NSW Syllabus

**Science Life Skills**

**Stage 6**

**Syllabus**

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# Introduction

## Stage 6 Curriculum

NSW Education Standards Authority (NESA) Stage 6 syllabuses have been developed to provide students with opportunities to further develop skills which will assist in the next stage of their lives.

The purpose of Stage 6 syllabuses is to:

* develop a solid foundation of literacy and numeracy
* provide a curriculum structure which encourages students to complete secondary education at their highest possible level
* foster the intellectual, creative, ethical and social development of students, in particular relating to:
  + application of knowledge, understanding, skills, values and attitudes in the fields of study they choose
  + capacity to manage their own learning and to become flexible, independent thinkers, problem-solvers and decision-makers
  + capacity to work collaboratively with others
  + respect for the cultural diversity of Australian society
  + desire to continue learning in formal or informal settings after school
* provide a flexible structure within which students can meet the challenges of and prepare for:
  + further academic study, vocational training and employment
  + changing workplaces, including an increasingly STEM-focused (Science, Technology, Engineering and Mathematics) workforce
  + full and active participation as global citizens
* provide formal assessment and certification of students’ achievements
* promote the development of students’ values, identity and self-respect.

The Stage 6 syllabuses reflect the principles of the NESA *K–10 Curriculum Framework* and *Statement of Equity Principles*, the reforms of the NSW Government *Stronger HSC Standards* (2016), and nationally agreed educational goals. These syllabuses build on the continuum of learning developed in the K–10 syllabuses.

The syllabuses provide a set of broad learning outcomes that summarise the knowledge, understanding, skills, values and attitudes important for students to succeed in and beyond their schooling. In particular, the attainment of skills in literacy and numeracy needed for further study, employment and active participation in society are provided in the syllabuses in alignment with the *Australian Core Skills Framework* (ACSF).

The Stage 6 syllabuses include the content of the Australian curriculum and additional descriptions that clarify the scope and depth of learning in each subject.

NESA syllabuses support a standards-referenced approach to assessment by detailing the important knowledge, understanding, skills, values and attitudes students will develop and outlining clear standards of what students are expected to know and be able to do. The syllabuses take into account the diverse needs of all students and provide structures and processes by which teachers can provide continuity of study for all students.

## Diversity of Learners

NSW Stage 6 syllabuses are inclusive of the learning needs of all students. Syllabuses accommodate teaching approaches that support student diversity, including students with special education needs, gifted and talented students, and students learning English as an additional language or dialect (EAL/D). Students may have more than one learning need.

### Students with Special Education Needs

All students are entitled to participate in and progress through the curriculum. Schools are required to provide additional support or adjustments to teaching, learning and assessment activities for some students with special education needs. [Adjustments](http://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/Diversity-in-learning/stage-6-special-education/adjustments) are measures or actions taken in relation to teaching, learning and assessment that enable a student with special education needs to access syllabus outcomes and content, and demonstrate achievement of outcomes.

Students with special education needs can access the outcomes and content from Stage 6 syllabuses in a range of ways. Students may engage with:

* Stage 6 syllabus outcomes and content with adjustments to teaching, learning and/or assessment activities; or
* selected Stage 6 Life Skills outcomes and content from one or more Stage 6 Life Skills syllabuses.

Decisions regarding curriculum options, including adjustments, should be made in the context of [collaborative curriculum planning](http://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/Diversity-in-learning/stage-6-special-education/collaborative-curriculum-planning) with the student, parent/carer and other significant individuals to ensure that decisions are appropriate for the learning needs and priorities of individual students.

Further information can be found in support materials for:

* Science Life Skills
* Special education needs
* Life Skills.

### Gifted and Talented Students

Gifted students have specific learning needs that may require adjustments to the pace, level and content of the curriculum. Differentiated educational opportunities assist in meeting the needs of gifted students.

Generally, gifted students demonstrate the following characteristics:

* the capacity to learn at faster rates
* the capacity to find and solve problems
* the capacity to make connections and manipulate abstract ideas.

There are different kinds and levels of giftedness. Gifted and talented students may also possess learning difficulties and/or disabilities that should be addressed when planning appropriate teaching, learning and assessment activities.

Curriculum strategies for gifted and talented students may include:

* differentiation: modifying the pace, level and content of teaching, learning and assessment activities
* acceleration: promoting a student to a level of study beyond their age group
* curriculum compacting: assessing a student’s current level of learning and addressing aspects of the curriculum that have not yet been mastered.

School decisions about appropriate strategies are generally collaborative and involve teachers, parents and students, with reference to documents and advice available from NESA and the education sectors.

Gifted and talented students may also benefit from individual planning to determine the curriculum options, as well as teaching, learning and assessment strategies, most suited to their needs and abilities.

### Students Learning English as an Additional Language or Dialect (EAL/D)

Many students in Australian schools are learning English as an additional language or dialect (EAL/D). EAL/D students are those whose first language is a language or dialect other than Standard Australian English and who require additional support to assist them to develop English language proficiency.

EAL/D students come from diverse backgrounds and may include:

* overseas and Australian-born students whose first language is a language other than English, including creoles and related varieties
* Aboriginal and Torres Strait Islander students whose first language is Aboriginal English, including Kriol and related varieties.

EAL/D students enter Australian schools at different ages and stages of schooling and at different stages of English language learning. They have diverse talents and capabilities and a range of prior learning experiences and levels of literacy in their first language and in English. EAL/D students represent a significant and growing percentage of learners in NSW schools. For some, school is the only place they use Standard Australian English.

EAL/D students are simultaneously learning a new language and the knowledge, understanding and skills of the *Science Life Skills Stage 6 Syllabus* through that new language. They may require additional support, along with informed teaching that explicitly addresses their language needs.

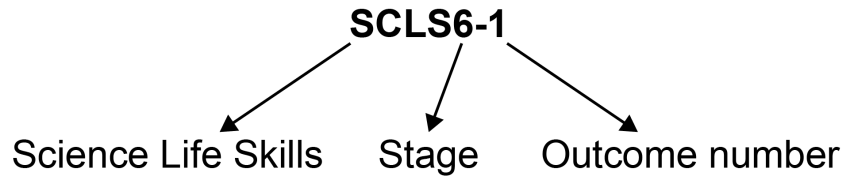
The *ESL Scales* and the[*English as an Additional Language or Dialect: Teacher Resource*](http://www.acara.edu.au/curriculum/student-diversity/english-as-an-additional-Language-or-dialect) provide information about the English language development phases of EAL/D students. These materials and other resources can be used to support the specific needs of English language learners and to assist students to access syllabus outcomes and content.

# Science Life Skills Key

The following codes and icons are used in the *Science Life Skills Stage 6 Syllabus*.

## Outcome Coding

Syllabus outcomes have been coded in a consistent way. The code identifies the subject, Year and outcome number. For example:



| **Outcome code** | **Interpretation** |
| --- | --- |
| SCLS6-1 | Science Life Skills, Stage 6 – outcome number 1 |
| INS11/12-1 | Investigating Science – outcome number 1 |
| INS11-8 | Investigating Science, Year 11 – outcome number 8 |
| INS12-12 | Investigating Science, Year 12 – outcome number 12 |

## Learning Across the Curriculum Icons

Learning across the curriculum content, including cross-curriculum priorities, general capabilities and other areas identified as important learning for all students, is incorporated and identified by icons in the syllabus.

**Cross-curriculum priorities**

Aboriginal and Torres Strait Islander histories and cultures icon Aboriginal and Torres Strait Islander histories and cultures

Asia and Australia’s engagement with Asia icon Asia and Australia’s engagement with Asia

Sustainability icon Sustainability

**General capabilities**

Critical and creative thinking icon Critical and creative thinking

Ethical understanding icon Ethical understanding

 Information and communication technology capability icon Information and communication technology capability

Intercultural understanding icon Intercultural understanding

Literacy icon Literacy

Numeracy icon Numeracy

Personal and social capability icon Personal and social capability

**Other learning across the curriculum areas**

Civics and citizenship icon Civics and citizenship

Difference and diversity icon Difference and diversity

Work and enterprise icon Work and enterprise

# Science Life Skills Stage 6

The *Science Life Skills Stage 6 Syllabus* aligns with the rationale, aim, objectives and outcomes of the *Investigating Science Stage 6 Syllabus*. The Life Skills content has been developed from each discipline of Science, providing opportunities for independent or integrated delivery with other Science Stage 6 courses.

Before deciding that a student should undertake a course based on Life Skills outcomes and content, consideration should be given to other ways of assisting the student to engage with the regular course outcomes. This assistance may include a range of adjustments to the teaching, learning and assessment activities of the Science Stage 6 curriculum.

If the adjustments do not provide a student with sufficient access to some or all of the Stage 6 outcomes, a decision can be explored for the student to undertake Life Skills outcomes and content. This decision should be made through the collaborative curriculum planning process involving the student and parent/carer and other significant individuals. School principals are responsible for the management of the collaborative curriculum planning process.

The following points need to be taken into consideration:

* students are not required to complete all Life Skills outcomes
* specific Life Skills outcomes should be selected based on the needs, strengths, goals, interests and prior learning of each student
* outcomes may be demonstrated independently or with support.

Further information in relation to planning, implementing and assessing Life Skills outcomes and content can be found in support materials for:

* Science
* Special education needs
* Life Skills.

# Rationale

The *Science* *Life Skills Stage 6 Syllabus* rationale is consistent with the *Investigating Science Stage 6 Syllabus* rationale. The Investigating Science rationale is provided below.

The *Investigating Science Stage 6 Syllabus* is designed to engage students of all abilities with scientific processes and have them apply those processes to investigate relevant personal, community and global scientific issues.

