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Learning-first approaches in NCEA Level 1 Science

Science knowledge is contested and refined over time

Te Tāhuhu o te Mātauranga
Ministry of Education

Science directions

The Curriculum and Assessment Change Programme has led to an expanded range of products for each subject in the Science Learning Area:

- Teachers can use the **Learning Matrix** as a tool to construct learning programmes that cover all of the *not-to-be-missed* learning in a subject.
- In NCEA Level 1 Science the **Big Ideas** are *about* science and the way scientists work and communicate.
- The contexts for learning include Big Ideas *of* science and this will be where traditional content is included.
- The **Subject Learning Outcomes** 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.

This slide deck exemplifies how teachers can access a **learning-first approach** in Science.

Kaupapa o te rā

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This slide deck is designed to stimulate thinking, discussion, and practice that:

- adopts a learning-first approach in Science, focusing on ***Big Idea: Science knowledge is contested and refined over time***
- unpacks relevant Significant Learning, including in teaching and learning activities and resources
- identifies assessment opportunities.

Big Ideas and Significant Learning

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Big Idea: Science knowledge is contested and refined over time.
Ākonga will:

- consider mātauranga Māori alongside science in contexts that relate to Aotearoa New Zealand
- consider Pacific knowledges alongside science in contexts that relate to the Pacific
- identify interrelationships between science practices, technological advances, mātauranga Māori, and the practical advancement of science knowledge
- recognise that scientific ideas are developed through critical and creative thinking, regulated by evidence
- consider how the values and needs of a society can influence the focus of scientific endeavours.

Teaching resources

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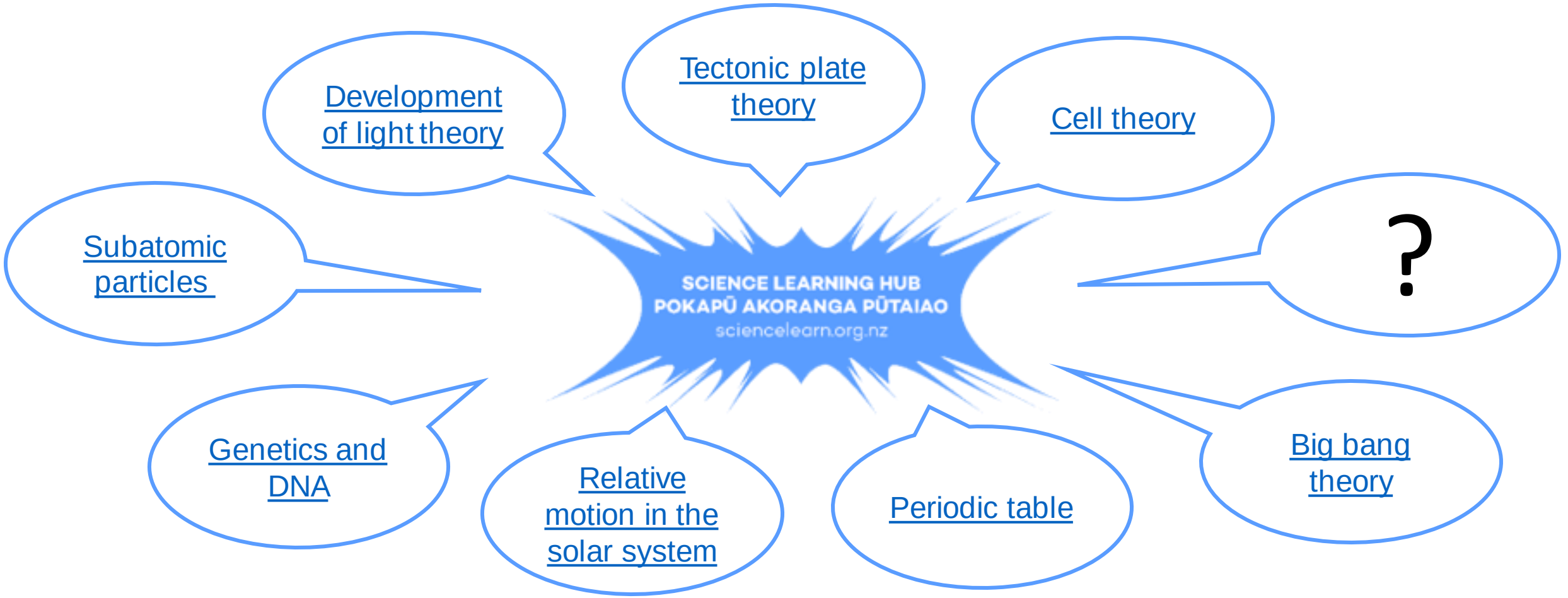
Each link on the following slides will take you to a resource on the ***Science Learning Hub — Pokapū Akoranga Pūtaiao***.

