

Year 9 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 9 Australian Curriculum: Science achievement standard

By the end of Year 9, students explain chemical processes and natural radioactivity in terms of atoms and energy transfers and describe examples of important chemical reactions. They describe models of energy transfer and apply these to explain phenomena. They explain global features and events in terms of geological processes and timescales. They analyse how biological systems function and respond to external changes with reference to interdependencies, energy transfers and flows of matter. They describe social and technological factors that have influenced scientific developments and predict how future applications of science and technology may affect people's lives.

Students design questions that can be investigated using a range of inquiry skills. They design methods that include the control and accurate measurement of variables and systematic collection of data and describe how they considered ethics and safety. They analyse trends in data, identify relationships between variables and reveal inconsistencies in results. They analyse their methods and the quality of their data, and explain specific actions to improve the quality of their evidence. They evaluate others' methods and explanations from a scientific perspective and use appropriate language and representations when communicating their findings and ideas to specific audiences.

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 9 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"> • justified explanation of chemical processes and natural radioactivity in terms of atoms and energy transfers • thorough description of important chemical reactions 	<ul style="list-style-type: none"> • informed explanation of chemical processes and natural radioactivity in terms of atoms and energy transfers • informed description of important chemical reactions 	<ul style="list-style-type: none"> • explanation of chemical processes and natural radioactivity in terms of atoms and energy transfers • description of important chemical reactions 	<ul style="list-style-type: none"> • description of chemical processes and natural radioactivity in terms of atoms and energy transfers • identification of chemical reactions 	statements about: <ul style="list-style-type: none"> • chemical processes • chemical reactions
	Physical sciences	thorough description of models of energy transfer which can be applied to provide justified explanation of phenomena	informed description of models of energy transfer which can be applied to provide informed explanation of phenomena	description of models of energy transfer which can be applied to provide explanation of phenomena	description of models of energy transfer which can be applied to provide description of phenomena	statements about energy transfer
	Earth and space sciences	justified explanation of global features and events in terms of geological processes and timescales	informed explanation of global features and events in terms of geological processes and timescales	explanation of global features and events in terms of geological processes and timescales	description of global features and events with reference to geological processes and timescales	statements about global features and events
	Biological sciences	critical analysis of how biological systems function and respond to external changes with reference to interdependencies, energy transfers and flows of matter	informed analysis of how biological systems function and respond to external changes with reference to interdependencies, energy transfers and flows of matter	analysis of how biological systems function and respond to external changes with reference to interdependencies, energy transfers and flows of matter	description of how biological systems function and respond to external changes	statements about biological systems

		A	B	C	D	E
The folio of student work has the following characteristics:						
Science as a human endeavour	Nature and development of science	<u>explanation</u> of <u>how</u> social and technological factors that have influenced scientific developments	<u>informed</u> description of social and technological factors that have influenced scientific developments	description of social and technological factors that have influenced scientific developments	<u>identification</u> of factors that have influenced scientific developments	<u>statements about</u> scientific developments
	Use and influence of science	<u>justified</u> prediction of how future applications of science and technology may affect peoples' lives	<u>informed</u> prediction of how future applications of science and technology may affect peoples' lives	prediction of how future applications of science and technology may affect people's lives	prediction of applications of science and technology	<u>statements about</u> applications of science and technology
Science inquiry skills	Questioning and predicting	design of questions and <u>justified hypotheses</u> that can be investigated using a range of inquiry skills	design of questions and <u>informed hypotheses</u> that can be investigated using a range of inquiry skills	design of questions that can be investigated using a range of inquiry skills	<u>guided</u> design of questions that can be investigated	<u>directed</u> design of questions that can be investigated

