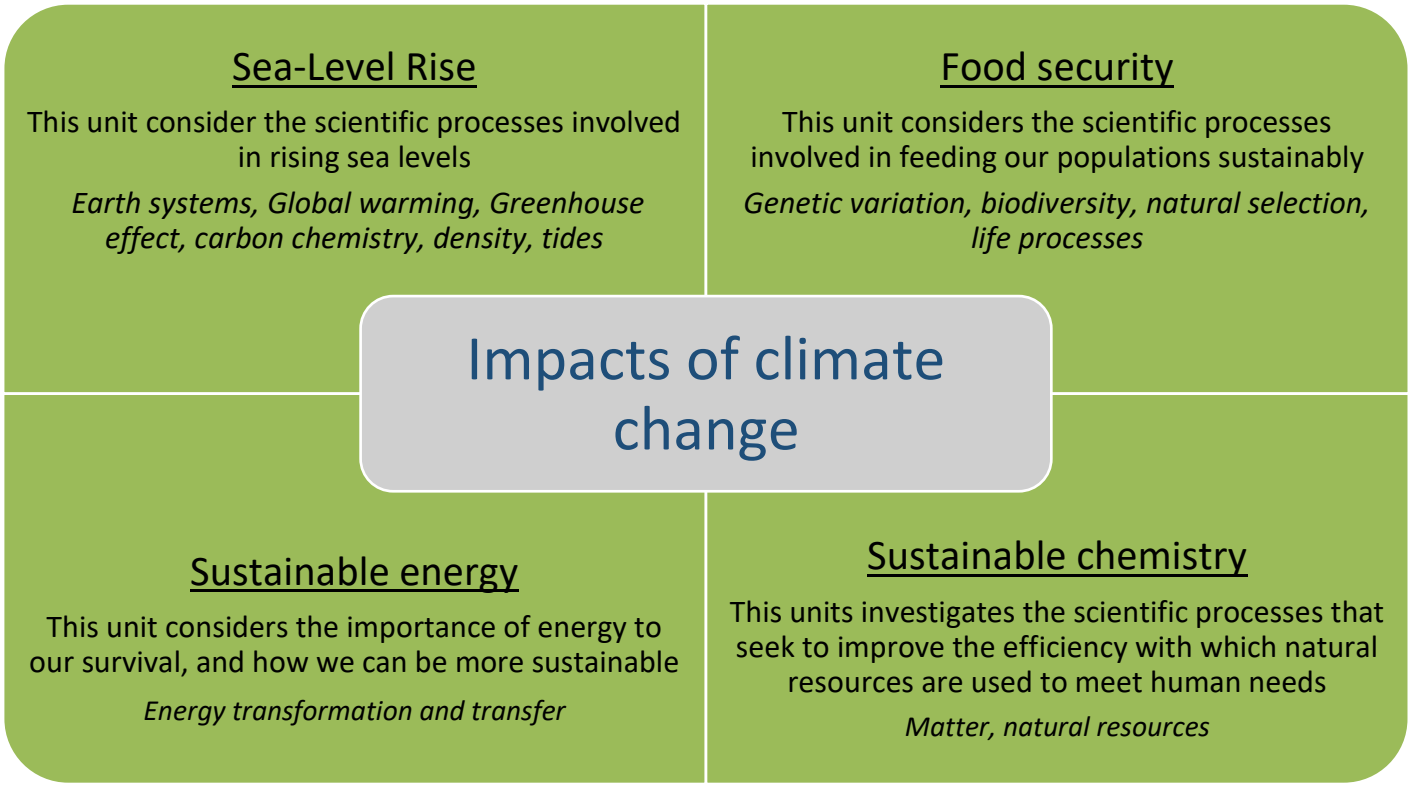
Sample 3 Level 1 Science Course Outline - guide to aid teacher planning

Introduction to the teaching and learning programme

This teaching and learning programme is based around the impacts of climate change on all aspects of society. Climate change is a problem which we all face, no matter who we are, and provides a context which will allow teachers to build understanding of key science concepts using real world applications of science in everyday settings.