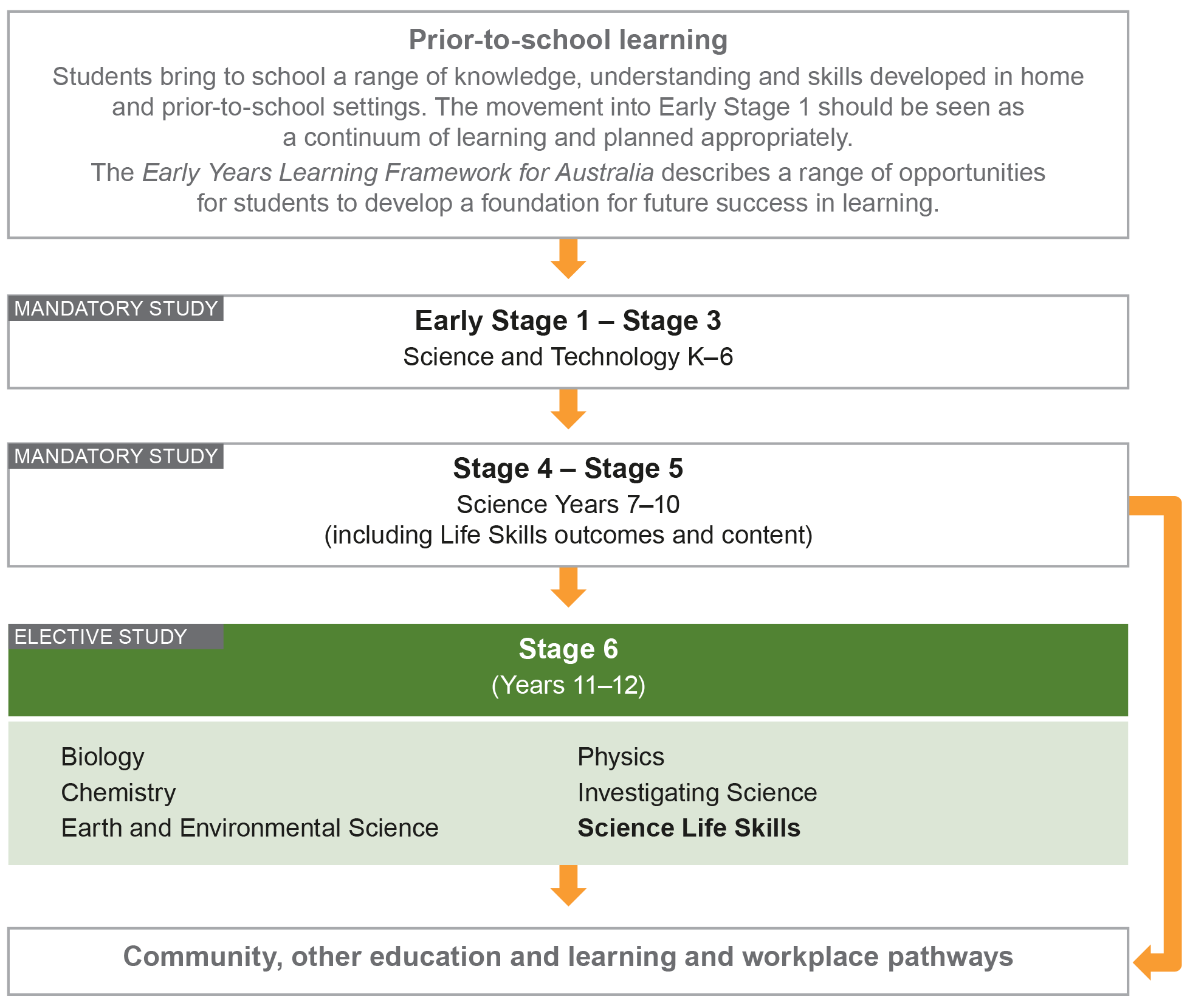
The ongoing study of science and the specific Working Scientifically processes and their application have led humans to accumulate an evidence-based body of knowledge about human interactions – past, present and future – with the world and its galactic neighbourhood. The course is firmly focused on developing these skills, as they provide a foundation for students to value investigation, solve problems, develop and communicate evidence-based arguments, and make informed decisions.

The course promotes active inquiry and explores key concepts, models and phenomena. It draws and builds on the knowledge, understanding, skills, values and attitudes gained in Science Stage 5. The course is designed to enhance students’ understanding of the value of evidence-based investigations and the use of science-based inquiry in their lives.

Investigating Science is designed to complement the study of the science disciplines by providing additional opportunities for students to investigate and develop an understanding of scientific concepts, their current and future uses, and their impacts on science and society. The course draws on and promotes interdisciplinary science by allowing students to investigate a wide range of STEM (Science, Technology, Engineering and Mathematics) related issues and concepts in depth.

Investigating Science encourages the development of a range of capabilities and capacities that will enhance a student's ability to participate in all aspects of community life and within a fast-changing technological landscape. The knowledge, understanding and skills gained from this course are intended to support students’ ongoing engagement with science, and to form the foundation for further studies and participation in current and emerging STEM-related post-school activities and industries.

# The Place of the Science Life Skills Stage 6 Syllabus in the K–12 Curriculum



# Aim

The *Science* *Life Skills Stage 6 Syllabus* aim is consistent with the *Investigating Science Stage 6 Syllabus* aim. The Investigating Science aim is provided below.

The study of Investigating Science in Stage 6 enables students to develop an appreciation and understanding of science as a body of knowledge and a set of valuable processes that provide humans with an ability to understand themselves and the world in which they live. Through applying Working Scientifically processes, the course aims to enhance students’ analytical and problem-solving skills in order to make evidence-based decisions and engage with and positively participate in an ever-changing, interconnected technological world.

# Objectives

## Skills

Students:

* develop skills in applying the processes of Working Scientifically.

## Knowledge and Understanding

Students:

* develop knowledge and understanding of cause and effect
* develop knowledge and understanding of models, theories and laws
* develop knowledge and understanding of science and technology
* develop knowledge and understanding of contemporary issues involving science.

## Values and Attitudes

Students:

* develop positive, informed values and attitudes towards science
* recognise the importance and relevance of science in their lives
* recognise the influence of economic, political and societal impacts on the development of scientific knowledge
* develop an appreciation of the influence of imagination and creativity in scientific research.

# Outcomes

## Table of Objectives and Outcomes – Continuum of Learning

For students undertaking Science Life Skills:

* students are not required to complete all Life Skills outcomes
* specific Life Skills outcomes should be selected on the basis that they meet the learning needs, strengths, goals and interests of each student
* outcomes may be demonstrated independently or with support.

### Skills

|  |
| --- |
| **Objective**  Students:   * develop skills in applying the processes of Working Scientifically |
| **Life Skills outcomes**  A student: |
| **Questioning and predicting**  **SCLS6-1** poses questions and hypotheses for scientific investigation |
| **Planning investigations**  **SCLS6-2** plans an investigation individually or collaboratively to obtain primary or secondary data and information |
| **Conducting investigations**  **SCLS6-3** participates in investigations individually or collaboratively to collect primary or secondary data and information |
| **Processing data and information**  **SCLS6-4** collects and represents qualitative or quantitative data and information using media as appropriate |
| **Analysing data and information**  **SCLS6-5** develops conclusions from primary or secondary data and information |
| **Problem solving**  **SCLS6-6** uses strategies to solve scientific problems |
| **Communicating**  **SCLS6-7** communicates information about an investigation using scientific language and terminology |

The Working Scientifically outcomes found at the beginning of each module are targeted for emphasis. The other Working Scientifically outcomes could also be addressed in each module**.**

### Knowledge and Understanding

|  |
| --- |
| **Objective**  Students:   * develop knowledge and understanding of cause and effect |
| **Life Skills outcomes**  A student:  **SCLS6-8** identifies how primary or secondary data is used in scientific investigations  **SCLS6-9** uses patterns and trends in data to make observations and draw conclusions |
| **Objective**  Students:   * develop knowledge and understanding of models, theories and laws |
| **Life Skills outcomes**  A student:  **SCLS6-10** explores models and descriptions of phenomena |
| **Objective**  Students:   * develop knowledge and understanding of science and technology |
| **Life Skills outcomes**  A student:  **SCLS6-11** recognises processes involved in a range of scientific investigations  **SCLS6-12** investigates technologies used in science |
| **Objective**  Students:   * develop knowledge and understanding of contemporary issues involving science |
| **Life Skills outcomes**  A student:  **SCLS6-13** recognises that scientific investigations can support or refute a hypothesis  **SCLS6-14** investigates how science impacts on society  **SCLS6-15** explores contemporary issues involving science |

## Science Life Skills Stage 6 and Related Investigating Science Stage 6 Syllabus Outcomes

### Skills

|  |  |
| --- | --- |
| **Objective**  Students:   * develop skills in applying the processes of Working Scientifically | |
| **Life Skills outcomes**  A student: | **Related Investigating Science outcomes**  A student: |
| **Questioning and predicting** | |
| **SCLS6-1** poses questions and hypotheses for scientific investigation | **INS11/12-1** develops and evaluates questions and hypotheses for scientific investigation |
| **Planning investigations** | |
| **SCLS6-2** plans an investigation individually or collaboratively to obtain primary or secondary data and information | **INS11/12-2** designs and evaluates investigations in order to obtain primary and secondary data and information |
| **Conducting investigations** | |
| **SCLS6-3** participates in investigations individually or collaboratively to collect primary or secondary data and information | **INS11/12-3** conducts investigations to collect valid and reliable primary and secondary data and information |
| **Processing data and information** | |
| **SCLS6-4** collects and represents qualitative or quantitative data and information using media as appropriate | **INS11/12-4** selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media |
| **Analysing data and information** | |
| **SCLS6-5** develops conclusions from primary or secondary data and information | **INS11/12-5** analyses and evaluates primary and secondary data and information |
| **Problem solving** | |
| **SCLS6-6** uses strategies to solve scientific problems | **INS11/12-6** solves scientific problems using primary and secondary data, critical thinking skills and scientific processes |
| **Communicating** | |
| **SCLS6-7** communicates information about an investigation using scientific language and terminology | **INS11/12-7** communicates scientific understanding using suitable language and terminology for a specific audience or purpose |

### Knowledge and Understanding

|  |  |
| --- | --- |
| **Objective**  Students:   * develop knowledge and understanding of cause and effect | |
| **Life Skills outcomes**  A student: | **Related Investigating Science outcomes**  A student: |
| **SCLS6-8** identifies how primary or secondary data is used in scientific investigations  **SCLS6-9** uses patterns and trends in data to make observations and draw conclusions | **INS11-8** identifies that the collection of primary and secondary data initiates scientific investigations  **INS11-9** examines the use of inferences and generalisations in scientific investigations |
| **Objective**  Students:   * develop knowledge and understanding of models, theories and laws | |
| **SCLS6-10** explores models and descriptions of phenomena | **INS11-10** develops and engages with modelling as an aid in predicting and simplifying scientific objects and processes  **INS11-11** describes and assesses how scientific explanations, laws and theories have developed |
| **Objective**  Students:   * develop knowledge and understanding of science and technology | |
| **SCLS6-11** recognises processes involved in a range of scientific investigations  **SCLS6-12** investigates technologies used in science | **INS12-12** develops and evaluates the process of undertaking scientific investigations  **INS12-13** describes and explains how science drives the development of technologies |
| **Objective**  Students:   * develop knowledge and understanding of contemporary issues involving science | |
| **SCLS6-13** recognises that scientific investigations can support or refute a hypothesis  **SCLS6-14** investigates how science impacts on society  **SCLS6-15** explores contemporary issues involving science | **INS12-14** uses evidence-based analysis in a scientific investigation to support or refute a hypothesis  **INS12-15** evaluates the implications of ethical, social, economic and political influences on science |

# Course Structure

| For each course:  **Year 11**  **(120 hours)**  **Year 12**  **(120 hours)** | **Working Scientifically Skills** | **Course** | **Suggested modules** | **Depth studies** |
| --- | --- | --- | --- | --- |
| Investigating Science Life Skills | Cause and effect  Scientific models  Science and technology  Science and society |
| Physical World Science Life Skills | Forces and motion  Energy |
| Earth and Space Science Life Skills | Earth’s resources  Human impacts  Earth’s processes and hazards  Resource management |
| Living World Science Life Skills | The structure and organisation of living things  Diversity and ecosystems  Heredity and genetics  Disease and disorders |
| Chemical World Science Life Skills | Properties of matter  Chemical reactions |

For Science Life Skills:

* Students may complete one or more coursesto contribute up to six units of study towards their Preliminary or HSC pattern of study.
* Students are not required to address or achieve all the Science Life Skills outcomes.
* Students are not required to complete all of the content to demonstrate achievement of an outcome.
* Outcomes and content should be selected to meet the particular needs of individual students.
* The modules provide possible frameworks for addressing the Science Life Skills outcomes and content, and are suggestions only. Teachers have the flexibility to develop modules that will meet the needs, strengths, goals, interests and prior learning of their students.
* Examples provided under the content points are suggestions only. Teachers may use the examples provided or develop other examples to meet the particular needs of individual students.
* Working Scientifically outcomes and content are to be integrated into modules wherever students undertake an investigation.
* Depth studies may be undertaken within any course and can relate to any module in a course.

