



# Science Department

## Overview:

Our students will develop scientific skills, attitudes using the Nature of Science and Capabilities to build a foundation for understanding, knowledge and values of their world and how it works.

"In science students explore how both the natural physical world and science itself works so that they can participate as critical and informed, and responsible citizens of society in which science plays a significant role." (The NZ Curriculum ,2007)

**The Nature of Science** strand is overarching unifying strand. The Science **Capabilities** are a subset of The Nature of Science. They will be explicitly taught in each learning unit.

## We believe through The Nature of Science students will:

- .Learn what Science is and how scientists work (Understanding about Science)
- Learn how scientists carry out investigations (Investigating in Science)
- Learn how scientist's ideas are communicated (Communicating in Science)
- Learn how to make links between scientific knowledge and everyday decisions and actions. (Participating and Contributing)

The five foundational **Science Capabilities** are skills and attributes students need to show they can do. The capabilities will be strengthened with practice overtime. These are:

1. *Gather and Interpret data*

2. *Use Evidence*
3. *Critique Evidence*
4. *Interpret Representations*
5. *Engage in Science*

The Nature of Science and Science Capabilities will be explicitly taught through the following four contextual strands of Science:

- **Living World** – develops an understanding of how living things interact with each other and their environment.
- **Planet Earth and Beyond** – develops an understanding of the interconnecting systems and processes of the Earth and beyond.
- **Physical World** – develops an understanding of a wide range of physical phenomena.
- **Material World** – develops an understanding of matter and the changes it undergoes.

### We will achieve this by

- Provide learning opportunities through the four contextual strands
- Integrating science through other curriculum areas where authentic, e.g. using science experiments /investigations to ignite oral and written language

### Planning

- Teaching and learning planning will be based on our *Science Programme of Work* and Using The Nature of Science and Science Capabilities.
- The four contextual strands of Science will be a vehicle through which The Nature of Science and Science Capabilities will be taught explicitly.
- Learning intentions and Success Criteria will focus on the Nature of Science and Science capabilities
- Science units will include initial specific investigations/experiments which may be extended through Inquiry learning or

## **SOLO**

- Year 9-11 Science programmes are using Scipad workbooks which are aligned with the NZ curriculum.

## **References**

Science Department Scheme (produced by Garry Lewis and Pip Baker 2008)

The New Zealand Curriculum

Collingwood Area School – School Charter, Strategic and Annual plans 2015-2017

Maree O’Boyle - Primary Science Facilitator 2016



<b>Year Level 9</b>	<b>Level 4/5</b>
<b>SOLO</b>	By the end of the year students will be at least to multi structural level moving towards relational
<b>Skills</b>	By the end of Year 9 students will be able to: Identify, Describe, Classify, Investigate, Distinguish, Link, Experiment,
<b>Possible Topics</b>  <b>To be covered through scipad workbooks.</b>	<p><b>Living World</b></p> <ul style="list-style-type: none"> <li>Identify the key structural features and functions involved in the life processes of plants and animals</li> <li>Classifying living things</li> </ul> <p>Scipad topics related to living world: Botany, Ecology, Food and Digestion</p> <p><b>Planet Earth and Beyond</b></p> <ul style="list-style-type: none"> <li>Investigate the composition, structure and features of the geosphere, hydrosphere and atmosphere.</li> <li>Investigate how the heat from the sun, the Earth and human activities is distributed around Earth by the geosphere, hydrosphere and atmosphere.</li> <li>Investigate the conditions on the planets and their moons and the factors that affect them</li> </ul> <p>Scipad topics related to Planet Earth and Beyond: Astronomy, Hydrology</p> <p><b>Physical World</b></p> <ul style="list-style-type: none"> <li>Identify and Describe the patterns associated with the physical phenomena found in simple everyday situations involving Heat, Sound and Energy</li> </ul> <p>Scipad topics related to Physical World: Waves and Energy</p> <p><b>Material World</b></p> <ul style="list-style-type: none"> <li>Distinguish between pure substances, mixtures and between elements and compounds</li> <li>Distinguish between an element and a compound, a pure substance and a mixture at particle level.</li> <li>Link the properties of different groups of substances to the way they are used in society or occur in nature.</li> </ul> <p>Scipad topics related to Material World: Mixing and Separating, Matter</p>
<b>Terminology</b>	<p>Literacy to be assessed using science topics – report writing, statistics and measuring.</p> <ul style="list-style-type: none"> <li>Terminology related to Environment, Ecosystems, Investigations, Classification, Life processes, geosphere, hydrosphere and atmosphere, Space, Energy, Heat, Sound, Elements, Compounds, Mixtures, Particle nature of matter.</li> </ul>
<b>Assessments</b>	Teacher judgement based on success criteria and SOLO, Thinking with Evidence Science Test, Projects, Written Tasks, Oral, Self and peer assessment.
<b>Teaching Strategies</b>	Enquiry based on the overarching of the nature of science.
<b>Community Support Ideas</b>	Parents on trips and use of community experts Involved in community activities.

