# **Science Level 1 Course Outline 3**

# Guide to aid teacher planning only - designed to be printed or viewed in A3, Landscape.

## Purpose

This example Course Outline has been produced to help teachers and schools understand the new NCEA Learning and Assessment matrices and could be used to create a year-long programme of learning. It will give teachers ideas of how the new standards might work to assess the curriculum at a particular level.

## Context: Impacts of Climate Change

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| **Significant Learning** | **Learning activities and assessment opportunities**  Throughout the year assessment for learning happens often. Evidence may also be collected for summative assessment. | **Duration**  Total of 32 weeks |
| Consider mātauranga Māori and Pacific knowledges alongside science in contexts that relate to Aotearoa New Zealand and the Pacific  Consider how different perspectives can be used when making decisions on socio-scientific issues  Identify interrelationships between science practices, technological advances, mātauranga Māori, and the practical advancement of science knowledge  Recognise that science ideas are communicated using a range of methods with discipline-specific practices  Consider how the values and needs of a society can influence the focus of scientific endeavours | **Food Security**  Learn how mātauranga Māori recognises the interconnectedness of all life and the importance of life processes.  Recognise that the survival of individuals is dependent on interconnected processes, including other organisms within the ecosystem. Learn how ecosystems with more biological diversity are more likely to survive environmental changes, such as those induced by humans.  Explore the frequency of extreme climatic events. Consider the impacts of climate change on crop production, eg, the length of growing seasons, the average temperatures of those seasons, and the increases in pests and disease.  Learn how agricultural practices are changing in response to climate change, for example:   * changes in latitudinal distributions * vertical farms * hydroponics * alternative foods, eg, insects for protein.   Study the life processes of plants, including:   * photosynthesis * growth * reproduction * germination * flowering.   Consider the environmental factors that may vary with climate change, for example:   * temperature * moisture levels * concentration of gases in the atmosphere * soil biome.   Invite industry specialists to speak in the classroom or organise (online) interviews. These could be individuals from the regional council, the primary production sector, or Manaaki Whenua etc. Illustrate potential pathways by profiling the careers of these individuals or use [career websites](https://www.careers.govt.nz/).  Engage in practical activities that investigate the effect of increasing CO2 levels on plant health, for example:   * photosynthesis * moisture levels * temperature change * growth * bacterial or fungal growth.   Consider organising (online) interviews with pharmacologists, pesticide manufacturers, or fertiliser sales representatives. Explore the link between knowledge and training opportunities in these fields.  Engage with local issues that are relatable for ākonga. Example topics and questions include:   * what can we do locally to secure our food supply * the effectiveness of pest and disease control measures for food species * alternative methods to control pest and disease * the best land use in a changing climate * whether or not to reduce the amount of meat we eat.   Through studying DNA, genes, chromosomes, mutations, biodiversity, and selective breeding, consider how variation helps secure our food supply in a changing climate.  Recognise that all living things are interrelated, and may show diversity at the genetic, individual, and population level.  Learn how genetic information provides continuity of life, underpins how life processes operate, and is passed from parent to offspring via DNA. Recognise that DNA is the unit of inheritance and carries information in a chemical code.  Learn that populations (not individuals) adapt to their environment as a result of evolution.  Understand why genetic variation is essential for evolutionary change.  Recognise that extinction can occur if populations are unable to adapt to the rate of environmental change.  Explore how [artificial selection](https://www.sciencelearn.org.nz/resources/811-easy-care-sheep-introduction) and [biotechnology](https://www.sciencelearn.org.nz/resources/2004-biotech-and-farming) are being used in Aotearoa New Zealand farming.  **Opportunity for assessment of SC1.1 - Demonstrate understanding of a science-informed response to a local issue** | 8 weeks |