These are activities, videos, and readings which feature pertinent science ideas. They highlight that **science knowledge is contested and refined over time.**

Science knowledge is contested and refined over time



Opportunities for learning

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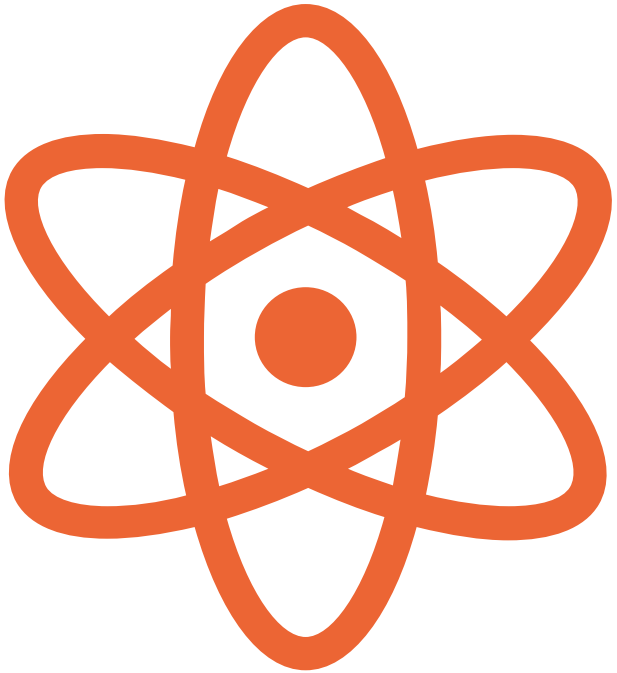
This may be an opportunity to go into greater depth in one content area.

Where is the theory now and how do we use it?

For example, look at atomic theory and the periodic table. This could lead into some learning about chemical reactions, structure and bonding, and the properties of materials.



Scientific ideas are developed through critical and creative thinking, regulated by evidence

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[Tenets of the Nature of Science (Science Learning Hub)]

Explore this article and its many links and examples.

Think about how the tenets relate back to the Significant Learning.

Use these connections to highlight the tenets of the nature of science:

- The tentative nature of scientific knowledge.
- The empirical nature of science.
- The inferential, imaginative and creative nature of science.
- The subjective and theory-laden nature of science.
- The socially and culturally embedded nature of science.

Scientific ideas are developed through critical and creative thinking, regulated by evidence

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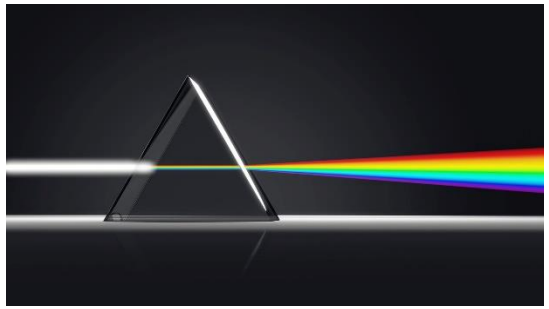
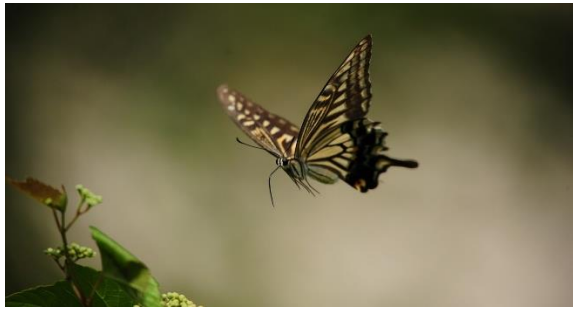


[The 10 greatest ideas in the history of science]

Read this article and look for developments. Who built on who's work? How were ideas developed? What evidence was used?

