Year 10 Australian Curriculum: Science achievement standard

By the end of Year 10, students analyse how the periodic table organises elements and use it to make predictions about the properties of elements. They explain how chemical reactions are used to produce particular products and how different factors influence the rate of reactions. They explain the concept of energy conservation and represent energy transfer and transformation within systems. They apply relationships between force, mass and acceleration to predict changes in the motion of objects. Students describe and analyse interactions and cycles within and between Earth's spheres. They evaluate the evidence for scientific theories that explain the origin of the universe and the diversity of life on Earth. They explain the processes that underpin heredity and evolution. Students analyse how the models and theories they use have developed over time and discuss the factors that prompted their review.

Students develop questions and hypotheses and independently design and improve appropriate methods of investigation, including field work and laboratory experimentation. They explain how they have considered reliability, safety, fairness and ethical actions in their methods and identify where digital technologies can be used to enhance the quality of data. When analysing data, selecting evidence and developing and justifying conclusions, they identify alternative explanations for findings and explain any sources of uncertainty. Students evaluate the validity and reliability of claims made in secondary sources with reference to currently held scientific views, the quality of the methodology and the evidence cited. They construct evidence-based arguments and select appropriate representations and text types to communicate science ideas for specific purposes.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA), *Australian Curriculum Version 8 Science for Foundation–10*, www.australiancurriculum.edu.au/Science/Curriculum/F-10

Year 10 Science standard elaborations

		A	B	C	D	E
The folio of student work has the following characteristics:						
Science understanding	Chemical sciences	<ul style="list-style-type: none"> • critical analysis of how the periodic table organises elements and use of this analysis to make justified predictions about the properties of elements • justified explanation of how: <ul style="list-style-type: none"> – chemical reactions are used to produce particular products – different factors influence the rate of reactions 	<ul style="list-style-type: none"> • informed analysis of how the periodic table organises elements and use of this analysis to make plausible predictions about the properties of elements • informed explanation of how: <ul style="list-style-type: none"> – chemical reactions are used to produce particular products – different factors influence the rate of reactions 	<ul style="list-style-type: none"> • analysis of how the periodic table organises elements and use of this analysis to make predictions about the properties of elements • explanation of how: <ul style="list-style-type: none"> – chemical reactions are used to produce particular products – different factors influence the rate of reactions 	<ul style="list-style-type: none"> • description of how the periodic table organises elements • making of predictions about the properties of elements • description of how: <ul style="list-style-type: none"> – chemical reactions can be used – rate of reactions can be changed 	statements about: <ul style="list-style-type: none"> • the periodic table • chemical reactions
	Physical sciences	<ul style="list-style-type: none"> • justified explanation of the concept of energy conservation and accurate representation of energy transfer and transformation within systems • reasoned and accurate application of relationships between force, mass and acceleration to make justified predictions about changes in the motion of objects 	<ul style="list-style-type: none"> • informed explanation of the concept of energy conservation and detailed representation of energy transfer and transformation within systems • accurate application of relationships between force, mass and acceleration to make informed predictions about changes in the motion of objects 	<ul style="list-style-type: none"> • explanation of the concept of energy conservation and representation of energy transfer and transformation within systems • application of relationships between force, mass and acceleration to predict changes in the motion of objects 	<ul style="list-style-type: none"> • description of the concept of energy conservation and partial representation of energy transfer and transformation within systems • partial application of relationships between force, mass and acceleration and changes in the motion of objects 	statements about energy and motion
	Earth and space sciences	<ul style="list-style-type: none"> • thorough description and critical analysis of interactions and cycles within and between Earth's spheres • critical evaluation of the evidence for scientific theories that explain the origin of the universe 	<ul style="list-style-type: none"> • informed description and informed analysis of interactions and cycles within and between Earth's spheres • informed evaluation of the evidence for scientific theories that explain the origin of the universe 	<ul style="list-style-type: none"> • description and analysis of interactions and cycles within and between Earth's spheres • evaluation of the evidence for scientific theories that explain the origin of the universe 	<ul style="list-style-type: none"> • description of interactions and cycles within and between Earth's spheres • explanation of the scientific theories that explain the origin of the universe 	statements about the: <ul style="list-style-type: none"> • Earth's spheres • origin of the universe