| Engage with the iterative process of science investigation through innovation, problem solving, inquiry, collaboration, and evaluation  Recognise how different approaches can be used in science investigations  Recognise that scientific ideas are developed through critical and creative thinking, regulated by evidence  Recognise that science ideas are communicated using a range of methods with discipline-specific practices | **Sustainable Energy**  While the total amount of energy in the universe is always the same, recognise that the energy can be transformed and/or transferred.  Learn that energy is the capacity to do work.  Investigate energy use and carbon footprint, for example:   * comparing energy and water use from showering, eg, 5 minutes shower vs 15 minutes shower * comparing transport methods, eg, electric, hybrid, petrol, and diesel cars, public transport, electric bikes * comparing home heating systems, eg, pellet and coal fires, heat pumps, oil heaters, fan heaters, gas vs electricity * how to reduce energy consumption, eg, home insulation, solar power.   Use a range of scientific investigative approaches to carry out tasks involving [energy transfer](https://www.sciencelearn.org.nz/resources/2826-energy-transfer), for example:   * solar cells * hand generators * gravity * rubber band catapults * batteries.   Understand that heat energy transfers from regions of relative warmth to colder regions.  Explore heat transfer mechanisms, ie, conduction, convection, and radiation, and learn how insulation interacts with these mechanisms. Consider how these mechanisms can be used to increase sustainable energy use within the home.  Investigate the heating and cooling curves of different substances to determine patterns.  Organise (online) interviews with industry specialists, eg, architects or construction engineers involved in the development of sustainable homes and buildings.  Explore [energy production and consumption](https://ourworldindata.org/energy/country/new-zealand?country=NZL) within Aotearoa New Zealand and consider the impact of increased [energy demands](https://www.sciencelearn.org.nz/videos/875-new-zealand-s-energy-demand) on climate change.  Learn about different energy sources and how they contribute to greenhouse gas emissions.  Consider how climate change may affect energy use, eg, increased use of air conditioning with rising temperatures.  **Opportunity for assessment of SC1.2 - Demonstrate understanding of the use of a range of scientific investigative approaches in a context** | 8 weeks |
| Engage with the iterative process of science investigation through innovation, problem solving, inquiry, collaboration, and evaluation  Recognise how different approaches can be used in science investigations  Recognise that scientific ideas are developed through critical and creative thinking, regulated by evidence  Recognise that science ideas are communicated using a range of methods with discipline-specific practices  Consider how the values and needs of a society can influence the focus of scientific endeavours | **Sustainable chemistry**  Learn about sustainable chemistry and why it is important.  Recognise that the total amount of matter remains the same in chemical reactions.  Explore the development of chemistry concepts, for example:   * chemical energy sources, eg, coal vs solar * carbon sequestering * paper production and recycling * plastic production and innovations in mitigating pollution * the atomic model, ie, research by [Rutherford](https://www.sciencelearn.org.nz/resources/2774-lord-ernest-rutherford) and [MacDiarmid](https://teara.govt.nz/en/biographies/6m2/macdiarmid-alan-graham)   Recognise that the particle nature of matter helps us to understand whether or not the matter is sustainable.  Use a range of approaches to investigate the particle nature of matter and chemical reactions. Learn about chemistry concepts such as:   * atomic structure * ions * chemical formulae * conservation of matter * chemical reactions (metals, acids, and bases).   Recognise that properties of substances observable at the macroscopic level can be explained by, but are different from, the structures of atoms and molecules and the interactions between them.  Explore the rearrangements of matter via [chemical reactions,](https://www.sciencelearn.org.nz/resources/1650-chemical-reactions-and-catalysts) and recognise that they involve changes at the atomic and sub-atomic level.  Investigate an examination of mass before and after a reaction (conservation of matter), for example:   * polystyrene in acetone * precipitation reactions * carbonate and acid (where did the missing mass go?) * burning a fuel.   Explore the potential career pathways related to chemistry, eg, fertiliser manufacturing, food and nutrition, and pharmaceutical sciences. Invite industry specialists to speak about their career or use [career websites](https://www.careers.govt.nz/) to illustrate opportunities for ākonga.  