<b>Key Competencies</b>	<ul style="list-style-type: none"><li>• Thinking</li><li>• Using Language, Symbols and Text Managing Self</li><li>• Relating to others</li><li>• Participating and contributing</li></ul>
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<b>Year Level 10</b>	<b>Level 5</b>
<b>SOLO</b>	By the end of the year students will be at least to multi structural level moving towards relational
<b>Skills</b>	By the end of Year 10 students will be able to: Identify, Describe, Classify, Investigate, Distinguish, Link, Experiment, Explore
<b>Possible Topics  To be covered through scipad workbooks</b>	<p><b>Living World</b></p> <ul style="list-style-type: none"> <li>Identify the key structural features and functions involved in the life processes of plants and animals - reproduction</li> <li>Describe the organisation of life at the cellular level</li> </ul> <p>Scipad topics related to Living World: Medical Science, Genetics and Evolution</p> <p><b>Planet Earth and Beyond</b></p> <ul style="list-style-type: none"> <li>Investigate the composition, structure and features of the geosphere, hydrosphere and atmosphere.</li> <li>Investigate how the heat from the sun, the Earth and human activities is distributed around Earth by the geosphere, hydrosphere and atmosphere.</li> <li>Investigate the conditions on the planets and their moons and the factors that affect them</li> </ul> <p>Scipad topics related to Planet Earth and Beyond: Earth Science and Geology, Fuels and Climate Change</p> <p><b>Physical World</b></p> <ul style="list-style-type: none"> <li>Identify and Describe the patterns associated with the physical phenomena found in simple everyday situations involving Forces, Electricity</li> <li>Explore the technological or biological application of physics</li> </ul> <p>Scipad topics related to Physical World: Electricity and Magnetism, Forces and Motion</p> <p><b>Material World</b></p> <ul style="list-style-type: none"> <li>Investigate chemical and physical properties of different groups of substances – acids and bases, fuels and metals</li> <li>Distinguish between pure substances, mixtures and between elements and compounds</li> <li>Describe the structure of the atoms of different elements</li> <li>Distinguish between an element and a compound, a pure substance and a mixture at particle level.</li> <li>Link the properties of different groups of substances to the way they are used in society or occur in nature.</li> </ul> <p>Scipad topics related to Material World: Atomic Science, Acids and Bases, Metallurgy</p>
<b>Terminology</b>	<p>Literacy to be assessed using science topics – report writing, statistics and measuring.</p> <ul style="list-style-type: none"> <li>Terminology related to Environment, Ecosystems, Investigations, Classification, Life processes, geosphere, hydrosphere and atmosphere, Space, Energy, Heat, Sound, Elements, Compounds, Mixtures, Particle nature of matter</li> </ul>
<b>Assessments</b>	Teacher judgement based on success criteria and SOLO, Thinking with Evidence Science Test, Projects, Written Tasks, Oral, Self and peer assessment
<b>Teaching Strategies</b>	Enquiry based on the overarching nature of science