# Assessment and Reporting

A student undertaking Science Life Skills will study selected outcomes and content, as identified through the [collaborative curriculum planning](http://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/Diversity-in-learning/stage-6-special-education/collaborative-curriculum-planning) process. The syllabus outcomes and content form the basis of learning opportunities for students.

[Assessment](http://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/Diversity-in-learning/stage-6-special-education/life-skills/assessment-and-reporting) should provide opportunities for students to demonstrate achievement in relation to the outcomes and to apply their knowledge, understanding and skills to a range of situations or environments, including the school and the wider community.

Evidence of student achievement of Life Skills outcomes can be based on a range of *assessment for learning* opportunities. There is no requirement for formal assessment of Life Skills outcomes. Schools are not required to report achievement using the Preliminary Common Grade Scale or assessment marks.

This information should be read in conjunction with requirements on the [Assessment Certification Examination (ACE)](http://ace.bostes.nsw.edu.au/) website.

Additional advice is available in the *Principles of Assessment for Stage 6*.

# Content

Content in Stage 6 Life Skills syllabuses is suggested. Content describes the intended learning for students as they work towards achieving one or more syllabus outcomes. It provides the foundations for students to progress to the next stage of schooling or post-school opportunities.

Teachers will make decisions about the choice of outcomes and selection of content regarding the sequence, emphasis and any adjustments required based on the needs, strengths, goals, interests and prior learning of students.

## Organisation of Content

The *Science Life Skills Stage 6 Syllabus* includes five courses:

* Investigating Science Life Skills
* Physical World Science Life Skills
* Earth and Space Science Life Skills
* Living World Science Life Skills
* Chemical World Science Life Skills.

The content of each of these courses is unique but the courses draw on the same outcomes to enable teaching and learning programs to be developed with a specific Science focus.

Students may undertake up to three Science Life Skills courses in both Years 11 and 12.

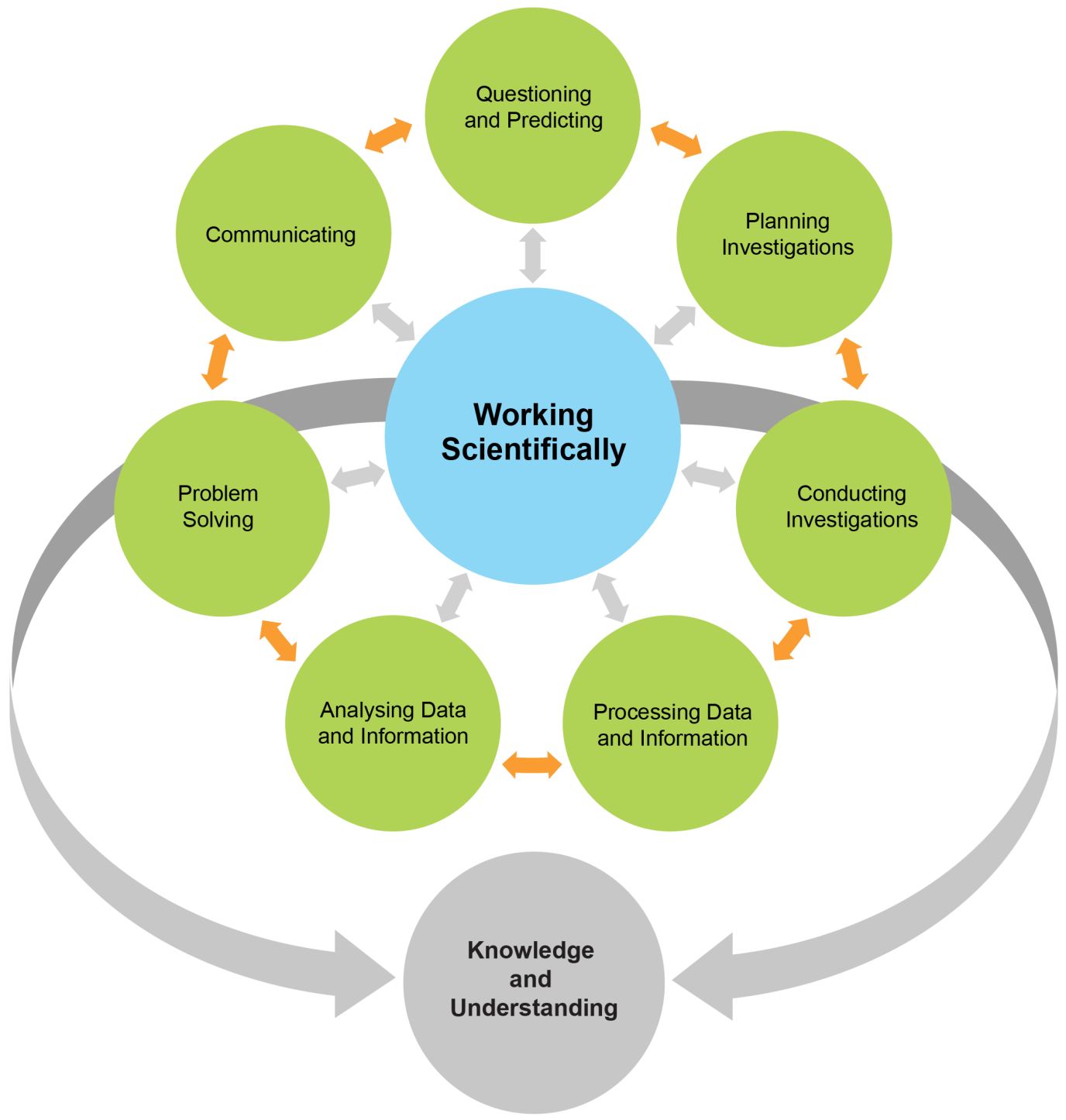
The Working Scientifically skills should be integrated as course content throughout the courses as appropriate.



## Working Scientifically

Working Scientifically skills are at the core of conducting practical and secondary-sourced investigations in science.

Where appropriate, students should have opportunities to develop their Working Scientifically skills by participating in a range of practical experiences, in order to develop their understanding and demonstrate achievement of Science Life Skills Stage 6.



## Investigations

An investigation is a scientific process of answering a question, exploring an idea or solving a problem that includes activities such as planning a course of action, collecting data, interpreting data, reaching a conclusion and communicating. Investigations can include the collection of primary and/or secondary-sourced data or information.

Practical investigations involve the collection of primary data. They can include:

* undertaking laboratory investigations, including fair tests and controlled experiments
* undertaking fieldwork and surveys
* constructing models.

Secondary-sourced investigations can include:

* researching by using a variety of media
* extracting and reorganising secondary-sourced information in the form of flow charts, tables, graphs, diagrams, prose, keys, spreadsheets and databases
* using models to inform understanding.

### Safety

Schools have a legal obligation in relation to safety. Teachers will need to ensure that they comply with relevant legislation as well as system and school requirements in relation to safety when implementing their programs. This includes legislation and guidelines relating to Work Health and Safety, and the handling and storage of chemical and dangerous goods.

### Animal Research

Schools have a legal responsibility in relation to the welfare of animals. The keeping of animals and all practical activities involving animals must comply with relevant guidelines or legislation.

## Inquiry Questions

The inquiry questions are included in the course content and used to frame the syllabus content within each module. The depth of knowledge and understanding and skill development required to fully address the inquiry questions may vary. This allows for differentiation of the course content due to the diverse needs and abilities of each student.

## Depth Studies

Depth studies can be undertaken to explore a particular aspect of science within any of the Science Life Skills courses.

Students may investigate a particular aspect of science through an investigation/activity or a series of investigations/activities, which are undertaken individually or collaboratively. Depth studies allow students a pathway to pursue their interests in science and engage more fully with scientific investigations. Depth studies may involve: a practical investigation; fieldwork; a secondary-sourced investigation; designing and creating a product; or data analysis. Depth studies may relate to any module a student undertakes.

### Ideas for Depth Studies

#### Practical Investigations

* Design and conduct experiments
* Test a claim
* Test a device

#### Secondary-sourced Investigations

* Make a documentary or media report
* Conduct a literature review
* Develop an evidence-based argument
* Write a journal article
* Write an essay – historical or theoretical
* Develop an environmental management plan
* Analyse a work of fiction or film for scientific relevance
* Create a visual presentation
* Investigate emerging technologies

#### Creating

* Design and invent
* Create a working model
* Create a portfolio

#### Fieldwork

Fieldwork may be a starting point for a practical investigation or secondary-sourced study and could be initiated by the following stimuli:

* an excursion
* engagement with community experts

#### Data Analysis

Data analysis could be incorporated into a practical investigation or secondary-sourced investigation. For example:

* construction and analysis of graphs/tables
* data analysis from a variety of sources
* research analysis, eg of longitudinal data, resource management data.



## Learning Across the Curriculum

Learning across the curriculum content, including the cross-curriculum priorities and general capabilities, assists students to achieve the broad learning outcomes defined in the NESA *Statement of Equity Principles*, the *Melbourne Declaration on Educational Goals for Young Australians* (December 2008) and in the Australian Government’s *Core Skills for Work Developmental Framework* (2013).

Cross-curriculum priorities enable students to develop understanding about and address the contemporary issues they face.