		Learning Focus	Significant learning comes by weaving together the ways of working and the "content" ideas (the Big ideas about and of Science)		Throughout the year assessment for learning happens often and evidence may be collated for summative assessment.	
			Working scientifically	Knowledge ideas	Possible Learning Activity	Suggested Assessment Opportunities
Term 1	Weeks 1-3	**Sea Level Rise** Changes to the ocean ● Ocean temperature (now and in the past) ● Impact of global warming on the sea (melting glaciers and sea ice, thermal expansion) ● density	Use a range of scientific investigative approaches. Describe features of science that contribute to the development of scientific ideas and processes Interpret scientific claims in communicated information	Interacting processes within and between the hydrosphere, biosphere, atmosphere, and geosphere shape and affect the surface, the climate, and life on Earth. Mātauranga Pūtaiao expresses the existence of and the relationships between organisms and systems in the natural world through concepts such as whakapapa, mauri, tapu, noa, kaitiakitanga and derived conceptual frameworks Changes in one sphere can cause changes to other spheres, often in unexpected and complex ways.	Look at graphs of ocean temperature and make inferences Carry out Density investigations Practical activity making a saturated salt solution and comparing its mass to the mass of an equivalent volume of distilled water Explore Science Learning Hub sites	Possible investigations for AS 1.1– Relationship between temperature and volume of water (fair test) Impacts of sea and land ice on sea level (modelling) Impacts of sea and land ice on sea level (modelling) What makes ice melt faster (Observations) - Effect that contact with water has on melting ice (modelling) - Practice case study for AS 1.3 - History of climate change
	Weeks 4 - 6	**Sea Level Rise** What is causing this problem? ● Greenhouse gases	Use a range of scientific investigative approaches Describe features of science that contribute to the development of	Interacting processes within and between the hydrosphere, biosphere, atmosphere, and geosphere shape and affect the surface, the climate, and life on Earth.	Historical data on atmospheric CO_2 Practical using spirit burners with different fuels	Practice AS 1.4 - Investigate a scientific claim in an article/website/Blog/etc about ocean temperatures/sea level rise/climate change

		• Carbon chemistry (including structure of atom, bonding, combustion • Fossil fuels • Carbon cycle	scientific ideas and processes Interpret scientific claims in communicated information	Rearrangements of matter (chemical reactions) can be observed at the macroscopic level and involve changes at the atomic and sub-atomic level.	Using molymods Series of 5 short videos about carbon and global warming- Carbon cycle game	
	Weeks 7-8	**Sea Level Rise** What are the impacts of sea level rise? • Human effect on the carbon cycle • Low lying atolls and coastlines • King tides and storm surges	Use a range of scientific investigative approaches. Engage in local socio-scientific issue.	Changes in one sphere can cause changes to other spheres, often in unexpected and complex ways. The Earth and space systems within the universe interact with each other.	Science Learning Hub - Coastal hazards There are local issues around the sea-level: Disappearing Pacific Islands South Dunedin Ferguson Park cricket wicket (Tauranga) Coastal erosion Loss of coastal forest/wetlands/mangrove West Coast landfill destruction (Fox)	Possible approaches for investigating AS 1.1 Use sea-level data to create models and compare short-term to long-term trends (modelling using secondary data) Effects of sea-level rise on coastal communities (explore and observe) Effect of sea-level rise on small islands (modelling) Possible issues for engaging AS 1.2 Disappearing coastlines/islands

	Weeks 9-10	**Sustainable Energy** Why is energy important to us? ● What is energy ● Energy transfer and transformation ● Sustainable energy	Use a range of scientific investigative approaches Describe features of science that contribute to the development of scientific ideas and processes	The total amount of energy in the universe is always the same but the energy can be transformed and/or transferred when things change or happen.	Range of energy transfer practicals: ● hammer some metal ● solar cells ● hand generator ● dropping marble ● rubber band shanghai ● batteries Explore total energy use at home: ● electricity ● gas ● fire wood ● fuel for your car Compare what uses the most eg about ½ a power bill could be water heating.	Possible approaches for investigating AS1.1 – Explore and observe different examples of heat transfer Explore and observe different energy transformations Investigate the cooling/heating curves of different substances to establish a pattern Investigating the effect of surface area on heat absorption (fair test) **Opportunity to complete AS 1.1 (Final task compares across a range of 3)** *Further opportunity in Term 4 may draw on investigations during future learning in other topics and contexts.* Possible case studies for AS 1.3 - History of electricity including Gilbert, Boyle, Edison, Westinghouse, Tesla, etc.
Term 2	Weeks 1-2	**Sustainable Energy** What is the impact of energy production on climate change? ● combustion of fossil fuels OR What is the impact of climate change on energy production?	Use a range of scientific investigative approaches). Interpret scientific claims in communicated information	Rearrangements of matter (chemical reactions) can be observed at the macroscopic level and involve changes at the atomic and sub-atomic level.	Combustion of carbon based compounds Managing changes in temperature increases energy demand eg. air conditioning/heating Alternative energy sources eg. solar, wind, hydro, etc Energy storage Video	Possible approaches for investigating AS 1.1 – Investigate the relationship between climatic temperature and energy demand Practice for communicating 1.4 - Investigate a scientific claim in an article/website/Blog/etc