<b>Community Support Ideas</b>	Parents on trips and use of community experts Involved in community activities
<b>Key Competencies</b>	Thinking Using Language, Symbols and Text Managing Self Relating to others Participating and contributing

<b>Year Level</b>	<b>11</b> <b>Level 6</b>
<b>SOLO</b>	By the end of the year students will be at least to multi structural level moving towards relational
<b>Skills</b>	By the end of Year 11 students will be able to: Explore, Explain, Investigate, Demonstrate, Identify, Distinguish, Link, Experiment, Investigate
<b>Possible Topics</b>  <b>To be covered through L1 Science Scipad workbooks</b>	<p><b>Living World</b></p> <ul style="list-style-type: none"> <li>• Explore patterns in the inheritance of genetically controlled characteristics</li> <li>• Explain the importance of variation within a changing environment</li> </ul> <p><b>Physical World</b></p> <ul style="list-style-type: none"> <li>• Investigate trends and relationships in physical phenomena in mechanics</li> <li>• Demonstrate an understanding of physical phenomena and concepts explaining and solving questions and problems that relate to straightforward situations.</li> </ul> <p><b>Material World</b></p> <ul style="list-style-type: none"> <li>• Identify patterns and trends in the properties of a range of groups of substances e.g. acids and bases, metals and non-metals</li> <li>• Explore factors that affect chemical processes</li> <li>• Distinguish between atoms, molecules and ions, including covalent and ionic bonding</li> <li>• Link atomic structure to the organisation of the periodic table</li> <li>• Use particle theory to explain factors that affect chemical processes</li> </ul>
<b>NCEA Terminology</b>	<ul style="list-style-type: none"> <li>• Achieve (Describe, SOLO multi-structural), Merit (Explain, SOLO Relational) and Excellence (Discuss, SOLO Extended Abstract)</li> <li>• Terminology related to Genetics and Variation, Mechanics, Atomic structure and bonding, Acids and Bases, Periodic table, Experimental Investigations</li> </ul>
<b>Assessments</b>	<p>Internal Standards offered this year are Practical Physics 90935, Chemistry 90930, Biology 90925, Investigate selected chemical reactions 90947</p> <p>External standards that students can sit are Acids and Bases 90944, Mechanics 90940, Genetic variation 90948</p> <p>L1 Chemistry Internal Standards available. Chemistry in a technological application 90931, Aspects of Carbon Chemistry 90932, Aspects of selected elements 90933, Aspects of chemical reactions 90944.</p> <p>L1 Physics internal standards available: Physics of an application 90936, Aspects of electricity and magnetism 90937, Aspects of wave behaviour 90938, Aspects of heat 90939,</p> <p>L1 Biology internal standards available: Report on a biological issue 90926, Biological ideas relating to microorganisms 90927, Biological ideas related to the life cycle of flowering plants 90928, biological ideas relating to a mammal(s) as a consumer(s) 90929</p>
<b>Teaching Strategies</b>	<p>Enquiry based on the overarching of the nature of science</p> <p>Exemplars of performance shared with students.</p> <p>Clear expectations given around deadlines and conditions of assessment. Opportunities for reassessment given wherever possible and desirable for the student.</p> <p>A variety of strategies are used including – practical work, note taking, problem solving, questioning, matching sentences and words, DVD's, applets, games, demonstrations, Investigations</p>
<b>Community Support</b>	Parents on trips and use of community experts Involved in community activities

<b>Ideas</b>		
<b>Key Competencies</b>	Thinking Using Language, Symbols and Text Managing Self	Relating to others Participating and contributing

If students take a second science, they can choose from Level one Biology, Chemistry, Physics, Earth and Space Science or Agriculture/Horticulture or can create a combination course from the topics and assessments in the matrices of Science and Ag/Hort.

