Te Poutāhū
Curriculum Centre

Science NCEA NZC Level 1
Subject Learning Outcomes for Assessment

Companion to the Science Learning Matrix

What are the Subject Learning Outcomes and how can I use them?

Subject Learning Outcomes identify the knowledge and skills that students need to be ready for assessment. Subject Learning Outcomes are informed by the Achievement Standards. They should be used in conjunction with the full suite of NCEA materials. For guidance on assessment criteria, please also refer to the Achievement Standards, Unpacking, and External Assessment Specifications or Conditions of Assessment as appropriate.

Subject Learning Outcomes do not replace any documents. This includes the External Assessment Specifications and Conditions of Assessment. All NCEA materials need to be used to fully understand the requirements of each Achievement Standard and to plan a robust teaching, learning, and assessment programme. Subject Learning Outcomes should not be used to make assessor judgments. The Achievement Standard and the Assessment Schedule for Internal Assessment Activities are used to make such judgments.

Subject Learning Outcomes, alongside other key documents, make clear to teachers what to include in their teaching and learning programmes and what student capabilities to check for, in the lead up to assessment. Each Subject Learning Outcome does not need the same amount of teaching time.

All learning should connect with students' lives in Aotearoa New Zealand and the Pacific. Teachers or students usually select the contexts. As such, contexts are not always specified in the Subject Learning Outcomes. Examples may be provided to illustrate topics and contexts, but they are not prescriptive.

Students are entitled to teaching that supports them to achieve higher levels of achievement. Subject Learning Outcomes mainly align with outcomes for the Achieved level. However, outcomes for higher levels of achievement are also included.

The knowledge and skills in the Subject Learning Outcomes are the expected learning that underpins each Achievement Standard. Students will draw on this learning during assessment. It is important to note that assessment is a sampling process so not everything that is taught will be assessed.

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Achievement Standard 1.1 (91920): Demonstrate understanding of a science-informed response to a local issue (5 Credits)

<table>
<tr><th>What is being assessed</th><th>Subject Learning Outcomes</th><th>Notes</th></tr>
<tr><td>Understanding of a science-based perspective on a local issue</td><td>Identify a relevant science idea for a given local issue. Examples of a science idea include F=ma, thermal expansion, parasitism, coastal erosion.
Describe a science idea (appropriate for Level 6 of the New Zealand Curriculum) that informs a science perspective in the context of a local issue. For example, describing how heat energy (from bores) is used to make electrical energy related to the local issue of depleted geothermal activity.
For merit, students are able to explain a science idea and how it informs the science-based perspective related to the local issue.</td><td rowspan="2"><u>Conditions of Assessment</u>

Local - refers to the issue being of interest or importance to the student. Examples of a local issue include renewable energy, waterway health, or use of supplements by athletes.

Perspective(s) - For the purpose of this achievement standard, a perspective is a particular way of regarding an issue that is shared by a group. Examples of groups include:
iwi or hapū
a local council
a company or business.</td></tr>
<tr><td>Understanding of a second perspective on the same local issue</td><td>Outline another perspective relevant to the local issue. For example, a mātauranga Māori perspective related to the issue of depleted geothermal activity.
For merit, students are able to explain the second perspective and how it relates to the local issue. For example, explaining the perspective of Drug Free Sport NZ and how it relates to the issue of performance enhancing drugs in sport.</td></tr>
<tr><td>The understanding of tiakitanga in relation to the local issue</td><td>Show understanding of tiakitanga in relation to the local issue, which could involve:
outlining
describing
linking
aspects of responsible science practice as part of the discussed perspective(s), and/or the response. For example, in a geothermal context this could include examples of ways that science practice may mitigate risk or depletion of the resource to prevent irreversible long-term damage, linking this to care of people and resources.</td><td>Tiakitanga - An approach in response to an issue that demonstrates:
taking care
ownership
responsibility.</td></tr>
</table>

Presenting a science-informed response to the local issue	• Identify a response to a local issue that is based on a relevant science idea. *For example, decision makers closing backyard bores in geothermal areas based on modelling data.*
	• For merit, students are able to explain a response to a local issue that is based on a relevant science idea.
	• For excellence, students are able to discuss the importance of the two perspectives in the science-informed response. This could involve:
	  ○ evaluating how each perspective contributes to the science informed response
	  ○ justifying the science-informed response, with reference to both perspectives.
	  ○ *For example, how a science perspective based on heat energy modelling, and a mātauranga Māori perspective, are both used by decision makers to respond to the issue of potential geothermal depletion.*
		The intention is for ākonga to show their understanding of complex real-world decision-making, in a science context.