The cross-curriculum priorities are:

* Aboriginal and Torres Strait Islander histories and cultures Aboriginal and Torres Strait Islander histories and cultures icon
* Asia and Australia’s engagement with Asia Asia and Australia’s engagement with Asia icon
* Sustainability. Sustainability icon

General capabilities encompass the knowledge, skills, attitudes and behaviours required to assist students to live and work successfully in the 21st century.

The general capabilities are:

* Critical and creative thinking Critical and creative thinking icon
* Ethical understanding Ethical understanding icon
* Information and communication technology capability  Information and communication technology capability icon
* Intercultural understanding Intercultural understanding icon
* Literacy Literacy icon
* Numeracy Numeracy icon
* Personal and social capability. Personal and social capability icon

NESA syllabuses include other areas identified as important learning for all students:

* Civics and citizenship Civics and citizenship icon
* Difference and diversity Difference and diversity icon
* Work and enterprise. Work and enterprise icon

Learning across the curriculum content is incorporated, and identified by icons, in the content of the *Science Life Skills Stage 6 Syllabus* in the following ways.

### Aboriginal and Torres Strait Islander Histories and Cultures Aboriginal and Torres Strait Islander histories and cultures icon

Aboriginal and Torres Strait Islander communities have diverse cultures, social structures and a history of unique, complex knowledge systems. In Science, students are provided with opportunities to learn about how Aboriginal and Torres Strait Islander Peoples have developed and refined knowledge about the world through observation, making predictions, testing (trial and error) and responding to environmental factors within specific contexts. Students may investigate examples of Aboriginal and Torres Strait Islander Peoples’ understanding of the environment and the ways in which traditional knowledge and Western scientific knowledge can be complementary.

When planning and programming content relating to Aboriginal and Torres Strait Islander histories and cultures teachers are encouraged to:

* involve local Aboriginal communities and/or appropriate knowledge holders in determining suitable resources, or to use Aboriginal or Torres Strait Islander authored or endorsed publications
* read the [*Principles and Protocols*](http://ab-ed.bostes.nsw.edu.au/principles-and-protocols) relating to teaching and learning about Aboriginal and Torres Strait Islander histories and cultures and the involvement of local Aboriginal communities.

### Asia and Australia’s Engagement with Asia Asia and Australia’s engagement with Asia icon

Asia and Australia’s engagement with Asia provides rich and engaging contexts for developing students’ science and technology skills, knowledge and understanding. In Science, students are provided with opportunities to recognise that the Asia region includes diverse environments. Students may develop an appreciation of how interactions within and between these environments and the impacts of human activity influence the region, including Australia, and have significance for the rest of the world.

Asia plays an important role in scientific and technological research and development in areas such as medicine, natural resource management and natural disaster prediction and management.

### Sustainability Sustainability icon

Sustainability is concerned with the ongoing capacity of the Earth to maintain all life. It provides authentic contexts for exploring, investigating and understanding systems in the natural and made environments. In Science, students are provided with opportunities to investigate relationships between systems and system components, and consider the sustainability of food sources and the natural and human environments. Students may engage with different perspectives in solving ethical problems.

### Critical and Creative Thinking Critical and creative thinking icon

Critical and creative thinking are integral to activities where students learn to generate and evaluate knowledge, clarify concepts and ideas, seek possibilities, consider alternatives and solve problems. Critical and creative thinking are embedded in the skills and processes of Working Scientifically. In order to make evidence-based decisions, students are provided with opportunities to develop critical and creative thinking skills through: asking and posing questions; making predictions; engaging in practical and secondary-sourced investigations; and using evidence.

### Ethical Understanding Ethical understanding icon

Students are provided with opportunities to form and make ethical judgements in relation to scientific investigations, design, codes of practice, and the use of scientific information and applications. In Science, students explore the importance of reporting honestly based on evidence. They consider ethical guidelines in their investigations, particularly in regard to the implications for others and the environment.

### Information and Communication Technology Capability Information and communication technology capability icon

Information and communication technology (ICT) can be used effectively and appropriately to access, create and communicate information and ideas, solve problems and work collaboratively. In Science, students are provided with opportunities to develop ICT capability when they: develop ideas and solutions; research science concepts and applications; investigate scientific phenomena; and communicate their scientific and technological understandings. In particular, they learn to: access information; collect, analyse and represent data; model and interpret concepts and relationships; and communicate scientific and technological ideas, processes and information.

### Intercultural Understanding Intercultural understanding icon

Students develop intercultural understanding as they learn to understand themselves in relation to others. This involves students valuing their own cultures and those of others, and engaging with people of diverse cultures in ways that recognise commonalities and differences, create connections and cultivate respect. In Science, students are provided with opportunities to appreciate how diverse cultural perspectives have impacted on the development, breadth and diversity of scientific knowledge and applications. They may learn about and engage with issues requiring cultural sensitivity, and may develop an understanding that scientists work in culturally diverse teams to address issues and solve problems of national and international importance.

### Literacy Literacy icon

Literacy is the ability to use a repertoire of knowledge and skills to communicate and comprehend effectively, using a variety of modes and media. Being ‘literate’ is more than the acquisition of technical skills – it includes the ability to identify, understand, interpret, create and communicate effectively using written, visual and/or digital forms of expression and communication for a number of purposes. In Science, students are provided with opportunities to understand that language varies according to the context and engage with different forms of written and/or spoken language to communicate scientific concepts. Students may develop an understanding that scientific information can also be presented in the form of diagrams, flow charts, tables, graphs and models.

### Numeracy Numeracy icon

Numeracy involves recognising and understanding the role of mathematics in the world. Students become numerate as they develop the confidence, willingness and ability to apply mathematics in their lives in constructive and meaningful ways. In Science, they are provided with opportunities to develop numeracy skills through practical measurement and the collection, representation and interpretation of data from first-hand investigations and secondary sources. Students may consider issues of uncertainty and reliability in measurement and learn data analysis skills, identifying trends and patterns from numerical data and graphs. They may use mathematical equations and concepts in order to solve problems.

### Personal and Social Capability Personal and social capability icon

Students develop personal and social capability as they learn to understand and manage themselves, their relationships and their lives more effectively. This includes establishing positive relationships, making responsible decisions, working effectively individually and in teams, and constructively handling challenging situations. Through applying the processes of Working Scientifically, students may develop skills in collaboration, planning and communication. They may learn to plan and conduct a depth study either individually or in a team.

### Civics and Citizenship Civics and citizenship icon

Civics and citizenship content involves knowledge and understanding of how our Australian society operates. In Science, students are provided with opportunities to broaden their understanding of aspects of civics and citizenship in relation to the application of scientific ideas and technological advances, including ecological sustainability and the development of environmental and sustainable practices at a local, regional and national level.

### Difference and Diversity Difference and diversity icon

Difference and diversity comprise gender, race and socio-economic circumstances. Students are provided with opportunities to understand and appreciate the difference and diversity they experience in their everyday lives. Working Scientifically provides opportunities for students to work collaboratively, where they can develop an appreciation of the values and ideas of all group members. This appreciation also enables them to identify individual rights, challenge stereotypes and engage with opinions different to their own.

### Work and Enterprise Work and enterprise icon

Students may develop work-related skills and an appreciation of the value of working individually and collaboratively when conducting investigations. In Science, students are provided with opportunities to prioritise safe practices and understand the potential risks and hazards present when conducting investigations. They may engage with risk assessment while working safely in the laboratory or in the field.

# Investigating Science Life Skills Course Content

## Course Structure

| **Year 11**  **(120 hours)**  **Year 12**  **(120 hours)** | **Working Scientifically Skills** | **Course** | **Suggested modules** | **Depth studies** |
| --- | --- | --- | --- | --- |
| Investigating Science Life Skills | Cause and Effect  Scientific Models  Science and Technology  Science and Society |
| Physical World Science Life Skills | Forces and Motion  Energy |
| Earth and Space Science Life Skills | Earth’s Resources  Human Impacts  Earth’s Processes and Hazards  Resource Management |
| Living World Science Life Skills | The Structure and Organisation of Living Things  Diversity and Ecosystems  Heredity and Genetics  Disease and Disorders |
| Chemical World Science Life Skills | Properties of Matter  Chemical Reactions |

For Science Life Skills:

* Students may complete one or more coursesto contribute up to six units of study towards their Preliminary or HSC pattern of study.
* Students are not required to address or achieve all the Science Life Skills outcomes.
* Students are not required to complete all of the content to demonstrate achievement of an outcome.
* Outcomes and content should be selected to meet the particular needs of individual students.
* The modules provide possible frameworks for addressing the Science Life Skills outcomes and content, and are suggestions only. Teachers have the flexibility to develop modules that will meet the needs, strengths, goals, interests and prior learning of their students.
* Examples provided under the content points are suggestions only. Teachers may use the examples provided or develop other examples to meet the particular needs of individual students.
* Working Scientifically outcomes and content are to be integrated into modules wherever students undertake an investigation.
* Depth studies may be undertaken within any course and can relate to any module in a course.

## Working Scientifically Skills

**The following Working Scientifically outcomes and content can be integrated into each course as appropriate.**

## Questioning and Predicting

### Outcomes

**A student:**

* poses questions and hypotheses for scientific investigation SCLS6-1

### Content

Students:

* ask questions about the world around them Personal and social capability icon
* make observations and pose questions based on these observations
* identify questions that can be scientifically tested
* recognise the difference between a fact and a prediction Critical and creative thinking icon
* make predictions based on questions from observations
* make predictions based on questions that can be scientifically tested

## Planning Investigations

### Outcomes

**A student:**

* plans an investigation individually or collaboratively to obtain primary or secondary data and information SCLS6-2

### Content

Students:

* recognise the need to plan an investigation to test questions or hypotheses Personal and social capability icon Work and enterprise icon
* participate in making decisions about how to test questions or hypotheses
* identify purposes for a range of scientific equipment and materials  Information and communication technology capability icon Work and enterprise icon
* select appropriate scientific equipment and materials that can be used to test a question or hypothesis  Information and communication technology capability icon Work and enterprise icon
* work individually and/or collaboratively to design a scientific investigation to test a question or hypothesis Work and enterprise icon
* record aspects of a plan for a scientific investigation using an appropriate format Literacy icon
* recognise safe and unsafe practices when planning a scientific investigation Work and enterprise icon
* identify practices to enhance safety in a scientific investigation Work and enterprise icon
* recognise variables to be measured, changed and maintained in an investigation Difference and diversity icon
* identify ways to change and measure variables in an investigation Critical and creative thinking icon
* recognise ethical considerations when planning a scientific investigation Ethical understanding icon

## Conducting Investigations

### Outcomes

**A student:**

* participates in investigations individually or collaboratively to collect primary or secondary data and information SCLS6-3

### Content

Students:

* recognise a plan as a sequence of steps Literacy icon
* follow a plan to participate in an investigation Personal and social capability icon
* use scientific equipment and materials accurately  Information and communication technology capability icon
* use technology when participating in an investigation  Information and communication technology capability icon
* engage in safe practices when participating in an investigation Work and enterprise icon
* accurately record observations and data when participating in an investigation Literacy icon Numeracy icon
* work individually and/or collaboratively to conduct an investigation Work and enterprise icon

## Processing Data and Information

### Outcomes

**A student:**

* collects and represents qualitative or quantitative data and information using media as appropriate SCLS6-4

### Content

Students:

* recognise that data and information can come from a range of sources, eg observations and measurements Numeracy icon
* identify data that can be measured Numeracy icon
* explore a range of methods to collect quantitative data Numeracy icon
* select the most appropriate form of organising and representing quantitative data  Information and communication technology capability icon Numeracy icon
* use appropriate measurements when representing quantitative data Numeracy icon
* recognise qualitative information, eg observations, descriptions Literacy icon
* use digital technologies to collect or represent qualitative information or quantitative data  Information and communication technology capability icon Numeracy icon
* relate collected information and data to questions or hypotheses Critical and creative thinking icon
* use appropriate scientific language when representing information or data Literacy icon

## Analysing Data and Information

### Outcomes

**A student:**

* develops conclusions from primary or secondary data and information SCLS6-5

### Content

Students:

* recognise representations of data Numeracy icon
* recognise secondary information sources that can be used in an investigation
* locate information in a secondary source Literacy icon
* describe data and information collected Literacy icon Numeracy icon
* identify patterns and trends in data Numeracy icon
* describe patterns and trends in data Critical and creative thinking icon
* draw conclusions from data and information gathered in an investigation Critical and creative thinking icon
* develop further questions from conclusions Critical and creative thinking icon

## Problem Solving

### Outcomes

**A student:**

* uses strategies to solve scientific problems SCLS6-6

### Content

Students:

* identify strategies that can be used to solve a problem Critical and creative thinking icon
* use primary data or secondary information when exploring a problem Critical and creative thinking icon Literacy icon Numeracy icon
* recognise and use problem-solving skills, eg questioning, collaboration, planning Personal and social capability icon Work and enterprise icon
* use strategies to solve problems Critical and creative thinking icon

## Communicating

### Outcomes

**A student:**

* communicates information about an investigation using scientific language and terminology SCLS6-7

### Content

Students:

* recognise scientific language Literacy icon
* communicate ideas related to an investigation Literacy icon
* use scientific language when communicating about an investigation Literacy icon
* use digital, visual, written or oral forms of communication as appropriate https://lh6.googleusercontent.com/WSefKq_SVlkCAk8JjIg-pKyEHoJ9mbq8vmhjNlaSXq0PM2NXsYXw6HhprbvvU0SC_O7S7pZxOTygyLn98r1oPNm-O5E79mQsI6M1JEU8xlv8c6iKp1oIe6_2wgLfuojrK4cfjYe5 Literacy icon
* select digital, visual, written or oral forms of communication appropriate to audience and purpose  Information and communication technology capability icon Literacy icon

## Module 1: Cause and Effect

### Outcomes

**A student:**

* poses questions and hypotheses for scientific investigation SCLS6-1
* plans an investigation individually or collaboratively to obtain primary or secondary data and information SCLS6-2
* participates in investigations individually or collaboratively to collect primary or secondary data and information SCLS6-3
* collects and represents qualitative or quantitative data and information using media as appropriate SCLS6-4
* identifies how primary or secondary data is used in scientific investigations SCLS6-8
* uses patterns and trends in data to make observations and draw conclusions SCLS6-9

**Related Investigating Science outcomes:** INS11/12-1, INS11/12-2, INS11/12-3, INS11/12-4, INS11-8, INS11-9

### Content Focus

Students recognise and make observations and use these to make predictions. They pose questions, and plan and conduct investigations to develop their knowledge and understanding of the world around them. They also explore data they have collected to identify patterns and trends and use these to make observations and draw conclusions.

### Working Scientifically

In this module, students participate in scientific investigations, collecting and representing data in order to answer questions and test hypotheses.

### Content

#### Observations

**Inquiry question:** What types of observations do people make in their everyday lives?

Students:

* identify that people make observations using their senses: what they can see, hear, feel or smell
* recognise that observations people make in their everyday lives can be made more specific by using descriptions or measurements, for example: Literacy icon Numeracy icon
  + when making an observation about electrical energy, eg the tumble dryer uses a lot of energy → the tumble dryer uses more energy than the dishwasher → the tumble dryer uses 1.5 kilowatts per hour (kWh) more per use than the dishwasher
  + when making an observation about the weather, eg it is hot today → today is the hottest day of the month → the temperature is 35degrees Celsiustoday
  + when making an observation about animal care, eg feeding the dog costs money → it costs more to feed the dog than the cat → or, it costs 25 per cent more each week to feed the dog than the cat
  + when making an observation about mixing ingredients in cooking, eg to make salad dressing, use oil and vinegar → to make salad dressing, combine a small amount of vinegar and a large amount of oil → to make salad dressing, combine vinegar and oil in a ratio of 1:2
* make observations using descriptions, including numbers, measurements and statistics, for example: Literacy icon Numeracy icon
  + electricity bill is higher in winter when the tumble dryer is used
  + average temperature this winter was higher than last winter
  + plant in the sunlight grew faster than the plant in the shade
  + pH level of the moisturiser is 4.8
* recognise that qualitative data is data that is observed and described but not measured
* recognise that quantitative data is data that is observed and can be measured, and involves numbers Numeracy icon
* identify that observations are a way of gaining information before beginning an investigation, for example: Critical and creative thinking icon
  + observing that a magnet sticks to the fridge and investigating what other metals a magnet will stick to
  + observing the amount and types of litter in a local waterway
  + observing that the pot plants in the house always grow towards the window and designing an investigation to find out if plants grow towards the light
  + observing the amount of foam produced by different household detergents
* identify ways in which Aboriginal and Torres Strait Islander Peoples use observations to assist them in everyday life, for example: Aboriginal and Torres Strait Islander histories and cultures icon Sustainability icon Intercultural understanding icon
  + observing the night sky to identify when to move to a new place to find food
  + observing the flowering of a particular plant to predict hunting, fishing and gathering
  + identifying that the black wattle flowering signals that it is time to catch blackfish

#### Role of Observations

**Inquiry question:** How are observations made in a scientific investigation?

Students:

* make observations from investigations, including observations that can be measured, for example: Numeracy icon
  + the rate at which objects of varying mass fall when dropped
  + the location of earthquakes and volcanic eruptions on a map
  + comparisons between similar bone structures in fossils and modern-day organisms, eg comparing jaws of modern-day herbivores and carnivores to fossil jaws
  + the position of animals on a rock platform
  + shape, colour and size of plant and animal cells
  + chemicals and their reactions, eg the chemical reaction between magnesium and acid
* communicate observations in a variety of ways, for example:  Information and communication technology capability icon Literacy icon Numeracy icon
  + orally
  + tabulation
  + graphing
  + visual representations
  + digital representations
* apply conventions when collecting and recording observations, for example: Critical and creative thinking icon  Information and communication technology capability icon Literacy icon Work and enterprise icon
  + including a heading with tables and graphs
  + labelling axes on a graph
* recognise that some observations can be used to make predictions, for example: Critical and creative thinking icon
  + heavier objects fall faster when dropped
  + more earthquakes occur in Japan than in Australia
  + plant cells are larger than animal cells
  + if magnesium reacts with acid then all metals will react with acid

#### Observations as Evidence

**Inquiry question:** How do we know the observations from scientific investigations are accurate?

Students:

* recognise that all investigations must be conducted safely Personal and social capability icon
* identify risks involved in an investigation, for example: Work and enterprise icon
  + acid could splash in a person’s eye and cause damage
* describe ways to minimise the risks in an investigation, for example: Critical and creative thinking icon
  + wearing safety glasses
* demonstrate safe practices when participating in an investigation Work and enterprise icon
* recognise that all investigations must be conducted in an environmentally friendly manner, for example: Sustainability icon Ethical understanding icon Civics and citizenship icon
  + toxic chemicals must be disposed of correctly
  + there should be minimal disturbance of the environment in fieldwork situations
* recognise the role of variables in a scientific investigation
* identify variables to be measured, changed or maintained in a scientific investigation Critical and creative thinking icon
* investigate how variables in a scientific investigation can be maintained Critical and creative thinking icon
* compare observations made in everyday life with primary data gathered in a scientific investigation Critical and creative thinking icon Literacy icon

#### Conclusions Promote Further Observations

**Inquiry question:** How do results from a scientific investigation instigate further scientific investigations?

Students:

* pose questions for testing that lead to further investigations, for example: Critical and creative thinking icon
  + Where is a load placed in a wheelbarrow to make it easier to lift?
  + Will changing the shape of an object affect how fast it moves through water?
  + Are all metals attracted to a magnet?
  + Do all metals conduct electricity?
  + Are bones of fossils, other than teeth, similar to modern-day animals?
  + Do plants grow towards the light?
  + Are fewer bacteria found on a person’s hands after they wash them?
  + Are bacteria also made up of cells?
  + Does sugar dissolve more quickly in hot or cold water?
  + Will using more concentrated acid make a reaction with metal go faster?
* recognise other questions and hypotheses arising from an investigation that may need to be tested

## Module 2: Scientific Models

### Outcomes

**A student:**

* plans an investigation individually or collaboratively to obtain primary or secondary data and information SLS6-2
* participates in investigations individually or collaboratively to collect primary or secondary data and information SCLS6-3
* collects and represents qualitative or quantitative data and information using media as appropriate SCLS6-4
* explores models and descriptions of phenomena SCLS6-10

**Related Investigating Science outcomes:** INS11/12-2, INS11/12-3, INS11/12-4, INS11-10,   
INS11-11

### Content Focus

Students engage with scientific models and gain an understanding of how models can represent scientific concepts. They explore a range of scientific models and participate in practical investigations to construct some models.

### Working Scientifically

In this module, students collect and represent data and information, construct models and communicate information in relation to representing scientific concepts.