[How simple ideas lead to scientific discoveries]

Watch this video, looking for examples of creative and critical thinking and evidence use.



[Ten recent discoveries that could lead to new inventions]

Read this article, looking for the evidence observed and the creative thinking that might turn it into an invention or innovation.

Opportunities for learning

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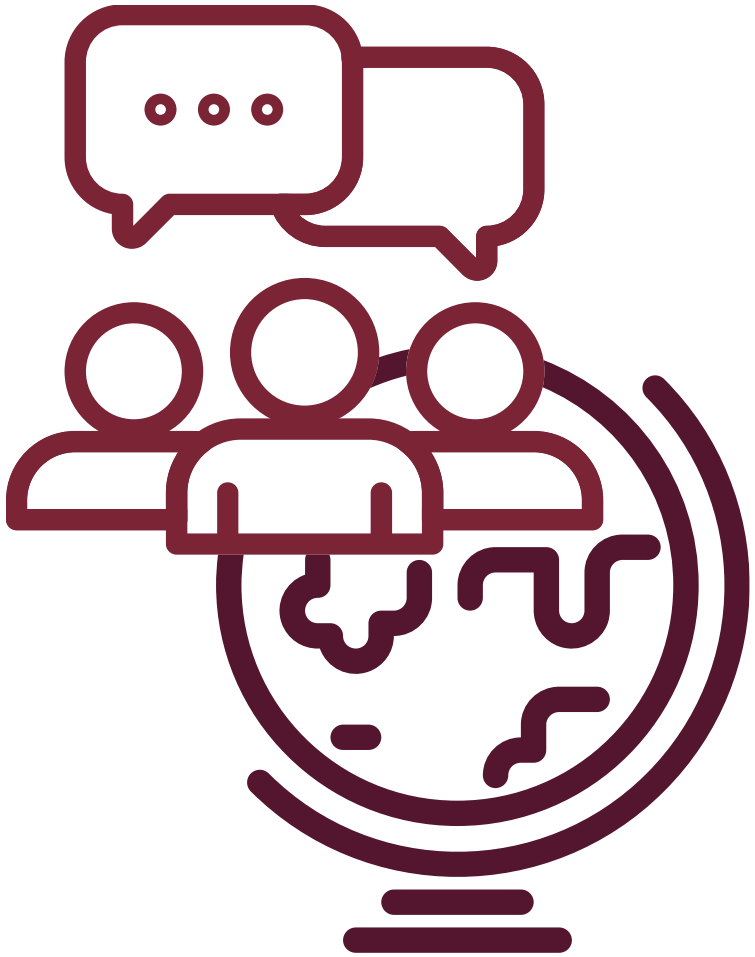
This may be an opportunity to go into greater depth in one content area. Consider the following prompts:

Where is that Science Big Idea and how do we use it?
or
Look at literacy techniques for approaching complex texts.

For example, in the article on the greatest science ideas we see a phylogenetic tree and a very complex punnet square. This could lead to some teaching around the ideas of genetics and evolution.

Ngohe | Activity for kaiako



Be aware of multiple knowledge systems.

The following resources might be a useful starting point:

- Enduring competencies for designing science learning pathways (NZCER)
- What is a knowledge system? (Science Learning Hub)
- Indigenous perspectives and gene editing (NZASE)

Consider mātauranga Māori alongside science in contexts that relate to Aotearoa New Zealand