Achievement Standard 1.2 (91921): Demonstrate understanding of the use of a range of scientific investigative approaches in a context (5 Credits)

What is being assessed	Subject Learning Outcomes	Notes

Investigation of a context using **at least three** different scientific approaches	• Recognise which investigative approaches are appropriate to explore a *question* relating to the *context*. *For example, carrying out 3 different investigative approaches to determine how global warming is resulting in changes in ocean temperature and the melting of glacial ice.*
	• Carry out at least three different investigative approaches from the following:
	  ○ Pattern seeking (evidence may be provided to students).
	  ○ Exploring and observing.
	  ○ Modelling.
	  ○ Classifying and identifying.
		Conditions of Assessment
		
		Context - refers to the overarching theme, setting, or idea and must provide sufficient depth to be explored using multiple investigative approaches. *Examples may include:*
		• *a chemical process, eg, ocean acidification*

	○ Fair testing. • Collect and record evidence for each investigative approach in a way that can be used to respond to the specified question, which could involve: ○ tabulated data ○ graphs ○ pictures or videos ○ annotated drawings or diagrams ○ written observations.	• *methods of energy transfer, eg, electrical circuits, thermal transfer* • *an ecological issue, eg, pest control* • *the use of a chemical product* • *a geological formation, eg, limestone caves* • *astronomical patterns, eg, tides* • *an agricultural/horticultural process, eg, optimisation of growing conditions.* *Question* - Each investigation should aim to answer a question that will allow students to understand an aspect of the overarching context. *For example, a question could be: "How does temperature affect the volume of water?".* *Modelling* - refers to the use of a model to make testable predictions, explore effects, or collect observations or data.
Showing understanding of the purpose of each investigative approach in response to a question	• Use *evidence* to describe the purpose of each investigative approach used. This could include: ○ describing why the evidence gathered by each investigative approach allowed the student to answer the question. *For example, comparing glacial length over time against a Keeling curve to determine the impact of carbon dioxide on global warming.* ○ describing, with reference to a wider body of knowledge, how or why the type of investigative approach was appropriate. *For example, using*	Examples of *evidence* could include (but are not limited to): • experimental data • observational data • statistics • surveys • consultation with a wider body of knowledge • discussion/wānanga.

	modelling to visualise a complex system, to determine if land ice or sea ice contributes more towards sea level rise. • For merit, students are able to use evidence to provide a reason why each approach is or is not useful in responding to a question within the context, which may include: ○ explaining why the type of evidence gathered by each investigative approach allowed the student to answer the question. *For example, if students are exploring the concept of thermal expansion of water and how it contributes to sea level rise, it would be more timely to demonstrate this phenomena using a fair test investigation rather than a pattern seeking investigation. This is because the turnaround time on a fair test will be significantly less in comparison to a pattern seeking investigation as less data points are needed to extrapolate a reliable trend.* ○ providing an evidence-based reason for why the type of investigative approach was appropriate. *For example, to demonstrate the direct relationship between temperature and the expansion of water, other factors have to be controlled. As such, it is important that to utilise a fair test investigation which allows us to control the variable and determine the relationship.*	While ākonga should work in groups to carry out investigations and collect evidence, they **will demonstrate their understanding through individual responses** to the investigations.
Analysing the use of a range of investigative approaches in the context	• For excellence, students are able to use evidence to *validate* findings. This could involve: ○ analysing the use of the range of scientific investigative approaches in a given context. *For example, using a pattern seeking investigation to track the length of a glacier as it is a phenomenon that occurs over a period of time. Using a fair test to determine the relationship between temperature and water expansion. Using modelling to observe the effects of land ice vs. sea ice and using the Archimedes Principle to explain the observation within the context.*	*Validate* - means to use evidence to check or prove how appropriate, or not, the data or findings are when used to respond to the question or context investigated. Analysing the accuracy of methods is not required.

	○ linking the findings of multiple investigative approaches to explain how they contribute to learning about the overarching context. *For example, as the temperature of the ecosystem increases, there is a decrease in the length of glaciers. This decrease in the length of glaciers contributes to an increase of water in the ocean and results in sea level rising. Another contributor to sea level rising is thermal expansion of water. As more water is added into the seas, the effect of the thermal expansion of water is compounded and this results in an increase in the rate of sea level rise.* ○ explaining how the three different types of investigative approach support understanding of different aspects of a complex context. *For example, using a flow chart to unpack how each of the investigations contributed to the understanding of the complex system.*	

Achievement Standard 1.3 (91922): Describe features of science that have contributed to the development of a science idea in a local context (5 Credits)

What is being assessed	Subject Learning Outcomes	Notes
Understanding of how features of science contributed to the development of a science idea in a local context	• Describe how two different *features of science* have contributed to a science idea in a local context. *For example, in an unfamiliar resource about the development of rongoā treatment (science idea) for type 2 diabetes, when prompted to talk about replicable, verifiable data collection (feature 1) and responding to needs and opportunities (feature 2), students can identify where these occurred.* • Identify the characteristics of features of science in *local* contexts, which may include: ○ socio-scientific issues, eg, ocean acidification around coastal Aotearoa, pest control methods in the Pureora forest	<u>Assessment specifications</u> Check assessment specifications to learn which features of science are assessed. *Features of science* include: • replicable, verifiable data collection. *Replicable: has been tested a number of times with similar outcomes.*