		A	B	C	D	E
The folio of student work has the following characteristics:						
Science understanding	Biological sciences	<ul style="list-style-type: none"> • justified explanation of the processes that underpin heredity and evolution • critical evaluation of the evidence for scientific theories that explain the diversity of life on Earth 	<ul style="list-style-type: none"> • informed explanation of the processes that underpin heredity and evolution • informed evaluation of the evidence for scientific theories that explain the diversity of life on Earth 	<ul style="list-style-type: none"> • explanation of the processes that underpin heredity and evolution • evaluation of the evidence for scientific theories that explain the diversity of life on Earth 	<ul style="list-style-type: none"> • description of the processes that underpin heredity and evolution • description of the evidence for scientific theories that explain the diversity of life on Earth 	statements about heredity, evolution and diversity of life
Science as a human endeavour	Nature and development of science	critical analysis of how and why models and theories have developed over time and justified discussion of the factors that prompted their review	informed analysis of how models and theories have developed over time and informed discussion of the factors that prompted their review	analysis of how the models and theories have developed over time and discussion of the factors that prompted their review	description of how models and theories have developed over time	statements about models or theories
Science inquiry skills	Questioning and predicting	development of questions and justified hypotheses that can be investigated scientifically	development of questions and informed hypotheses that can be investigated scientifically	development of questions and hypotheses	guided development of questions and hypotheses	directed development of questions and hypotheses

		A	B	C	D	E
The folio of student work has the following characteristics:						
Science inquiry skills	Planning and conducting (including field work and laboratory experimentation)	<ul style="list-style-type: none"> independent design <u>and justified</u> improvements to appropriate methods of investigation <u>accurate and systematic collection and recording of reliable data</u> explanation of how reliability, safety, fairness and ethical actions <u>are managed</u> in methods identification <u>and integration</u> (where appropriate) of digital technologies to enhance the quality of data 	<ul style="list-style-type: none"> independent design <u>and informed</u> improvements to appropriate methods of investigation <u>accurate and systematic collection and recording of data</u> explanation of how <u>the implications of</u> reliability, safety, fairness and ethical actions are considered in methods identification <u>and incorporation</u> (where appropriate) of digital technologies to enhance the quality of data 	<ul style="list-style-type: none"> independent design and improvement of appropriate methods of investigation explanation of how reliability, safety, fairness and ethical actions are considered in methods identification of where digital technologies can be used to enhance the quality of data 	<ul style="list-style-type: none"> <u>partial</u> design of methods of investigation that consider fairness, reliability, safety and ethical actions 	<ul style="list-style-type: none"> <u>use of provided</u> methods of investigation <u>identification</u> of safety considerations
	Processing and analysing data and information	<p>identification <u>and justification of plausible</u> alternative explanations for findings and <u>justified</u> explanation of any sources of uncertainty when:</p> <ul style="list-style-type: none"> analysing data selecting evidence to develop and justify conclusions 	<p>identification of <u>plausible</u> alternative explanations for findings and <u>informed</u> explanation of any sources of uncertainty when:</p> <ul style="list-style-type: none"> analysing data selecting evidence to develop and justify conclusions 	<p>identification of alternative explanations for findings and explanation of any sources of uncertainty when:</p> <ul style="list-style-type: none"> analysing data selecting evidence to develop and justify conclusions 	<ul style="list-style-type: none"> <u>statements about</u> alternative explanations <u>identification</u> of patterns in data <u>drawing of</u> conclusions 	<p><u>statements about:</u></p> <ul style="list-style-type: none"> alternative explanations data and findings