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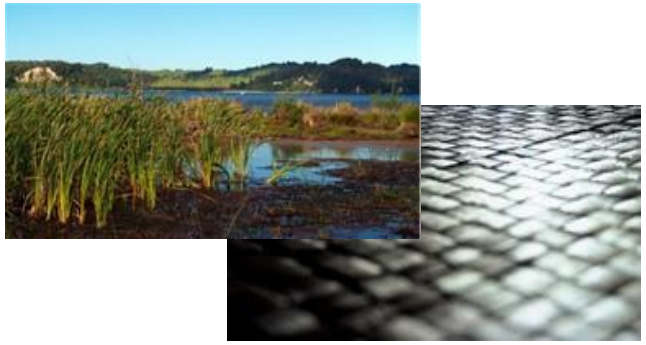

[Working together](#) | [Video](#)

Explore these resources around the protection of native species. What contributions have mātauranga Māori and science made to these efforts?

https://www.doc.govt.nz/nature/native-animals/invertebrates/crayfish-koura/

[Both adding value](#)

What contributions do mātauranga Māori and science make to the investigation on kōura?

[Different perspectives](#)

Listen to the pūrākau ‘The Taniwha Rakairuru’. What mātauranga Māori could be used in wider contexts?

Consider Pacific knowledges alongside science in contexts that relate to the Pacific

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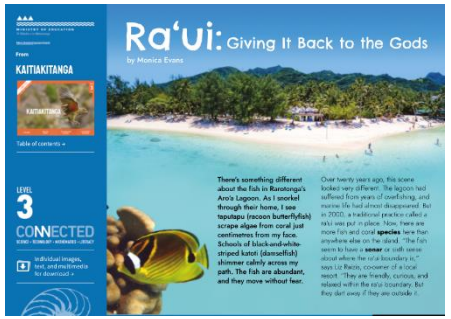

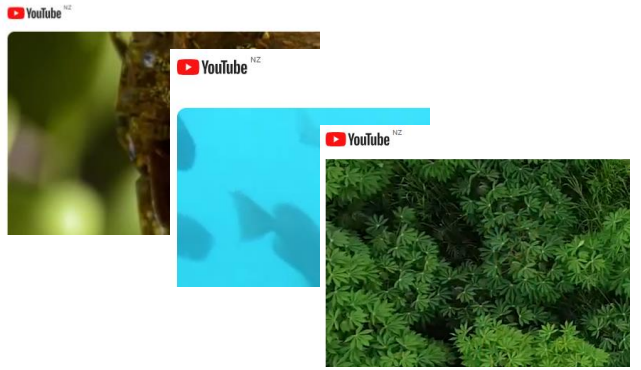

Ra'ui: Giving it back to the gods (Science Learning Hub) describes ra'ui. This is a Pacific method for conserving species population, similar to rahui. The original *Connected* article includes discussions of different perspectives. Not everyone agrees.

Seasons in Samoa (NIWA) discusses the role of indigenous knowledge in improving scientific understanding. It focuses on Samoan observations of seasonal changes. How might Pacific knowledge and science knowledge work together?

The three videos from Pacific Community describe how Indigenous knowledge is being used for problem solving in the Pacific. Climate change in Niue, sustainable fishing in Tonga, and finding freshwater in the Marshall Islands. What examples of Indigenous knowledge can you find?

Identify interrelationships between science practices, technological advances, mātauranga Māori, and the practical advancement of science knowledge

