

# the Nature of Science

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### What is science about?

Science is a way of investigating the world and the wider universe. It involves generating and testing ideas, gathering evidence - including modelling, and communicating and debating what is understood. It is a systematic way of creating new knowledge and understanding. Science is a way of investigating the world and the wider universe. It involves generating and testing ideas, gathering evidence - including modelling, and communicating and debating what is understood. It is a systematic way of creating new knowledge and understanding.

### Why study science?

Science is able to inform problem solving and decision making in many areas of life. Many of the major challenges and opportunities that confront our world need to be approached from a scientific perspective, taking into account social and ethical considerations. By studying science, students:

- develop an understanding of the world, built on current scientific theories;
- learn that scientific progress is made through the process of developing and testing ideas, and ways of developing and testing ideas, and ways of developing and testing ideas;
- use their current scientific knowledge and skills for problem solving and decision making;
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### How is the learning area structured?

The fundamental aims of science education are expressed as a series of achievement aims, grouped by strand. For these aims, the objectives and achievement objectives of each level are derived from the aims and are similarly grouped by strand.

The Nature of Science strand is the overarching, unifying strand. Through it, students learn what science is and how scientists work. They develop the skills, attitudes, and values to build a foundation for understanding the world. They come to appreciate that while scientific knowledge is durable, it is also constantly re-evaluated in the light of new evidence, and they come to see scientists carry out investigations, and they come to see science as a socially valuable knowledge system. They learn how science ideas are communicated and to make links between scientific knowledge and everyday decisions and actions. These outcomes are pursued through the following major contents in which scientific knowledge has developed and continues to develop.

**The Physical World strand** is about understanding how the physical world works and the environment. Students develop an understanding of the diversity of life, the processes of change and the link between life processes and the environment as the link between life processes and the environment as the link between life processes and the environment as the link between life processes and the environment.

**The Planet Earth and Beyond strand** is about the Earth, the other parts of the solar system, and the universe beyond. Students learn that Earth's subsystems (land, air, and water) are interconnected and that all are important. They come to appreciate that humans can affect this interconnectedness in both positive and negative ways.

Students also learn that Earth provides all the resources required to sustain life except energy from the Sun, and that, as humans, we act on the systems of these finite resources. This means having and understanding the numerous interactions of Earth's systems with the solar system. Students then compare the resources being our planet and make informed decisions about the protection and wise use of Earth's resources.

**The Physical World strand** provides explanations for a wide range of physical phenomena, including light, sound, heat, electricity, magnetism, waves, forces, and motion, using the concept of energy, which is transformed into one form to another without loss. By studying physics, students gain an understanding of the relationship between parts of the physical world and of

the ways in which they can be represented. Knowing about physics enables people to understand a wide range of contemporary issues and challenges and potential technological solutions.

**The Materials World strand** involves the study of matter and the changes in understanding of the composition and properties of matter. It involves understanding the fundamental properties of matter, and the energy involved. They use chemistry to interpret their observations by considering the properties and behaviour of atoms, molecules, and ions. They learn to communicate their understanding of the symbols and conventions of chemistry. Using their knowledge of chemistry, they are better able to understand science-related challenges, such as

environmental sustainability and the development of new materials, pharmaceuticals, and sources of energy.

The core strand, Nature of Science, is required learning for all students up to year 10. The other strands provide content for learning. Over the course of years 1-10, science programmes should provide learning in all four content strands.

Students in years 11-13 are able to specialise in one or more science disciplines, depending on the choices in their secondary education. The content of the science programmes, but a wider range of programmes is possible, for example, subjects may offer programmes in biochemistry education for sustainability, agriculture, horticulture, human biology or electronics.

- Read the parts of the New Zealand Curriculum document which have been circled.
- Discuss what these sections mean for you as a teacher.
- Do you fore-front the nature of science in your planning and classroom practice?