<b>Year Level 12</b>	<b>Level 7</b>
<b>SOLO</b>	By the end of the year students will be at least to multi structural level moving towards relational
<b>Skills</b>	By the end of Year 12 students will be able to: Explore, Explain, Investigate, Demonstrate, Identify, Distinguish, Apply, Experiment, Investigate, understand, Develop, Analyse, Relate
<b>Possible Topics</b>	<p><b>Biology (Living World)</b></p> <ul style="list-style-type: none"> <li>● Explore the diverse ways in which animals and plants carry out the life processes.</li> <li>● Explore ecological distribution patterns and explain possible causes for these patterns.</li> <li>● Understand that DNA and the environment interact in gene expression</li> <li>● Explain how the interaction between ecological factors and natural selection leads to genetic changes within populations.</li> </ul> <p><b>Earth and Space Science</b></p> <ul style="list-style-type: none"> <li>● Develop an understanding of the causes of natural hazards and their interactions with human activity on Earth.</li> <li>● Explain the nature and life cycles of different types of stars in terms of energy changes and time.</li> </ul> <p><b>Physics (Physical World)</b></p> <ul style="list-style-type: none"> <li>● Investigate physical phenomena (in the areas of mechanics, electricity, electromagnetism, light and waves and atomic and nuclear physics) and produce qualitative and quantitative explanations for a variety of unfamiliar situations.</li> <li>● Analyse data to deduce complex trends and relationships in physical phenomena.</li> <li>● Use physics ideas to explain a technological or biological application of physics.</li> </ul> <p><b>Chemistry (Material World)</b></p> <ul style="list-style-type: none"> <li>● Investigate and measure the chemical and physical properties of a range of groups of substances (acids and base3s, oxidants and reductants, selected organic and inorganic compounds).</li> <li>● Relate properties of matter to structure and bonding</li> <li>● Develop an understanding of and use the fundamental concepts of chemistry (equilibrium and thermochemical principles) to interpret observations.</li> <li>● Apply knowledge of chemistry to explain aspects of the natural world and how chemistry is used in society to meet needs, resolve issues and develop new technologies.</li> </ul> <p><b>Agriculture and Horticulture</b></p> <ul style="list-style-type: none"> <li>● Extended practical investigation</li> <li>● Plant propagation techniques used for commercial production in NZ</li> <li>● How management practices influence plant growth and development and how physical factors can be modified.</li> <li>● Landscaping</li> <li>● Understanding of livestock reproduction techniques, management practices and interactions between livestock behaviour.</li> </ul> <p><b>Science Level 2</b></p> <ul style="list-style-type: none"> <li>● A level 2 science course can be made up of any of the topics and assessments from the above courses.</li> </ul>