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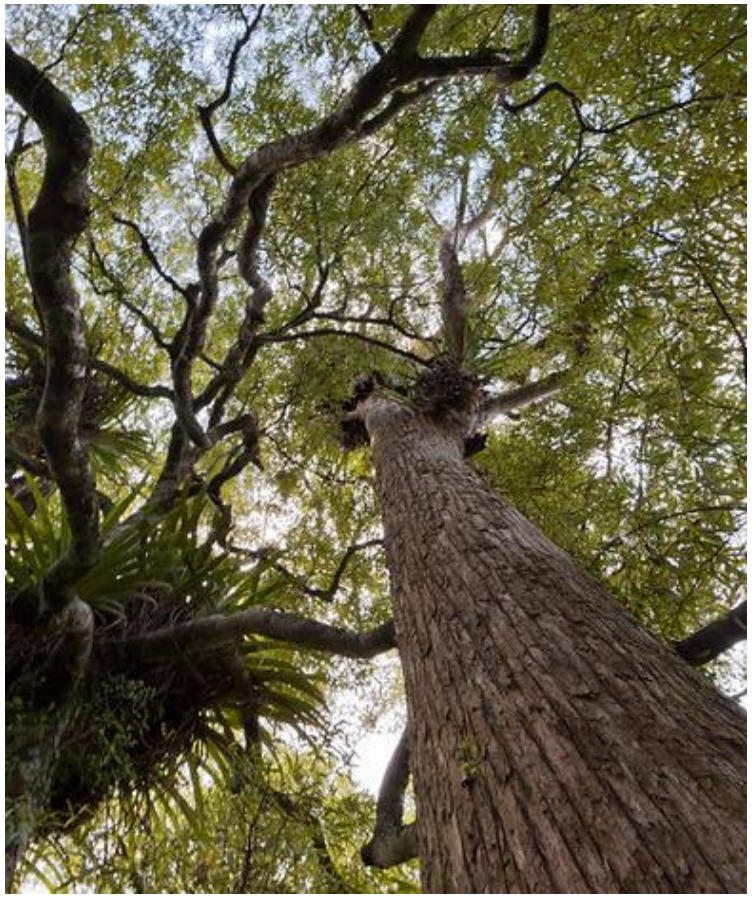
Explore these articles from the Science Learning Hub — Pokapū Akoranga Pūtaiao. They have timelines for how different processes have developed. See how many connections you can find between technological advances, science practices, and science knowledge.

- Rethinking plastics
- New Zealand's green-lipped mussel industry
- 1080 and pest control
- History of microscopy

Watch the episode of Project Mātauranga which discusses kauri dieback. In this case, look for how mātauranga Māori has worked with science to find solutions.



https://www.flickr.com/photos/27345927@N07/5491399500

Opportunities for learning

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This may be an opportunity to go into greater depth in one of these areas or another that is relevant to your locality.

It may also be a chance **for students to share examples of their cultural knowledge.**

The green-lipped mussel stories have several links to the scientific analysis of the effect of pea crabs on mussel farming. These exemplify how scientists work and try to solve problems.

When exploring these resources, draw on mātauranga Māori connections. For example:

- *Mātauranga Māori key to successful mussel restoration project (The Feed)*
- *Creating a sustainable mussel spat supply with mātauranga Māori (Sustainable Seas National Science Challenge)*.

Consider how the values and needs of a society can influence the focus of scientific endeavours

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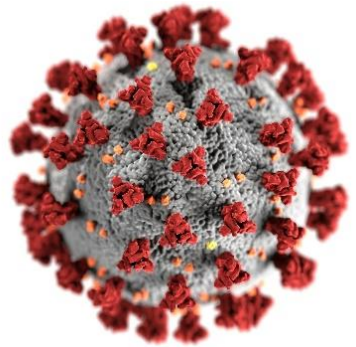
https://commons.wikimedia.org/w/index.php?curid=5369334

Read The chemistry of Fritz Haber (NZASE). What societal needs were met by this scientist's work? Were the values and needs of all members of society met? Would you consider him a hero?

Watch the trailer for *Oppenheimer*. Why was this scientist focused on this particular work? What societal needs were met by his work? Were the values and needs of all members of society met? Now watch The life of Oppenheimer. Do you still feel the same way?



Read The race for a Covid-19 vaccine, explained (The Spinoff) from July 2020. How many labs or companies are working on a vaccine? Do you think they were all looking at a Covid-19 virus in 2019? Were the values and needs of all members of society met?

Assessment opportunity — AS91922 (Science 1.3)