		A	B	C	D	E
The folio of student work has the following characteristics:						
Science inquiry skills	Evaluating	<u>critical</u> evaluation of the validity and reliability of claims made in secondary sources with reference to: <ul style="list-style-type: none"> • currently held scientific views • the quality of the methodology • the evidence cited 	<u>informed</u> evaluation of the validity and reliability of claims made in secondary sources with reference to: <ul style="list-style-type: none"> • currently held scientific views • the quality of the methodology • the evidence cited 	evaluation of the validity and reliability of claims made in secondary sources with reference to: <ul style="list-style-type: none"> • currently held scientific views • the quality of the methodology • the evidence cited 	<u>description</u> of the validity and reliability of claims made in secondary sources	<u>statements about claims</u> in secondary sources
	Communicating	<u>concise and coherent</u> communication of science ideas for specific purposes through: <ul style="list-style-type: none"> • construction of <u>justified</u> evidence-based arguments • <u>discerning</u> selection of appropriate representations and text types 	<u>coherent</u> communication of science ideas for specific purposes through: <ul style="list-style-type: none"> • construction of <u>informed</u> evidence-based arguments • <u>informed</u> selection of appropriate representations and text types 	communication of science ideas for specific purposes through: <ul style="list-style-type: none"> • construction of evidence-based arguments • selection of appropriate representations and text types 	communication of science ideas for specific purposes through: <ul style="list-style-type: none"> • construction of arguments • selection of representations, <u>everyday language</u> and text types 	<u>fragmented</u> communication of science ideas for specific purposes

Notes

The SEs describe the qualities of achievement in the two dimensions common to all Australian Curriculum learning area achievement standards:

- understanding
- skills.

Dimension	Description
understanding	the concepts underpinning and connecting knowledge in a learning area, related to a student's ability to appropriately select and apply knowledge to solve problems in that learning area
skills	the specific techniques, strategies and processes in a learning area

Terms used in Year 10 Science SEs

These terms clarify the descriptors in the Year 10 Science SEs. They help to clarify the descriptors and should be used in conjunction with the ACARA Australian Curriculum Science glossary: www.australiancurriculum.edu.au/f-10-curriculum/science/glossary.

Term	Description
accuracy; accurate	consistent with a standard, rule, convention or known fact; in the context of Science: <ul style="list-style-type: none"> • <i>accurate</i> measurements are close to the accepted value • <i>accurate</i> representations are a true representation of observations or collected data
analysis; analyse	consider in detail for the purpose of finding meaning or relationships, and identifying patterns, similarities and differences; in order to explain and interpret it
appropriate	fitting, suitable to the context
coherent	rational; well-structured and makes sense
communicating (sub-strand)	conveying information or ideas to others through appropriate representations, text types and modes
concise	brief and to the point; without repetition of information, loss of clarity or loss of argument, logic or solution
critical	analysis or evaluation of an issue or information in order to form a critical judgment, especially in a detailed way, and involving skilful judgment as to truth or merit and is informed by evidence
description; descriptive; describe	give an account of characteristics or features
detailed	meticulous; including many of the parts
direction; directed	following the instructions of the facilitator

Term	Description
evaluating (sub-strand); evaluation; evaluate	considering the quality of available evidence and the merit or significance of a claim, proposition or conclusion with reference to that evidence; in Year 10, <i>evaluating</i> includes: <ul style="list-style-type: none"> • evaluating conclusions • identifying sources of uncertainty and possible alternative explanations • describing ways to improve the quality of data • critically analysing the validity of information in primary and secondary sources • evaluating approaches used to solve problems
explanation; explanatory; explain	provide additional information that demonstrates understanding of reasoning and/or application
fragmented	disjointed, incomplete or isolated
guided	visual and/or verbal prompts to facilitate or support independent action
how vs why	'how' is used to know the manner in which something has happened; 'why' is asked to find out the reasons behind something
identification; identify	establish or indicate who or what someone or something is
incorporation; incorporate	Take in or contain (something) as part of a whole; include
informed	having relevant knowledge; being conversant with the topic; in the context of Science, <i>informed</i> means referring to scientific background knowledge and/or empirical observations
integration; integrate	To make into a whole by bringing all parts together
justification; justify	show how an argument or conclusion is right or reasonable; provide sound reasons or evidence; in the context of Science, <i>justified</i> also means that the evidence is provided through reference to scientific background knowledge and/or empirical observations as part of the justification
partial	incomplete, half-done, unfinished
planning and conducting (sub-strand)	making decisions regarding how to investigate or solve a problem and carrying out an investigation, including the collection of data; in Year 10, this includes: <ul style="list-style-type: none"> • planning, selecting and using appropriate investigation methods • assessing risk and addressing ethical issues • selecting and using appropriate equipment • systematically and accurately collecting and recording reliable data
plausibility; plausible	credible and possible; in the context of Science, a <i>plausible</i> prediction is based on scientific knowledge