<b>NCEA Terminology</b>	<ul style="list-style-type: none"> <li>● Achieve (Describe, SOLO multi-structural), Merit (Explain, SOLO Relational) and Excellence (Discuss, SOLO Extended Abstract)</li> <li>● <b>Biology</b> Terminology of practical investigations, Adaptations of plants or animals, cell structure, function and processes, genetic variation and change, ecology and patterns, gene expression, microscopes</li> <li>● <b>Earth and Space Science</b> Terminology of practical investigations, Geological processes, extreme environments, Stars and planetary systems, Earth systems</li> <li>● <b>Chemistry</b> Terminology of practical investigations, Quantitative analysis, ions and precipitates, Oxidation-reduction, Atomic structure, bonding and energy changes, chemical reactivity, organic chemistry</li> <li>● <b>Physics</b> Terminology of practical investigations, Waves, Mechanics, Atomic and Nuclear Physics, Electricity and electromagnetism.</li> <li>● <b>Ag/Hort</b> Terminology of practical investigations, landscaping, plant propagation and management practices that influence growth, livestock management and practices.</li> </ul>
<b>Assessments</b>	<b>Biology</b>
	<p><b>Internal Standards</b> offered are 91153 Practical investigation, 91154 Analyse biological validity of information presented to the public, 91155 Demonstrate understanding of adaptations of plants or animals to their way of life, 91158 Investigate a pattern in an ecological community, 91160 Investigate biological material at the microscope level</p> <p><b>External standards</b> offered are 91156 Demonstrate understanding of life processes at the cellular level, 91157 Demonstrate understanding of genetic variation and change, 91159 Demonstrate understanding of gene expression</p> <p><b>Earth and Space Science</b></p> <p><b>Internal Standards</b> offered are 91187 Practical Investigation, 91188 An issue and the validity of the information communicated to the public, 91189 Geological processes in a NZ locality, 91190 How organisms survive in an extreme environment</p> <p><b>External standards</b> offered are 91191 Demonstrate understanding of the causes of extreme Earth events in NZ, 91192 demonstrate understanding of stars and planetary systems, 91193 Demonstrate understanding of physical principles related to the Earth System.</p> <p><b>Chemistry</b></p> <p><b>Internal Standards</b> offered are 91161 Quantitative analysis, 91162 identifying ions in solutions, 91167 Redox reactions</p> <p><b>External standards</b> offered are 91164 Bonding, structural properties and energy changes, 91166 Chemical reactivity, 91165 Organic chemistry</p> <p><b>Physics</b></p> <p><b>Internal Standards</b> offered are 91168 Practical investigation that leads to a non-linear mathematical relationship, 91172 Atomic and nuclear physics, 91169 Understanding of physics relevant to a selected context</p> <p><b>External standards</b> offered are 91171 Mechanics, 91170 Waves, 91173 Electricity and electromagnetism</p> <p><b>Agriculture and Horticulture</b> A variety of internal and external achievement standards can be offered depending on the students interests and needs.</p>
<b>Teaching Strategies</b>	<p>Enquiry based on the overarching of the nature of science</p> <p>Exemplars of performance shared with students.</p> <p>Clear expectations given around deadlines and conditions of assessment. Opportunities for reassessment given wherever possible and desirable for the student.</p> <p>A variety of strategies are used including – practical work, note taking, problem solving, questioning, matching sentences and words, DVD's, applets, games, demonstrations, Investigations</p>

<b>Community Support Ideas</b>	Parents on trips and use of community experts Involved in community activities
<b>Key Competencies</b>	Thinking Using Language, Symbols and Text Managing Self Relating to others Participating and contributing

Students may also take a Level 2 science course made up of a mixture of any standards from any area of science above plus any Agriculture and Horticulture standard if they decide they don't want to do a full course in a single science subject.

<b>Year Level 13</b>	<b>Level 8</b>
<b>SOLO</b>	By the end of the year students will be at least to multi structural level moving towards relational
<b>Skills</b>	By the end of Year 13 students will be able to: Explore, Explain, Investigate, Demonstrate, Identify, Distinguish, Link, Experiment, Investigate, Develop, Analyse, Relate, Apply, Understand
<b>Possible Topics</b>	<p><b>Biology (Living World)</b></p> <ul style="list-style-type: none"> <li>Understand the relationship between organisms and their environment.</li> <li>Explore the evolutionary processes that have resulted in the diversity of life on Earth and appreciate the place and impact of humans within these processes.</li> <li>Understand how humans manipulate the transfer of genetic information from one generation to the next and make informed judgements about the social, ethical and biological implications relating to this manipulation.</li> </ul> <p><b>Earth and Space Science</b></p> <ul style="list-style-type: none"> <li>Develop an in-depth understanding of the interrelationship between human activities and the geosphere, hydrosphere, atmosphere and biosphere over time.</li> <li>Explore recent astronomical events or discoveries showing understanding of the concepts of distance and time.</li> </ul> <p><b>Physics (Physical World)</b></p> <ul style="list-style-type: none"> <li>Investigate physical phenomena (in the areas of mechanics, electricity, electromagnetism, light and waves and atomic and nuclear physics) and produce qualitative and quantitative explanations for a variety of complex situations.</li> <li>Analyse and evaluate data to deduce complex trends and relationships in physical phenomena.</li> <li>Use physics ideas to explain a technological or biological or astronomical application of physics and discuss related issues.</li> </ul> <p><b>Chemistry (Material World)</b></p> <ul style="list-style-type: none"> <li>Investigate and measure the chemical and physical properties of a range of groups of substances (acids and bases, oxidants and reductants, selected organic and inorganic compounds).</li> <li>Relate properties of matter to structure and bonding</li> <li>Develop an understanding of and use the fundamental concepts of chemistry (equilibrium and thermochemical principles) to interpret observations.</li> <li>Apply knowledge of chemistry to explain aspects of the natural world and how chemistry is used in society to meet needs, resolve issues and develop new technologies.</li> </ul>
<b>NCEA Terminology</b>	<ul style="list-style-type: none"> <li>Achieve (Describe, SOLO multi-structural), Merit (Explain, SOLO Relational) and Excellence (Discuss, SOLO Extended Abstract)</li> <li><b>Biology</b> Terminology of practical investigations, Adaptations of plants and animals and their responses to the environment, evolution, human evolution, biotechnology,</li> <li><b>Earth and Space Science</b> Terminology of practical investigations, Geological processes and dating, Processes in the ocean and atmosphere systems, Astronomy</li> <li><b>Chemistry</b> Terminology of practical investigations, Quantitative analysis, Oxidation-reduction, Atomic structure, bonding and thermochemical principles, equilibrium principles and aqueous systems, organic chemistry, spectroscopic data</li> <li><b>Physics</b> Terminology of practical investigations relating to two variables in a non-linear relationship, Waves, Mechanical systems, Modern physics, Electrical systems</li> </ul>