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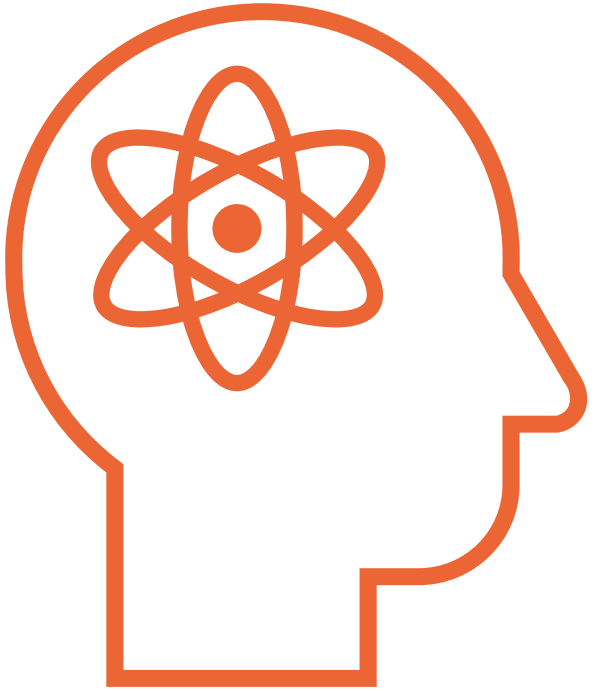
This **Achievement Standard** requires ākonga to describe features of science in a local context. There are eleven features of science included in the Explanatory Notes. These features reflect lots of the ideas developed in our **Big Idea** and **Significant Learning**.

Teachers can use the Science **Subject Learning Outcomes** to check students are ready to be assessed.

Not all of the features of science will be included in assessment every year. In 2023 only five were selected. This information is in NZQA's External Assessment Specifications.



The features of science

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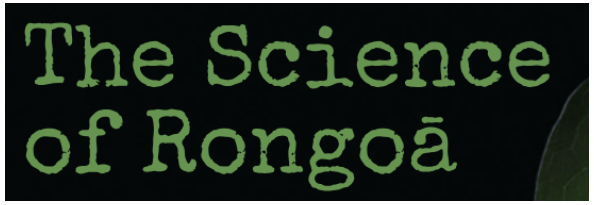
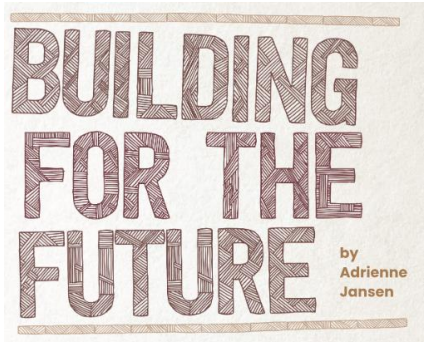
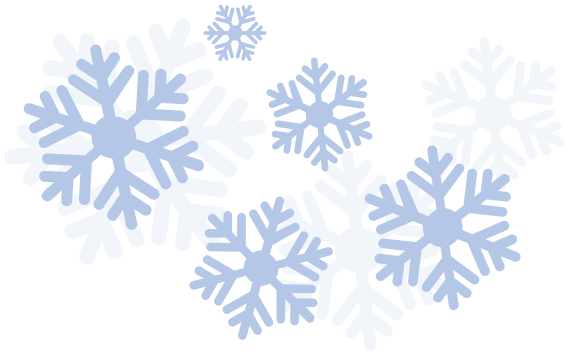
Examples of features of science include:

- replicable, verifiable data collection
- interpreting patterns and interactions
- linking new evidence to existing models, theories, and ideas
- rigorously reviewing claims
- using specific language, symbols, and conventions
- the development of science ideas in response to new evidence or varied perspectives, such as Māori and Pacific knowledge systems
- the influence of the development and use of technology on science
- responding to needs and opportunities
- the influence of social and cultural factors on science
- 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.

Formative assessment







Once ākonga can identify the features of science in familiar contexts, have them examine new situations. They should be able to say what the features look like, and how they have been demonstrated. These three articles contain many aspects of science.

- The science of rongoā Curiosity, creativity, reviewing claims, Māori knowledge systems, replicable verifiable data, science is tentative by nature.
- Building for the future Responding to needs, social and cultural factors, Pacific knowledge, verifiable data collection, creativity, collaboration.
- Your house is cold (Science Journal for Kids) Replicable, verifiable data collection, interpreting patterns and interactions, responding to needs, curiosity).

Summary

This document encourages you to start programme design with a **Learning Matrix**. It focuses on one Big Idea and its related Significant Learning.

Learning activities designed using the **Big Ideas** and **Significant Learning** will support the use of relevant content as contexts. The final stage is to assess the learning.

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