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### Nature of Science substrands

Nature of Science substrands	Understanding about science	Investigating in science	Communicating in science	Participating and contributing
	<ul style="list-style-type: none"> <li>• Learn about science as a knowledge system: the features of scientific knowledge and the processes by which it is developed, and learn about the ways in which the work of scientists interacts with society.</li> </ul> <p><b>When the focus is on scientists' work</b></p>	<ul style="list-style-type: none"> <li>• Carry out science investigations using a variety of approaches: classifying and identifying, pattern seeking, exploring, investigating models, fair testing, making things, or developing systems.</li> </ul> <p><b>When the focus is on student investigations</b></p>	<ul style="list-style-type: none"> <li>• Develop knowledge of the vocabulary, numeric and symbol systems, and conventions of science and use this knowledge to communicate about their own and others' ideas.</li> </ul> <p><b>Making meaning of scientific representations</b></p>	<ul style="list-style-type: none"> <li>• Bring a scientific perspective to decisions and actions as appropriate.</li> </ul> <p><b>Is about taking action</b></p>
Matching the science capabilities*	Gather and interpret data Use evidence Critique evidence	Gather and interpret data Use evidence Critique evidence	Interpret representations	
Level 1 & 2	<ul style="list-style-type: none"> <li>• Appreciate that scientists ask questions about our world that lead to investigations and that open-mindedness is important because there may be more than one explanation.</li> </ul>	<ul style="list-style-type: none"> <li>• Extend their experiences and personal explanations of the natural world through exploration, play, asking questions, and discussing simple models.</li> </ul>	<ul style="list-style-type: none"> <li>• Build their language and develop understandings of the natural world can be</li> </ul>	
Level 3 & 4	<ul style="list-style-type: none"> <li>• Appreciate that science is a way of explaining the world and that science knowledge changes over time.</li> <li>• Identify ways in which scientists work together and provide evidence to support their ideas.</li> </ul>	<ul style="list-style-type: none"> <li>• Build on prior experiences, working together to share and examine their own and others' knowledge.</li> <li>• Ask questions, find evidence, explore simple models, and carry out appropriate investigations to develop simple explanations.</li> </ul>	<ul style="list-style-type: none"> <li>• Begin to use symbols and engage in</li> </ul>	
Level 5 & 6	<ul style="list-style-type: none"> <li>• Understand that scientists' investigations are informed by current scientific theories and aim to collect evidence that will be interpreted through processes of logical argument.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop and carry out more complex investigations, including using models.</li> <li>• Show an increasing awareness of the complexity of working scientifically, including recognition of multiple variables.</li> <li>• Begin to evaluate the suitability of the investigative methods chosen.</li> </ul>		
Level 7 & 8	<ul style="list-style-type: none"> <li>• Understand that scientists have an obligation to connect their new ideas to current and historical scientific knowledge and to present their findings for peer review and debate.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop and carry out investigations that extend their science knowledge, including developing their understanding of the relationship between investigations and scientific theories and models.</li> </ul>		

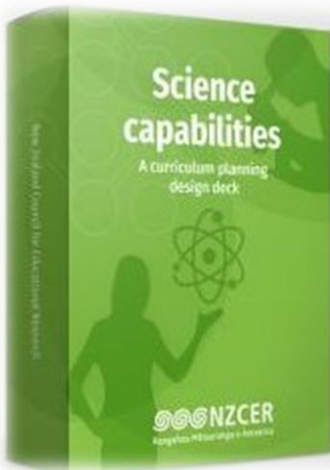
- What are the key differences between the four substrands of the nature of science?
- What are some of the ways you could/or have developed the skills attitudes and values described in the NoS achievement objectives at a particular level?

# Science Capabilities

Building knowledge of science **content** and the **processes** of science is important, and so is building knowledge of the **nature of science**. Five science capabilities have been defined to combine learning in these three areas.

The science capabilities help students practice the types of thinking, questioning, and actions needed to become informed citizens. This helps build their knowledge and confidence to use their growing capabilities.

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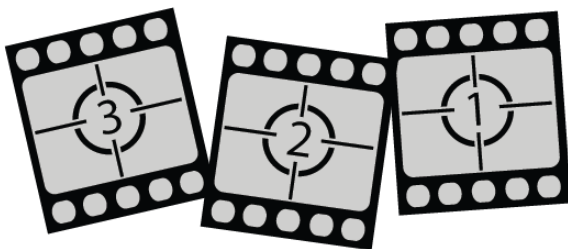


1. Shuffle the cards and spread them out white-side up.
2. Sort the cards into 4 sets of 7 to match 4 of the "science capabilities"
  - How familiar is the scope of each capability?
  - Are some statements more familiar than others? If so, why do you think this?
3. Flip the cards over to see if your grouping matches the capability on the back.
  - Discuss any that you sorted into a different pile.

Actually, aspects of all the capabilities will overlap and blend so it is not surprising that there can be debate about where any one statement is best placed.

These groupings for the cards are "on balance" judgements about aspects you might want to foreground when your focus is on a specific capability.

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Complete the summary sheet ready to discuss with your home group:

- 3 key points
  - 2 interesting things
    - 1 question you have