Consider the benefits of sustainable chemistry, for example:   * recycling * using renewable resources * reducing environmental impacts of processing * manufacturing and repurposing.   Recognise the finite nature of atoms on Earth, eg, the water we drink has been through several sets of kidneys before you drink it.  Recognise the value of using reactive versus unreactive compounds in the environment.  **Opportunity for collection of report material for assessment of SC1.3 - Describe the features of science that have contributed to the development of a science idea in a local context**  **Opportunity for assessment of SC1.4 - Demonstrate understanding of science-related claims in communicated information** | 8 weeks |
| Identify interrelationships between science practices, technological advances, mātauranga Māori, and the practical advancement of science knowledge  Consider mātauranga Māori and Pacific knowledges alongside science in contexts that relate to Aotearoa New Zealand and the Pacific   Consider how different perspectives can be used when making decisions on socio-scientific issues  Recognise that scientific ideas are developed through critical and creative thinking, regulated by evidence  Use science understanding to critique claims or predictions made in communicated information | **Sea Level Rise**  Explore the effects of climate change on the marine environment, for example:   * increasing [ocean temperature](https://www.youtube.com/watch?app=desktop&v=10H2ILuXjO8+https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3D3sqdyEpklFU+https%3A%2F%2Fwww.youtube.com%2Fwatch%3Ftime_continue%3D39&v=OMXqsJ-aojc&feature=emb_logo) * sea level rise as a result of melting glaciers, sea ice, thermal expansion, etc * changes in [sea water density](https://www.sciencelearn.org.nz/resources/2280-temperature-salinity-and-water-density).   Learn about the [water cycle](https://www.sciencelearn.org.nz/resources/713-h-o-on-the-go-the-water-cycle-introduction) and the interacting processes within and between the hydrosphere, biosphere, atmosphere, and geosphere. Consider how these interacting processes shape and affect the Earth’s surface, climate, and organisms.  Recognise that mātauranga Māori uses the concept of whakapapa to understand the interconnectedness of all life and the importance of life processes. Learn about other mātauranga Māori concepts such as mauri, tapu, noa, and kaitiakitanga, and how they relate to the natural world.  Look at investigations such as:   * [the relationship between temperature and volume of water](https://archive.epa.gov/climatechange/kids/documents/sea-level-rise.pdf) * [impacts of sea and land ice on sea level](https://www.scientificamerican.com/article/bring-science-home-sealevel-rise/) * [what makes ice melt faster](https://www.scientificamerican.com/article/what-makes-ice-melt-fastest/) * [the effect that contact with water has on melting ice](https://www.sciencelearn.org.nz/resources/2279-melting-glacial-ice) * the effect of climate change on [coastal areas](https://www.sciencelearn.org.nz/resources/116-studying-storm-surge-and-coastal-hazards) within Aotearoa New Zealand.   Consider the [history of climate change](https://www.sciencelearn.org.nz/resources/1862-the-ocean-co-and-climate-change-timeline862-the-ocean-co-and-climate-change-timeline).  Explore the historical data on atmospheric CO2, carry out a practical using spirit burners with different fuels, and use molymods (or other models) to model the chemistry concepts involved. Learn about the [carbon cycle](https://www.youtube.com/watch?v=yhlg9txl7yM) and reinforce this knowledge by playing a [carbon cycle game](https://edu.rsc.org/resources/carbon-cycle-game/4013431.article).  Investigate a scientific claim in the media about ocean temperatures, sea level rise, or climate change.  Consider local examples of environmental damage due to climate change, for example:   * flooding in South Dunedin * coastal damage in the Tasman area caused by ex-tropical cyclone Fehi * erosion of the Fox Glacier landfill.   Use [sea level data](https://www.jpl.nasa.gov/edu/teach/activity/graphing-sea-level-trends/) to create models and compare the short-term and long-term trends. Consider the effects of [sea level rise](https://climate.nasa.gov/vital-signs/sea-level/) on coastal communities, in particular the effects of sea level rise on small islands within the [Pacific](https://www.who.int/westernpacific/activities/protecting-the-islanders-from-climate-change-and-environmental-hazards).  **Opportunity for collection of report material for assessment of SC1.3 - Describe the features of science that have contributed to the development of a science idea in a local context**  **Opportunity for assessment of SC1.4 - Demonstrate understanding of science-related claims in communicated information** | 8 weeks |