### Content

#### Models to Inform Understanding

**Inquiry question:** Why do scientists develop models?

Students:

* recognise that scientists, in order to simplify or help explain something in the world, develop models, for example: Work and enterprise icon
  + a representation of an electrical circuit
  + a model of the solar system
  + a model of an ecosystem
  + the particle model to explain the characteristics of solids, liquids and gases or air pressure
* explore a specific scientific model Critical and creative thinking icon  Information and communication technology capability icon Literacy icon
* recognise that models can be used to make predictions, for example: Critical and creative thinking icon
  + lights in parallel circuits shine brighter than lights in series circuits
  + a model of the Sun, Earth and Moon to predict when the next full moon will be seen and the next solar eclipse will occur
  + a food web to predict the impact of removing a species from an ecosystem
  + the particle model to predict that antifreeze prevents water from freezing
* explore models that have been changed because of new observations, for example: Critical and creative thinking icon Intercultural understanding icon
  + the Geocentric versus Heliocentric models of the solar system

#### Constructing a Model

**Inquiry question:** How can a model be constructed to simplify how a scientific concept is understood?

Students:

* construct a scientific model using appropriate techniques and materials, for example a sculpture made from balsa wood or a digital print Critical and creative thinking icon  Information and communication technology capability icon
* investigate a scientific idea that has been represented using a model, for example: Critical and creative thinking icon
  + recognising the scientific idea represented in the model
  + relating the elements of the model to scientific processes

## Module 3: Science and Technology

### Outcomes

**A student:**

* poses questions and hypotheses for scientific investigation SCLS6-1
* plans an investigation individually or collaboratively to obtain primary or secondary data and information SCLS6-2
* participates in investigations individually or collaboratively to collect primary or secondary data and information SCLS6-3
* recognises processes involved in a range of scientific investigations SCLS6-11
* investigates technologies used in science SCLS6-12

**Related Investigating Science outcomes:** INS11/12-1, INS11/12-2, INS11/12-3, INS12-12,   
INS12-13

### Content Focus

Students develop an understanding of the process of scientific investigation. They observe and participate in a range of scientific investigations and recognise how these can be made reliable and valid. They also explore advances in scientific understanding and how science and technology are related.

### Working Scientifically

In this module, students plan and conduct investigations safely, accurately and reliably. They use appropriate technology when conducting scientific investigations and to collect and represent data.

### Content

#### Practical Investigations to Obtain Primary Data

**Inquiry question**: What initiates a scientific investigation?

Students:

* recognise why scientific investigations are needed Civics and citizenship icon
* explore one or more investigations that have been carried out to recognise:
  + why the investigation was conducted
  + the hypothesis of the investigation
* explore how the investigation has benefited the world Critical and creative thinking icon Ethical understanding icon

#### Reliability and Validity

**Inquiry question:** How can an investigation be designed so that it is a fair test?

Students:

* recognise that to make an investigation a fair test, all the variables but one must remain unchanged
* participate in designing an investigation that is a fair test, for example: Critical and creative thinking icon Literacy icon Numeracy icon Work and enterprise icon
  + keeping the variables constant
  + repeating the investigation
* recognise that for an investigation to be reliable, it needs to be repeated several times under the same conditions and consistent results obtained Ethical understanding icon
* communicate observations made as a result of an investigation Literacy icon Numeracy icon
* draw conclusions from the observations made in the investigation Critical and creative thinking icon
* recognise that after an investigation further questions may be posed, which may lead to another investigation, for example: Critical and creative thinking icon
  + Does the shape of an object affect the speed at which it moves through air as well as water?
  + Is the water-holding capacity the same for all types of soil?
  + Do all plants grow at the same rate in sunlight?
  + Do all metals react with acids at the same rate?

#### Communicating

**Inquiry question**: How are scientific ideas communicated?

Students:

* communicate ideas related to an investigation Literacy icon
* use scientific language to communicate ideas related to an investigation Literacy icon
* represent ideas related to an investigation in a variety of ways, for example:  Information and communication technology capability icon Literacy icon
  + digital, visual, written or oral representations

#### Scientific Investigation and Technology

**Inquiry question:** How are technologies used in scientific investigations?

Students:

* identify examples of technologies used in science, for example:  Information and communication technology capability icon Work and enterprise icon
  + lenses, microscopes, thermometers, light bulbs, rulers, Bunsen burners, stopwatches, ray boxes
* explore technologies developed by Aboriginal and Torres Strait Islander Peoples, for example: Aboriginal and Torres Strait Islander histories and cultures icon Literacy icon
  + spear throwers, eg woomeras and other hunting weapons
  + stone technology for cutting tools and grinding seed
  + message sticks for communication
  + technologies used to catch fish
  + firestick farming
* participate in designing a practical investigation that uses appropriate technology, for example: Critical and creative thinking icon  Information and communication technology capability icon Work and enterprise icon
  + how a slope helps in lifting a load
  + the relationship between pivot, effort and load
  + static electricity
  + electrical conductivity
  + how a mass of the bob and length of the pendulum affects the timing of a pendulum
  + radiation of heat of black and silver surface
  + the composition of different types of soil
  + the relationship between heartbeat and exercise
  + how salt affects both the melting point and boiling point of water
  + the best type of material to use for insulation
* identify the technology used when carrying out the investigation  Information and communication technology capability icon
* use digital technologies to gather primary and secondary data, for example:  Information and communication technology capability icon Literacy icon Numeracy icon Personal and social capability icon
  + websites
  + surveys
  + social media
* use digital technologies to gather and communicate information, for example:  Information and communication technology capability icon Literacy icon Numeracy icon
  + record and calculate data using a spreadsheet
  + construct graphs using online graphing tools
  + collect photos or diagrams from the internet to create a visual presentation
* engage in safe practices when using technologies in scientific investigations Work and enterprise icon

#### A Continuous Cycle

**Inquiry question:** Why develop new technologies?

Students:

* investigate how new discoveries in science have led to improvements in technologies, for example: Critical and creative thinking icon  Information and communication technology capability icon
  + discovery of electromagnetic waves has led to communication technologies
  + discovery of LEDs has led to more efficient lighting
  + improvements in lenses led to the development of microscopes, telescopes and eyeglasses
  + discovery of semiconductors led to the development of transistors, which enabled more efficient computers
* explore how new technologies have led to further investigations in science, for example: Critical and creative thinking icon  Information and communication technology capability icon
  + robotics led to scientists exploring Mars
  + space telescopes and probes have led to further investigations into the solar system and beyond
  + submarines have led to scientists exploring the ocean floor
  + carbon dating led scientists to work out the age of fossils
  + drones have led to improved methods of tracking animal populations, including endangered species
  + more powerful microscopes led to investigations into the structure of cells
* explore how improvements in technology have occurred as a result of Working Scientifically, for example:  Information and communication technology capability icon Work and enterprise icon
  + development of the light bulb resulted from fire, torches, kerosene lamps, incandescent light bulbs (Edison), LEDs
  + development of a battery as a result of the work of Galvani, Volta and Davy
  + development of biomechanical devices, eg artificial limbs

## Module 4: Science and Society

### Outcomes

**A student:**

* collects and represents qualitative or quantitative data and information using media as appropriate SCLS6-4
* develops conclusions from primary or secondary data and information SCLS-5
* uses strategies to solve scientific problems SCLS-6
* communicates information about an investigation using scientific language and terminology SCLS6-7
* recognises that scientific investigations can support or refute a hypothesis SCLS6-13
* investigates how science impacts on society SCLS6-14
* explores contemporary issues involving science SCLS6-15

**Related Investigating Science outcomes:** INS11/12-4, INS11/12-5, INS11/12-6, INS11/12-7, INS12-14, INS12-15

### Content Focus

Students explore myths that seem to have a scientific basis. They also explore how science can be used for human progress and development. They engage with ethical issues in science and how these impact on scientific research.

### Working Scientifically

In this module, students participate in investigations to test ideas and draw conclusions. They use a variety of strategies to communicate ideas about the use of science in society.

### Content

#### Testing Claims

**Inquiry question:** What are some myths or commonly held ideas about the world that need to be scientifically tested?

Students:

* recognise that an idea about how or why something happens needs to be scientifically tested if it is to be considered true Critical and creative thinking icon
* identify commonly held ideas about the world that may be right or wrong and that can be scientifically tested, for example: Critical and creative thinking icon
  + an object always moves in the direction of the force exerted on it
  + the Great Wall of China is the only human-made structure visible from space
  + patterns in the stars can predict the future
  + water boiled in a microwave oven will kill plants if used to water them
  + stomach ulcers are caused by stress
  + being exposed to cowpox prevents you catching smallpox
  + human-made chemicals are more dangerous than natural chemicals

**Inquiry question:** How can a myth or commonly held idea be tested?

Students:

* explore the ways in which scientists have carried out fair tests to investigate ideas, for example: Critical and creative thinking icon
  + Marshall and Warren disproving the idea that stress leads to stomach ulcers by showing that they are caused by bacteria
  + Pasteur disproving the idea that life grew out of non-living materials by showing that bacteria come from other bacteria
* design a simple investigation to test a commonly held idea about the world Ethical understanding icon Work and enterprise icon
* recognise that new scientific discoveries need to be checked by other scientists to see if they are true Ethical understanding icon
* recognise that sometimes scientists report their results dishonestly, for example: Ethical understanding icon
  + Piltdown Man – fraudulent fossil evidence

#### Incidents, Events and Science

**Inquiry question:** How can scientific discoveries be used for human progress and development?

Students:

* recognise that new developments in science can be used to improve human life, for example: Civics and citizenship icon Work and enterprise icon
  + development of light bulbs, which allowed people to see more easily at night
  + development of thermal blankets and pacemakers as a result of space programs
  + improvements in communication, eg satellites, use of optic fibres, mobile phones and warning systems for natural disasters
  + development of genetically modified foods, which can add vitamins to rice for people in developing countries (Golden Rice), reduce pollution (Enviropig) and reduce the use of pesticides (Bt cotton)
  + improvements in medical science, eg optic fibres, which have led to communication and keyhole surgery, cochlear implant, bionic eye, new materials for hip transplants, ultrasound and vaccines
  + discovery of microorganisms, which led to the development of food-preserving methods and less sickness from food poisoning
  + development of polymers and plastics
  + development of water purification and wastewater treatment processes
  + development of vaccination programs to prevent disease
* investigate a scientific research or discovery that has contributed to world health and wellbeing Ethical understanding icon

#### Influences on Scientific Research

**Inquiry question:** How is scientific research influenced?

Students:

* recognise the benefits of scientific research, for example: Difference and diversity icon
  + social benefits
  + economic benefits
* identify the cost of scientific research, eg space exploration Ethical understanding icon
* make a judgement about the cost and benefit of a particular area of scientific research, for example: Critical and creative thinking icon Ethical understanding icon
  + Are advances in scientific research beneficial to world health and wellbeing?
  + Should more money be spent on scientific research?