Term	Description
processing and analysing data and information (sub-strand)*	<p>representing data in meaningful and useful ways; identifying trends, patterns and relationships in data, and using this evidence to justify conclusions;</p> <p>in Year 10, this includes:</p> <ul style="list-style-type: none"> • analysing patterns and trends in data • describing relationships between variables • identifying inconsistencies • drawing conclusions that are consistent with evidence
questioning and predicting (sub-strand)	<p>identifying and constructing questions, proposing hypotheses and suggesting possible outcomes;</p> <p>in Year 10, this includes formulating questions or hypotheses that can be investigated scientifically</p>
questions (that can be investigated scientifically)	<p>a <i>question</i> that is connected to scientific concepts and methods and is able to be investigated through the systematic observation and interpretation of data; there are three types of investigable questions:</p> <ol style="list-style-type: none"> 1. descriptive questions: produce a qualitative or quantitative description of an object, material, organism or event 2. relational questions: identify associations between the characteristics of different phenomena 3. cause–effect questions: determine whether one or more variables cause or affect one or more outcome variables <p>Sharkawy, A 2010, 'A Quest to Improve: Helping students learn how to pose investigable questions', <i>Science and Children</i>, vol. 48, no. 4, pp. 32–35</p>
reliability; reliable	<p>constant and dependable or consistent and repeatable;</p> <p>in Science, in the context of collecting data from:</p> <ul style="list-style-type: none"> • first-hand investigations, <i>reliability</i> refers to the consistency of the data collected, i.e. a consistent pattern of results is established through repetition • secondary sources, <i>reliability</i> refers to information and data from secondary sources that is consistent with information and data from a number of reputable sources; <p>Note: <i>reliability</i> and <i>validity</i> are terms that can easily be confused by students; in the context of collecting data from:</p> <ul style="list-style-type: none"> • first-hand investigations, <i>validity</i> refers to whether the measurements collected are caused by the phenomena being tested, i.e. if the procedure is testing the hypothesis • secondary sources, <i>validity</i> refers to the degree to which evidence supports the assertion or claim being evaluated; <p>McCloughan, G 2001, 'Reliability and validity — what do they mean?', <i>Curriculum Support for Teaching in Science in 7–12</i>, vol. 6, no. 3, pp. 14–15</p>
representation	<p>use words, images, symbols or signs to convey meaning;</p> <p>in the context of Science, <i>representation</i> is an important learning and presentation tool that contributes strongly to science literacy development; scientists represent ideas in a variety of ways, including models, graphs, charts, drawings, diagrams and written texts; the use of these models and other representations is to help understand or present meaning about an idea, an object, a process or a system, or even something that cannot be directly observed, e.g. an atom or inside our body</p>

Term	Description
science knowledge	<i>science knowledge</i> refers to facts, concepts, principles, laws, theories and models that have been established by scientists over time; in the context of Years 7 to 10, students develop their understanding of microscopic and atomic structures, how systems at a range of scales are shaped by flows of energy and matter and interactions due to forces, and develop the ability to quantify changes and relative amounts
statement; state	a sentence or assertion
systematic	methodical, organised and logical
thorough	demonstrating depth and breadth, inclusive of relevant detail