		A	B	C	D	E
The folio of student work has the following characteristics:						
Science inquiry skills	Planning and conducting	<p>design and <u>refinement</u> of methods that include:</p> <ul style="list-style-type: none"> the control, and accurate measurement of variables <u>to ensure the</u> systematic collection and recording of <u>reliable</u> data description of <u>how to manage</u> safety and ethical considerations 	<p>design of methods that include:</p> <ul style="list-style-type: none"> the control and accurate measurement of variables <u>to ensure the</u> systematic collection and recording of data description of <u>the implications</u> of ethical and safety and considerations 	<p>design of methods that include:</p> <ul style="list-style-type: none"> the control and accurate measurement of variables systematic collection of data description of ethical and safety considerations 	<p><u>partial</u> design of methods that include:</p> <ul style="list-style-type: none"> control variables collection of data <u>identification</u> of ethical and safety and considerations 	<ul style="list-style-type: none"> <u>use of provided</u> methods <u>identification</u> of safety considerations
	Processing and analysing data and information	<p>analysis of trends in data to identify and <u>explain</u> relationships between variables to:</p> <ul style="list-style-type: none"> <u>draw justified conclusions</u> <u>identify and explain</u> inconsistencies in results 	<p>analysis of trends in data to identify and <u>describe</u> relationships between variables to:</p> <ul style="list-style-type: none"> <u>draw conclusions consistent with evidence</u> <u>identify and describe</u> inconsistencies in results 	<p>analysis of trends in data to:</p> <ul style="list-style-type: none"> identify relationships between variables reveal inconsistencies in results 	<p><u>statements about</u> trends and inconsistencies in data</p>	<p><u>statements about</u> data</p>
	Evaluating	<ul style="list-style-type: none"> analysis of own methods and the quality of own data <u>to inform justified</u> explanation of <u>effective</u> actions to improve the quality of their evidence <u>critical</u> evaluation of others' methods and explanations from a scientific perspective 	<ul style="list-style-type: none"> analysis of own methods and the quality of own data <u>to inform</u> explanation of <u>effective</u> actions to improve the quality of their evidence <u>informed</u> evaluation of others' methods and explanations from a scientific perspective 	<ul style="list-style-type: none"> analysis of own methods and the quality of own data explanation of specific actions to improve the quality of own evidence evaluation of others' methods and explanations from a scientific perspective 	<p><u>descriptions of:</u></p> <ul style="list-style-type: none"> own methods and data others' methods and explanations 	<p><u>statements about</u> methods, data and explanations</p>

		A	B	C	D	E
The folio of student work has the following characteristics:						
Science inquiry skills	Communicating	<p><u>concise and coherent</u> use of appropriate language and <u>accurate</u> representations when communicating findings and ideas to specific audiences</p>	<p><u>coherent</u> use of appropriate language and <u>accurate</u> representations when communicating findings and ideas to specific audiences</p>	<p>use of appropriate language and representations when communicating findings and ideas to specific audiences</p>	<p>use of <u>everyday</u> language and representations when communicating findings and ideas to audiences</p>	<p><u>fragmented</u> use of language and representations when communicating findings and ideas to audiences</p>

Key shading emphasises the qualities that discriminate between the A–E descriptors

Notes

Australian Curriculum common dimensions

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 9 Science SEs

These terms clarify the descriptors in the Year 9 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
direction; directed	following the instructions of the facilitator

Term	Description
effectively; effective	meeting the assigned purpose; in a way that produces a desired or intended result
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 9, <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
examination; examine	to determine the nature or condition of something
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
identification; identify	establish or indicate who or what someone or something is
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
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 9, 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
processing and analysing data and information (sub-strand)	representing data in meaningful and useful ways; identifying trends, patterns and relationships in data, and using this evidence to justify conclusions; in Year 9, this includes: <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

Term	Description
questioning and predicting (sub-strand)	identifying and constructing questions, proposing hypotheses and suggesting possible outcomes; in Year 9, this includes formulating questions or hypotheses that can be investigated scientifically
questions (that can be investigated scientifically)	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: <ol style="list-style-type: none"> descriptive questions: produce a qualitative or quantitative description of an object, material, organism or event relational questions: identify associations between the characteristics of different phenomena 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	constant and dependable or consistent and repeatable; in Science, in the context of collecting data from: <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	use words, images, symbols or signs to convey meaning; 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
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