<b>Assessments</b>	<p><b>Biology</b></p> <p><b>Internal Standards</b> offered are 91601 Practical investigation, 91602 Integrate biological knowledge to develop an informed response to a socio-scientific issue, 91604 Demonstrate understanding of how an animal maintains a stable internal environment, 91607 Demonstrate understanding of human manipulations of genetic transfer and its biological implications</p> <p><b>External standards</b> offered are 91603 Demonstrate understanding of the responses of plants and animals to their external environment, 91605 Demonstrate understanding of evolutionary processes leading to speciation, 91606 Demonstrate understanding of trends in human evolution</p> <p><b>Earth and Space Science</b></p> <p><b>Internal Standards</b> offered are 91410 Practical Investigation, 91411 Investigate a socio- scientific issue in an Earth and Space Science context, 91412 Investigate the evidence related to dating geological events, 91415 Investigate an aspect of Astronomy</p> <p><b>External standards</b> offered are 91413 Demonstrate understanding of processes in the ocean system, 91414 Demonstrate understanding of processes in the atmosphere system</p> <p><b>Chemistry</b></p> <p><b>Internal Standards</b> offered are 91387 Carry out an investigation in chemistry involving quantitative analysis, 91388 demonstrate understanding of spectroscopic data in chemistry, 91393 Demonstrate understanding of oxidation-reduction processes</p> <p><b>External standards</b> offered are 91390 demonstrate understanding of thermochemical principles and the properties of particles and substances, 91391 Demonstrate understanding of the properties of organic compounds, 91392 Demonstrate understanding of equilibrium principles in aqueous systems.</p> <p><b>Physics</b></p> <p><b>Internal Standards</b> offered are 91521 Practical investigation, 91522 demonstrate understanding of the application of physics to a selected context, 91525 Demonstrate understanding of modern physics, 91527 use physics knowledge to develop an informed response to a socio-scientific issue</p> <p><b>External standards</b> offered are 91524 demonstrate understanding of Mechanical systems, 91523 demonstrate understanding of Waves systems, 91526 demonstrate understanding of electrical systems</p>
<b>Teaching Strategies</b>	<p>Enquiry based on the overarching of the nature of science</p> <p>Exemplars of performance shared with students.</p> <p>Clear expectations given around deadlines and conditions of assessment. Opportunities for reassessment given wherever possible and desirable for the student.</p> <p>A variety of strategies are used including – practical work, note taking, problem solving, questioning, matching sentences and words, DVD's, applets, games, demonstrations, Investigations</p>
<b>Community Support Ideas</b>	<p>Parents on trips and use of community experts</p> <p>Involved in community activities</p>
<b>Key Competencies</b>	<p>Thinking</p> <p>Using Language, Symbols and Text</p> <p>Managing Self</p> <p>Relating to others</p> <p>Participating and contributing</p>