	○ technologies, eg, developing faster planes, improving batteries through the New Zealand battery project ○ local projects, eg, Rocket Lab or conservation groups such as Tasman Environmental Trust ○ the history of development of a scientific idea, eg, sourcing new geothermal wells for energy generation at GNS, atomic model developments involving Ernest Rutherford's gold foil experiment, developing New Zealand's DNA databank.	*Verifiable: other scientists have confirmed the results in some way.* • interpreting patterns and interactions • linking new evidence to existing models, theories, and ideas • the development of science ideas in response to new evidence or varied perspectives, such as Māori and Pacific knowledge systems • the influence of social and cultural factors on science • the influence of the development and use of technology on science • responding to needs and opportunities • rigorously reviewing claims • using specific language, symbols, and conventions • being tentative by nature. The only certainty in science is when a claim is disproved. • the attributes of the people who carry out the science such as curiosity, collaboration, competitiveness, creativity, and critical thinking. *Local* - refers to contexts relevant to Aotearoa New Zealand or the wider Pacific. *Examples of local contexts could include extreme tides, pest control methods,*
Recognising how features of science have contributed to the development of a science idea	• Outline how each of the specified features of science has influenced a given science idea. *For example, describing how energy generation methods in New Zealand (science idea) have changed over time in response to the development and use of geothermal energy generation (the influence of the development and use of technology on science) and in response to human needs.* • For merit, students are able to explain the significance of each specified feature of science to the development of a given science idea, which could involve: ○ providing a reason for how the feature of science has caused a science idea to change over time. *For example, explaining how the harvesting of tuna (science idea) has changed in response to new evidence (feature of science) about their life cycle and reproduction.* ○ describing how the feature of science has influenced the application of a science idea in a local issue. *For example, explaining how the use of scientific language, symbols, and conventions (feature of science) have allowed scientists around the world to collaborate (feature of science) and gain a deeper understanding of climate change and its effects (science idea).* • For excellence, students are able to discuss how the features of science have interacted to contribute to the development of a scientific idea, which could involve: ○ justifying, or analysing, how the features of science relate to: ▪ each other **and**	

	▪ the development of the scientific idea. *For example, discussing how the attributes of the people (feature of science) carrying out the pest control (science idea) meant that their application of those pest control methods was tentative (feature of science), and how this allowed them to improve their pest control operation over time as they experimented and found more efficient solutions (feature of science).*	*developing faster planes, improving batteries, conservation groups, Rocket Lab, energy generation, atomic model.*

Achievement Standard 1.4 (91923): Demonstrate understanding of science-related claims in communicated information (5 Credits)

What is being assessed	Subject Learning Outcomes	Notes
Interpreting key aspects from *communicated information*	• Describe the *source*. • Describe the intended purpose of the communicated information. *For example, an article promoting organic farming commissioned by organic farming organisations may have the intended purpose of convincing an audience of the benefits of such practice.* • Describe claims in communicated information that are based on scientific ideas or concepts. *For example, the American Psychological Association (source) claims that personality is determined by genes and environment, but not astrology (claim), and uses data to support this conclusion.* • Identify examples of scientific language. • Identify examples of *scientific conventions*. *For example: the correct use of chemical formula, correctly labelled axes, or error bars on graphs, in communicated information.*	<u>Assessment specifications</u> *Communicated information* is information from any channel, source, or media. *Examples could include: conversations, radio or tv shows, advertisements, research, books, cartoons, online content.* The *communicated information* must attempt to use scientific evidence to justify a conclusion (rightly or wrongly). *Source* refers to the person, persons, or organisation who created, or commissioned the creation of, the communicated information.

Evaluating the use of scientific language or conventions used to support science-related claims	• For merit, students are able to explain how the scientific language or conventions used support science-based claims in communicated information, which could involve: ○ explaining how scientific language or conventions can strengthen, or weaken, science-related claims. *For example, in an article referring to "h2o", students could explain how this affects the veracity of the claims being made.* ○ explaining whether scientific language or conventions are being used correctly or incorrectly, and how this affects support for science-related claims. *For example, in an online video about a water bottle that adds hydrogen to water, students could explain how the scientific language is being used incorrectly and how this reduces support for the claims being made.* • For excellence, students are able to evaluate the use of scientific language **or** conventions used with reference to the science-related claims in communicated information, which could involve: ○ analysing both the correct and incorrect use of scientific language and/or conventions and how this impacts support for the science-related claims. *For example, using a resource about homeopathy, students could discuss how peer review lends credibility to claims made against homeopathy while a lack of data from homeopaths reduces support for their claim that homeopathy works.* ○ discussing how the scientific language or conventions used represent or misrepresent the science ideas in the claims. *For example, students could explain in depth what the scientific phrases and/or data used actually mean and how the misuse of this language can create a narrative that misrepresents a science idea.*	*Scientific conventions* may include the use of SI units, metric prefixes, scientific method, symbols, formulae, tabulated data, diagrams, peer review, significant figures, referencing material, and/or graphing protocols.