		• Increased demand due to temperatures • Reduction of fossil fuel use				about the impacts of climate change and energy demand/use/production
	Weeks 3 - 6	**Sustainable Energy** How can we be more sustainable with heat transfer? • heat energy • conduction • insulation • convection • radiation	Use a range of scientific investigative approaches. Engage with a local socio-scientific issue.	The total amount of energy in the universe is always the same but the energy can be transformed and/or transferred when things change or happen. Energy is the capacity to do work. Heat energy transfers from regions of relative warmth to colder regions.	https://www.sciencelearn.org.nz/resources/750-heat-energy Personal energy use eg 15min showers! and transport (carbon footprint) Home insulation - how to reduce our energy consumption Home ventilation - energy needed to heat damp air Using science ideas to design cooler homes in the Pacific Are electric vehicles better? Pellet fires versus coal fires	Possible approaches for investigating AS 1.1 – Investigate effect of colour on heat absorption (fair testing) - Identify patterns in the way water cools in a can using different insulators (pattern seeking) Possible issues for engaging AS 1.2- Alternative energy sources e.g Investigating an alternative energy supply for school, Would it be possible for my kāinga to use renewable energy, and what would we need to do to get there? What are the local impacts of increasing human demands on energy
	Weeks 7-8	**Food security** How is climate change impacting our food supply? • Crops • Livestock • Fisheries	Engage with a local socio-scientific issue Interpret scientific claims in communicated information.	Matauranga pūtaiao recognises the interconnectedness of all life and the importance of life processes. Survival of individuals is dependent on interconnected processes and organ systems, and on other members of ecosystems	Frequency of extreme climatic events Impacts of CC on length of growing seasons & the average temperatures of those seasons; changes in latitudinal distributions Incursions of tropical disease organisms	Possible issues for engaging AS 1.2 - What can we do locally to secure our food supply? Do pest/disease control measures for food species actually make a difference? Or appropriate use of alternative methods

		• Pests and disease • soil deterioration • Agricultural emissions • Reduced land availability • Availability of substitutes		Ecosystems with more biological diversity are more likely to survive environmental changes which can be human induced.	Threat of seawater inundation for Pacific Island crops/agriculture Is soil becoming extinct? Methane emissions from ruminants and their contribution to CC Vertical farms Hydroponics Alternative foods eg insects for protein Is vegetarian "greener" when we use imported ingredients?	The suitability of land for dairying in a changing climate Why should we reduce the amount of meat we eat? Practice for communicating AS 1.4 - Interpret a scientific claim made in an article/website/Blog/etc about the impacts of climate change on food supply)

	Week 9- 10	How can we get variation that helps secure our food supply? ● DNA, genes, chromosomes ● mutations ● biodiversity ● Selective breeding	Use a range of scientific investigative approaches Describe features of science that contribute to the development of scientific ideas and processes Interpret scientific claims in communicated information.	All living things are interrelated, and may show diversity at the genetic, individual, and population levels. Genetic information provides for continuity of life, underpins how life processes operate, and is passed from parent to offspring via DNA. DNA is the unit of inheritance and it carries information in a chemical code. At the population level, processes of evolution drive the diversity of life. Populations (NOT individuals) adapt to their environment as a result of evolution. Genetic variation is essential for evolutionary change. Where populations cannot adapt to the rate of environmental change, extinction occurs.	Genetic inheritance Role of mutations in creating variation Breeds and varieties that are better suited for the changing environmental conditions, producing more food Selective breeding breeds and varieties with desirable characteristics	Possible case studies for <u>development of scientific ideas/processes</u> AS 1.3- History of DNA – Griffith, Franklin, Watson and Crick Inheritance - Gregor Mendel Practice for <u>communicating</u> AS 1.4- Interpret a scientific claim in an article/website/Blog/etc about development of new breeds/varieties
Term 3	Weeks 1-4	How has climate change impacted crop production? ● life processes ● environmental factors ● increases in pests and disease	Use a range of scientific investigative approaches Interpret scientific claims in communicated information	All living things are interrelated, and may show diversity at the genetic, individual, and population levels. Genetic information provides for continuity of life, underpins how life processes operate, and is passed from parent to offspring via DNA. Matauranga pūtaiao recognises the	Life processes - photosynthesis, growth, reproduction (germination, flowering) environmental factors - temperature, moisture levels, concentration of gases in atmosphere, soil biome	Possible AS 1.1 activities - How does increasing CO2 levels affect photosynthesis? How do moisture levels affect plant growth/bacterial or fungal growth? How salt-tolerant is this [Pacific Island] crop species? How does temperature affect rate of

