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|  | 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.

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| 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](http://www.australiancurriculum.edu.au/Science/Curriculum/F-10) |

## Year 9 Science standard elaborations

|  | A | B | C | D | E |
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|  | The folio of student work has the following characteristics: |
| Science understanding | Chemical sciences | * justified explanation of chemical processes and natural radioactivity in terms of atoms and energy transfers
* thorough description of important chemical reactions
 | * informed explanation of chemical processes and natural radioactivity in terms of atoms and energy transfers
* informed description of important chemical reactions
 | * explanation of chemical processes and natural radioactivity in terms of atoms and energy transfers
* description of important chemical reactions
 | * description of chemical processes and natural radioactivity in terms of atoms and energy transfers
* identification of chemical reactions
 | statements about:* 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  |
| Science as a human endeavour | Nature and development of science | explanation of how social and technological factors that have influenced scientific developments  | informed description of social and technological factors that have influenced scientific developments  | description of social and technological factors that have influenced scientific developments | identification of factors that have influenced scientific developments | statements about scientific developments |
| Use and influence of science | justified prediction of how future applications of science and technology may affect peoples’ lives | informed 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 | statements about applications of science and technology |
| Science inquiry skills | Questioning and predicting | design of questions and justified hypotheses that can be investigated using a range of inquiry skills | design of questions and informed hypotheses that can be investigated using a range of inquiry skills | design of questions that can be investigated using a range of inquiry skills | guided design of questions that can be investigated  | directed design of questions that can be investigated |
| Science inquiry skills | Planning and conducting | design and refinement of methods that include:* the control, and accurate measurement of variables to ensure the systematic collection and recording of reliable data
* description of how to manage safety and ethical considerations
 | design of methods that include:* the control and accurate measurement of variables to ensure the systematic collection and recording of data
* description of the implications of ethical and safety and considerations
 | design of methods that include:* the control and accurate measurement of variables
* systematic collection of data
* description of ethical and safety considerations
 | partial design of methods that include:* control variables
* collection of data
* identification of ethical and safety and considerations
 | * use of provided methods
* identification of safety considerations
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| Processing and analysing data and information | analysis of trends in data to identify and explain relationships between variables to:* draw justified conclusions
* identify and explain inconsistencies in results
 | analysis of trends in data to identify and describe relationships between variables to:* draw conclusions consistent with evidence
* identify and describe inconsistencies in results
 | analysis of trends in data to:* identify relationships between variables
* reveal inconsistencies in results
 | statements about trends and inconsistencies in data | statements about data |
| Evaluating | * analysis of own methods and the quality of own data to inform justified explanation of effective actions to improve the quality of their evidence
* critical evaluation of others’ methods and explanations from a scientific perspective
 | * analysis of own methods and the quality of own data to inform explanation of effective actions to improve the quality of their evidence
* informed evaluation of others’ methods and explanations from a scientific perspective
 | * 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
 | descriptions of:* own methods and data
* others’ methods and explanations
 | statements about methods, data and explanations |
| Science inquiry skills | Communicating | concise and coherent use of appropriate language and accurate representations when communicating findings and ideas to specific audiences | coherent use of appropriate language and accurate representations when communicating findings and ideas to specific audiences | use of appropriate language and representations when communicating findings and ideas to specific audiences | use of everyday language and representations when communicating findings and ideas to audiences | fragmented use of language and representations when communicating findings and ideas to audiences |
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| 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.

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| 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](http://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:* accurate measurements are close to the accepted value
* accurate representations are a true representation of observations or collected data
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| 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 |
| 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, evaluating includes:* 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
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| 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, informed 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, justified 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:* 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
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| plausibility;plausible | credible and possible;in the context of Science, a plausible 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:* analysing patterns and trends in data
* describing relationships between variables
* identifying inconsistencies
* drawing conclusions that are consistent with evidence
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| 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 question 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: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

Sharkawy, A 2010, ‘A Quest to Improve: Helping students learn how to pose investigable questions’, Science and Children, vol. 48, no. 4, pp. 32–35 |
| reliability;reliable | constant and dependable or consistent and repeatable;in Science, in the context of collecting data from:* first-hand investigations, reliability refers to the consistency of the data collected, i.e. a consistent pattern of results is established through repetition
* secondary sources, reliability refers to information and data from secondary sources that is consistent with information and data from a number of reputable sources;

Note: reliability and validity are terms that can easily be confused by students;in the context of collecting data from:* first-hand investigations, validity refers to whether the measurements collected are caused by the phenomena being tested, i.e. if the procedure is testing the hypothesis
* secondary sources, validity refers to the degree to which evidence supports the assertion or claim being evaluated;

McCloughan, G 2001, ‘Reliability and validity — what do they mean?’, Curriculum Support for Teaching in Science in 7–12, vol. 6, no. 3, pp. 14–15 |
| representation | use words, images, symbols or signs to convey meaning;in the context of Science, representation 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 | science knowledge 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 |