				interconnectedness of all life and the importance of life processes.		germination/photosynthesis/respiration/bacterial or fungal growth? Practice 1.4 activity- Interpret a scientific claim in an article/website/Blog/etc about reduced winter chilling on fruit production.
	Weeks 5-7	**Sustainable chemistry** What is sustainable chemistry and why do we need it? (understanding chemistry is the solution to the problem not its cause)	Interpret scientific claims in communicated information	The total amount of matter remains the same in chemical reactions.	chemical sources of energy today and yesterday eg coal vs a hydrogen fuel cell/solar panel carbon sequestering Follow paper from tree to landfill/recycling or Where does plastic come from and where does it go to innovations in biodegradation of modern "plastics"	Practice 1.4 activity- Interpret scientific claims made in an article/website/Blog/etc about an aspect of sustainable chemistry
	Weeks 8-10	**Sustainable chemistry** What do we need to know about matter to be sustainable? ● Particle nature of matter	Explore the development of the atomic model. Use a range of approaches to investigate the particle nature of matter and chemical reactions.	All matter in the universe is made of very small particles. 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.	atomic structure ions chemical formulae conservation of matter chemical reactions (metals, acids and bases) examine mass before and after a reaction (conservation of matter), for example: - polystyrene in acetone - precipitation reactions	Possible approaches for AS1.1 – Investigate the effect of changing one variable on the rate of reaction (fair testing) What happens if you vary the amount of reactants? (pattern seeking) **Alternative opportunity for summative assessment of AS 1.1 – Investigations (Complete comparison of 3 different investigative approaches)** Possible case study for AS1.3 –

				Rearrangements of matter (chemical reactions) can be observed at the macroscopic level and involve changes at the atomic and sub-atomic level.	- carbonate and acid (where did the missing mass go?) - burning a fuel	Development of the atomic model
Term 4	Weeks 1-4	What are the benefits of sustainable chemistry? ● Recycling ● Using renewable resources ● Reducing environmental impacts of processing and manufacturing ● Repurposing	Engage in a local socio-scientific issue Describe features of science that contribute to the development of scientific ideas and processes Interpret scientific claims in communicated information	The total amount of matter remains the same in chemical reactions.	Finite atoms on Earth, eg. the water we drink has been through several sets of kidneys before you drink it How do we protect what we have so it is there tomorrow? eg. atoms that go into plastics are unavailable for thousands of years Value of using reactive versus unreactive compounds in the environment Are electric vehicles better? Components (atoms) in a mobile phone (there is more gold in a cell phone than in goldmine)	Possible issues for AS1.2 – What is meant by organic food? Are 'natural' foods better than artificial foods? Should we destroy native bush to mine for natural resources? Possible case study use of CFC's **Submission for AS 1.2 – Real World issue (Internally assessed report)** Practice for AS 1.3- Interpret a scientific claim in an article/website/Blog/etc about an advantage/disadvantage of sustainable chemistry

Assessment Matrix

AS	Title	Int/Ext Credits	Assessment Type and Date	Assessment Elements
1.1	Use a range of scientific investigative approaches.	Internal 5 credits	Selection of three reports from all investigations undertaken and a comparison of the chosen range of three approaches.	"Sea Level on the Rise" (Exemplar internal assessment activity) Choose three approaches from: ● fair testing approach - investigating thermal expansion

			By the end of T3.	● modelling - investigating melting of glacial and sea ice on sea level rise ● pattern seeking - investigating patterns between sea level and tides ● exploring and observing - investigating tidal variation ● classifying and identifying - investigating biodiversity Alternatively, assess a selection of three approaches in Term 3.
1.2	Engage with a local socio-scientific issue	Internal 5 credits	Present evidence that - explains the relevant science ideas - describes perspectives on the issue - proposes and explains a response - links the ideas or perspectives and the response. Early Term 4	Choose ONE of the following issues: ● Sea level rise and low-lying islands/coastal communities ● alternative energy sources ● local impacts of increasing demands on energy use ● food security ● meat alternatives ● suitability of land for dairy farming in changing climate ● organic versus natural food ● destruction of native bush for natural resources
1.3	Describe features of science that contribute to the development of scientific ideas and processes	External 5 credits	Common assessment activity - task set and marked by NZQA and sat individually under examination conditions End of Term 2	*Practice activities:* - *history of climate change* - *history of electricity* - *history of DNA* - *Mendel and inheritance*
1.4	Interpret scientific claims in communicated information	External 5 credits	Common assessment task - NZQA assessment task under examination conditions Late Term 4	Practice activities in interpreting scientific claims made in communicated information about: - climate change - impacts on energy demand/production due to climate change - impacts of climate change on food supply - new breeds/varieties of plants/animals - impact of environmental change on crop production - advantages/disadvantages of a sustainable chemical approach