**Inquiry question:** Do all scientific investigations have to be carried out ethically?

Students:

* recognise that investigations undertaken at school have to be completed ethically, for example: Ethical understanding icon
  + animals being observed must be treated with respect and returned to the place where they were collected
  + if animals are kept in the classroom for observation, all their daily needs (food, water, shelter) and the correct temperature must be provided
* compare ethical points of view in relation to performing scientific investigations, for example: Ethical understanding icon
  + Should animals be used to test make-up products?
  + How should research animals be treated?
  + Should humans be used for scientific research, eg drug trials, sleeping habit trials?
  + Should Marshall have infected himself with the bacteria that he thought might cause stomach ulcers?
  + Should Jenner have injected an eight-year-old boy with cowpox?
* explore how human activities can negatively affect our environment, for example: Sustainability icon Civics and citizenship icon
  + nuclear testing
  + pollution of air, water, and/or land
  + destroying habitat to make way for roads, houses and shopping centres
  + disposal of chemical waste
* recognise that sometimes scientific developments lead to unintended problems to which scientists need to find solutions, for example: Sustainability icon Ethical understanding icon Civics and citizenship icon
  + development of the car has led to increased air pollution
  + environmental issues often result from mining activity
  + burning fossil fuels causes greenhouse gases to be produced
  + lead in paint and petrol can lead to brain damage, which caused scientists to develop paint and petrol without lead
  + plastic is a useful product but it will not break down, which makes it difficult to dispose of and it often ends up in waterways

# Physical World Science Life Skills

## Course Structure

| **Year 11**  **(120 hours)**  **Year 12**  **(120 hours)** | **Working Scientifically Skills** | **Course** | **Suggested modules** | **Depth studies** |
| --- | --- | --- | --- | --- |
| Investigating Science Life Skills | Cause and Effect  Scientific Models  Science and Technology  Science and Society |
| Physical World Science Life Skills | Forces and Motion  Energy |
| Earth and Space Science Life Skills | Earth’s Resources  Human Impacts  Earth’s Processes and Hazards  Resource Management |
| Living World Science Life Skills | The Structure and Organisation of Living Things  Diversity and Ecosystems  Heredity and Genetics  Disease and Disorders |
| Chemical World Science Life Skills | Properties of Matter  Chemical Reactions |

For Science Life Skills:

* Students may complete one or more coursesto contribute up to six units of study towards their Preliminary or HSC pattern of study.
* Students are not required to address or achieve all the Science Life Skills outcomes.
* Students are not required to complete all of the content to demonstrate achievement of an outcome.
* Outcomes and content should be selected to meet the particular needs of individual students.
* The modules provide possible frameworks for addressing the Science Life Skills outcomes and content, and are suggestions only. Teachers have the flexibility to develop modules that will meet the needs and interests of their students.
* Examples provided under the content points are suggestions only. Teachers may use the examples provided or develop other examples to meet the particular needs of individual students.
* Working Scientifically outcomes and content are to be integrated into modules wherever students undertake an investigation.
* Depth studies may be undertaken within any course and can relate to any module in a course.

## Module 1: Forces and Motion

### Outcomes

**A student:**

* poses questions and hypotheses for scientific investigation SCLS6-1
* plans an investigation individually or collaboratively to obtain primary or secondary data and information SCLS6-2
* participates in investigations individually or collaboratively to collect primary or secondary data and information SCLS6-3
* collects and represents qualitative or quantitative data and information using media as appropriate SCLS6-4
* uses strategies to solve scientific problems SCLS6-6
* identifies how primary or secondary data is used in scientific investigations SCLS6-8
* uses patterns and trends in data to make observations and draw conclusions SCLS6-9
* investigates technologies used in science SCLS6-12

**Related Investigating Science outcomes:** INS11/12-1, INS11/12-2, INS11/12-3, INS11/12-4, INS11/12-6, INS11-8, INS11-9, INS12-13

### Content Focus

Students engage in observations and practical investigations to recognise motion in everyday life. They explore types of forces and investigate how force can impact on motion.

### Working Scientifically

In this module, students plan and conduct investigations to collect data and solve problems in relation to forces and motion.

### Content

#### Forces in Everyday Life

**Inquiry question:** How are forces evident in everyday contexts?

Students:

* recognise a force as a push, pull, twist or tear
* observe forces acting on objects in everyday contexts, for example:
  + a car starting and stopping
  + kicking a football
  + pinning a sign on a noticeboard
  + squeezing the water out of wet clothes
  + a magnet sticking to a fridge
* explore a range of contact forces in everyday contexts, for example:
  + throwing a ball
  + writing on paper
  + typing on a device
* explore a range of non-contact forces in everyday contexts, for example:
  + gravity
  + the movement of tides
  + using a magnetic closing device, eg the clasp of a bag, the cover for a mobile device
* identify that forces make objects move or remain stationary Work and enterprise icon

#### Balanced and Unbalanced Forces

**Inquiry question:** What is the difference between balanced and unbalanced forces?

Students:

* recognise balanced forces as forces of equal magnitude acting in opposite directions on an object, for example:
  + a book on a table
  + a boat floating on water
  + a box hanging from a rope
* observe balanced forces to recognise that objects do not move when balanced forces are applied
* construct models of balanced forces in everyday contexts Critical and creative thinking icon  Information and communication technology capability icon
* recognise unbalanced forces as forces of unequal size acting on an object
* observe unbalanced forces to recognise that objects move when unbalanced forces are applied, for example:
  + a lift going up
  + pulling a book across a table
  + a vehicle moving
* recognise weight as a force
* conduct an investigation to collect data on how weight affects the balance of forces enacting on an object in the water Critical and creative thinking icon Numeracy icon
* investigate everyday problems involving unbalanced forces, for example: Critical and creative thinking icon
  + a car crash
* demonstrate safe practices when investigating balanced and unbalanced forces Work and enterprise icon

#### Oppositional Force

**Inquiry question:** How is friction created in a range of environments?

Students:

* observe what happens when two objects or surfaces rub against each other
* recognise that the resistance created by objects moving against each other is known as friction
* recognise friction as an oppositional force
* observe a range of examples of friction in everyday contexts, for example:
  + skiing on water or snow
  + sliding a glass across a table
  + the rope and pulley on a set of blinds
  + climbing a vertical rock wall without slipping
* participate in a practical investigation into factors that impact on friction, for example: Critical and creative thinking icon
  + roughness/smoothness of an object’s surface
  + speed of an object
  + size of an object
  + amount of pressure on an object
  + surface adhesion
* identify risks and respond appropriately when investigating factors that impact on friction Work and enterprise icon

#### Forces that Attract and Repel

**Inquiry question:** What is gravitational force?

Students:

* recognise gravitational force as a force of attraction between objects
* recognise that every object has gravitational pull
* investigate how mass affects gravitational force Critical and creative thinking icon
* explore the effects on the Earth of the gravitational pull of the Sun and Moon, for example: Difference and diversity icon
  + the Sun’s gravitational pull keeps the Earth orbiting the Sun
  + the Moon’s gravity affects the rise and fall of the tides on the Earth
* recognise that people are kept on the ground as a result of gravity pulling us downwards and the floor pushing us upwards Critical and creative thinking icon

**Inquiry question:** How does magnetic force attract and repel objects?

Students:

* observe the magnetic pull of a magnet on iron or metal
* recognise that magnetic force is not visible
* observe magnetic forces as either attracting or repelling objects
* participate in an investigation to observe the magnetic field of a magnet
* explore the cause and reason for the magnetic field around the Earth Critical and creative thinking icon

#### History of Discoveries of Physical Forces

**Inquiry question:** How have discoveries throughout history improved human understanding of physical forces?

Students:

* explore a historical discovery that led to an understanding of physical forces, for example: Intercultural understanding icon
  + Archimedes’s principle
  + Newton’s Law of Universal Gravitation

#### Mechanical Forces

**Inquiry question:** How have mechanical forces contributed to a more efficient society?

Students:

* investigate forces acting when simple machines are used, for example:
  + pulleys
  + levers
  + gears
  + wheels and axes
* explore an example of the use of simple machines in ancient societies, for example: Aboriginal and Torres Strait Islander histories and cultures icon Intercultural understanding icon
  + use of levers and ramps by the Egyptians to construct monuments
  + the design of a woomera by Aboriginal Peoples to act as a lever for throwing spears
* investigate how the development and use of simple machines has led to more efficient work practices Work and enterprise icon

## Module 2: Energy

### Outcomes

**A student:**

* participates in investigations individually or collaboratively to collect primary or secondary data and information SCLS6-3
* collects and represents qualitative or quantitative data and information using media as appropriate SCLS6-4
* communicates information about an investigation using scientific language and terminology SCLS6-7
* explores models and descriptions of phenomena SCLS6-10

**Related Investigating Science outcomes:** INS11/12-3, INS11/12-4, INS11/12-7, INS11-10,   
INS11-11

### Content Focus

Students explore models of energy to develop an understanding of how energy can be transferred and transformed. They observe, explore or construct electrical circuits and recognise how an understanding of energy transformations has led to technological applications that people use in their everyday lives.

### Working Scientifically

In this module, students collect and represent data and information, construct models and communicate information in relation to energy.

### Content

#### Energy is Necessary for a Range of Activities

**Inquiry question:** How is energy used in everyday life?

Students:

* recognise that energy is needed to make something work, for example:
  + humans need energy from food
  + food needs heat to cook it
  + kitchen appliances need energy from electricity to operate
  + sailboats need energy from the wind to move
* identify different forms of energy, for example: Difference and diversity icon
  + heat
  + light
  + sound
  + electrical
  + mechanical
  + chemical (as found in fuel and gas)
* explore ways in which energy is obtained, for example: Civics and citizenship icon
  + the Sun provides heat, known as solar energy
  + fuel, eg gas or oil can provide heat and light
  + water is used to generate electricity
  + wind
* recognise a variety of uses of energy in a range of environments, for example: Civics and citizenship icon
  + electricity for lighting (lamp or lights)
  + electricity for heating (radiant heaters)
  + electricity for sound (radio or television)
  + electricity (kitchen appliances)
  + gas for cooking (stoves)
  + petrol for movement (car)
* identify a variety of machines that need energy to work, for example: Work and enterprise icon
  + bicycle
  + motorbike
  + car
  + clock
  + lawnmower
  + workplace machinery
* explore the energy source for a variety of machines, for example: Critical and creative thinking icon
  + watches (battery), clocks (battery or electricity)
  + lawnmowers (petrol or electricity)
  + power tools (battery or electricity)
  + workplace machinery (electricity, oil, gas)
  + hot-water system (solar, electricity, gas)
  + bicycle (mechanical)
* explore sources of energy used for travel, for example: Work and enterprise icon
  + cars (petrol, diesel or gas)
  + boats (diesel, petrol or wind)
  + planes (aviation fuel)
* investigate the use of energy in heating and cooling systems, for example: Critical and creative thinking icon Work and enterprise icon
  + refrigerators
  + air conditioners
* predict the consequences of an energy supply being unavailable Civics and citizenship icon

#### Energy Transfer and Conversion

**Inquiry question:** How are energy transformations used in a range of contexts?

Students:

* investigate how energy is changed from one form to another in order to be of practical use, for example: Critical and creative thinking icon Civics and citizenship icon
  + electrical energy makes lights work
  + gas is converted into heat in a stove
  + sound is converted into electrical energy through a microphone to make a recording and reconverted back into sound energy so that it can be replayed
  + kinetic energy is converted into electricity in generators
  + light is converted into chemical energy by cameras and reconverted back into light to view the photographs
* recognise an electrical circuit as a representation of the movement of electricity
* explore an electrical circuit to recognise how a light comes on when the switch is activated  Information and communication technology capability icon
* engage in safe practices when investigating electrical circuits Work and enterprise icon
* construct or draw simple series circuits to represent a transfer of electricity Critical and creative thinking icon  Information and communication technology capability icon

#### Energy Efficiency

**Inquiry question:** How can energy be used more efficiently in the home?

Students:

* identify which energy sources are the most efficient and cost-effective in particular circumstances, for example: Sustainability icon
  + gas stove versus electric stove
  + gas heating versus oil heating
* recognise the cost of using energy in the home Numeracy icon
* collect and compare data on the cost of running a range of appliances in the home Numeracy icon
* explore a range of ways to save energy in the home, for example: Sustainability icon
  + use of gas as opposed to electricity
  + using energy-efficient light bulbs
  + plugging gaps under doors to ensure heat does not escape
  + switching off and unplugging appliances when they are not in use
  + turn off lights when areas are not in use
  + use a microwave instead of a conventional oven
  + purchase electrical appliances that have high efficiency ratings
  + use insulation to reduce heating and cooling costs

# Earth and Space Science Life Skills

## Course Structure

| **Year 11**  **(120 hours)**  **Year 12**  **(120 hours)** | **Working Scientifically Skills** | **Course** | **Suggested modules** | **Depth studies** |
| --- | --- | --- | --- | --- |
| Investigating Science Life Skills | Cause and Effect  Scientific Models  Science and Technology  Science and Society |
| Physical World Science Life Skills | Forces and Motion  Energy |
| Earth and Space Science Life Skills | Earth’s Resources  Human Impacts  Earth’s Processes and Hazards  Resource Management |
| Living World Science Life Skills | The Structure and Organisation of Living Things  Diversity and Ecosystems  Heredity and Genetics  Disease and Disorders |
| Chemical World Science Life Skills | Properties of Matter  Chemical Reactions |

For Science Life Skills:

* Students may complete one or more coursesto contribute up to six units of study towards their Preliminary or HSC pattern of study.
* Students are not required to address or achieve all the Science Life Skills outcomes.
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* Examples provided under the content points are suggestions only. Teachers may use the examples provided or develop other examples to meet the particular needs of individual students.
* Working Scientifically outcomes and content are to be integrated into modules wherever students undertake an investigation.
* Depth studies may be undertaken within any course and can relate to any module in a course.

## Module 1: Earth’s Resources

### Outcomes

**A student:**

* participates in investigations individually or collaboratively to collect primary or secondary data and information SCLS6-3
* collects and represents qualitative or quantitative data and information using media as appropriate SCLS6-4
* communicates information about an investigation using scientific language and terminology SCLS6-7
* explores models and descriptions of phenomena SCLS6-10

**Related Investigating Science outcomes:** INS11/12-3, INS11/12-4, INS11/12-7, INS11-10,   
INS11-11

### Content Focus

Students explore models of the Earth and its position in space. They investigate rocks and minerals, and the role of technologies in geology. They also consider the importance of the Earth’s resources in people’s lives.

### Working Scientifically

In this module, students participate in investigations to collect and represent data in order to draw conclusions and communicate ideas about the Earth’s resources.

### Content

#### Earth in Space

**Inquiry question**: How does the Earth’s position in space affect people’s daily lives?

Students:

* identify some components of the solar system, for example:
  + Moon
  + stars
  + Sun
  + planets
  + meteors
  + comets
* make observations in relation to changes that occur in the solar system over time, for example: Numeracy icon
  + day/night
  + rising/setting Sun
  + stars and the Moon appear at night
  + the Sun appears during the day
* recognise that the Earth moves around the Sun
* identify that night and day are caused by the rotation of the Earth once every 24 hours Numeracy icon
* demonstrate actions that are taken in relation to changes that are associated with the daily rotation of the earth on its axis, for example: Personal and social capability icon
  + sleeping at the appropriate time
  + working mainly in daylight hours
* identify planetary changes that occur over longer periods of time, for example:
  + seasonal changes
  + weather patterns
  + tidal changes
* demonstrate skills in adapting to planetary changes, for example: Personal and social capability icon
  + planting vegetables in the correct season
  + planning holidays according to seasons and weather patterns around the world
  + sea fishing at high tide
* explore models of the solar system and how these have changed over time, for example: Critical and creative thinking icon  Information and communication technology capability icon
  + Geocentric Theory changed to the Heliocentric Theory
  + discovery of new planets
* construct a model of the solar system  Information and communication technology capability icon
* explore how Aboriginal People use astronomy, for example: Aboriginal and Torres Strait Islander histories and cultures icon
  + using the motions of objects in the sky for constructing calendars and navigation
  + recording and measuring cyclical phenomena, eg eclipses
  + using astronomically based songlines for navigation

**Inquiry question:** How has space exploration contributed to advancements in technology?

Students:

* investigate space exploration using a range of sources Critical and creative thinking icon
* investigate contributions of space exploration to human welfare, for example: Ethical understanding icon
  + heart pacemakers
  + thermal blankets
  + building materials
  + mobile phones
  + miniaturisation of computing systems

#### Composition and Structure of the Earth

**Inquiry question:** What is the inner structure of the Earth?

Students:

* explore a model of the Earth to recognise that the structure of the Earth consists of four layers – inner core, outer core, mantle and crust  Information and communication technology capability icon
* explore the features of each of the Earth’s layers, for example:
  + inner core is the hottest part
  + outer core is made up of liquid
  + mantle is the widest section
  + crust is a thin layer made of solid rock
* construct a model of the structure of the Earth  Information and communication technology capability icon

#### Rocks, Minerals and the Rock Cycle

**Inquiry question:** What are the components of rocks?

Students:

* explore methods of classifying rocks and minerals used by Aboriginal and Torres Strait Islander Peoples Aboriginal and Torres Strait Islander histories and cultures icon
* explore the Rock Cycle to identify different types of rocks and how they are formed, for example: https://lh5.googleusercontent.com/IgYyZGyDyB28iBMNCjiZ1KbmAIve8AlHfOPQPXqn8NC_aPegbvHTbzMR3EKm6ilUjLX7l9oqXwX5dPNLVfSBG_OnZIDS1MZMsv6OpLwzTocJuABBhfk-yj1BlbpoioCXdFXoMiSd
  + magma from volcanic activity forms igneous rock
  + erosion breaks rock down into sediments
  + sedimentary rocks are formed in layers from sediments
  + sedimentary and igneous rocks form metamorphic rocks when exposed to heat and pressure underground
* participate safely in an investigation of the Rock Cycle

#### Geological Timescale

**Inquiry question:** How is the evolution of the Earth measured?

Students:

* recognise timelines and time periods in everyday contexts, for example: Numeracy icon
  + schedule of the school day
  + a week, a month, a year
* identify historical time periods, for example: Numeracy icon Difference and diversity icon
  + ancient history
  + Middle Ages
  + modern history
* recognise representations of periods of time, for example: Numeracy icon
  + daily schedule
  + calendar
  + timeline
* recognise that the Earth’s evolution is represented through the geological timescale Numeracy icon
* identify that the period of the Earth’s evolution is much older than other time periods Numeracy icon
* engage with a visual representation of the geological timescale to recognise the chronological formation of the Earth Literacy icon Numeracy icon
* explore the difference between relative age and numeric age in everyday contexts, for example: Numeracy icon
  + the first floor of a building was built before the top floor (relative age)
  + the church is 100 years old and the school is 54 years old (numeric age)
* investigate models of rock layers to explore how they provide information about the relative age of the Earth, for example: Literacy icon Numeracy icon
  + the bottom layers of rock are the oldest

#### Geological Resources

**Inquiry question:** How are rocks and minerals used?

Students:

* investigate the difference between rocks and minerals Difference and diversity icon
* identify a range of uses for rocks and minerals in our society, for example: Civics and citizenship icon
  + diamonds - for jewellery and in electronics
  + granite - in construction, eg the Sydney Harbour Bridge and bench surfaces
* recognise rocks and minerals as non-renewable resources
* explore how long it takes for rocks and minerals to form
* investigate the use of an Australian rock or mineral to explore the implications of using non-renewable resources, for example: Sustainability icon
  + extraction of iron ore in Western Australia for infrastructure and equipment
  + mining of coal to generate electricity

**Inquiry question:** How are non-renewable geological resources discovered and extracted?

Students:

* explore how rocks and minerals are obtained, for example:
  + extraction from the ground
* investigate traditional Aboriginal quarrying and mining methods Aboriginal and Torres Strait Islander histories and cultures icon
* explore the effect of open-cut mining on the natural environment, for example: Sustainability icon Critical and creative thinking icon
  + removal of the natural environment to create open-pit mines
  + effects of transportation and processing

## Module 2: Human Impacts

### Outcomes

**A student:**

* poses questions and hypotheses for scientific investigation SCLS6-1
* plans an investigation individually or collaboratively to obtain primary or secondary data and information SCLS6-2
* participates in investigations individually or collaboratively to collect primary or secondary data and information SCLS6-3
* collects and represents qualitative or quantitative data and information using media as appropriate SCLS6-4
* uses strategies to solve scientific problems SCLS6-6
* identifies how primary or secondary data is used in scientific investigations SCLS6-8
* uses patterns and trends in data to make observations and draw conclusions SCLS6-9

**Related Investigating Science outcomes:** INS11/12-1, INS11/12-2, INS11/12-3, INS11/12-4, INS11/12-6, INS11-8, INS11-9

### Content Focus

Students recognise the significance of the Earth’s resources for living things. They explore a range of resources provided by the Earth and how humans use these resources to maintain life. They also consider the human impact on the environment.

### Working Scientifically

In this module, students pose questions and hypotheses when planning and participating in investigations about human impacts on the Earth’s resources.

### Content

#### Significance of the Earth’s Resources for Living Things

**Inquiry question:** What resources does the Earth provide to sustain life?

Students:

* recognise that the Sun is necessary for life to exist on Earth
* recognise that the atmosphere has gases that enable living things to survive, for example:
  + the oxygen that humans need to breathe is in the air
* identify a range of natural resources provided by the Earth, for example:
  + timber
  + rocks and minerals
  + water
* explore a range of ways in which humans use specific natural resources Sustainability icon

**Inquiry question:** How can the Earth’s energy sources be managed more sustainably?

Students:

* identify that conventional energy sources are finite, for example:
  + coal, oil, natural gas
* explore the environmental impact of different energy sources and the implications of their use, for example: Sustainability icon Ethical understanding icon
  + the enhanced greenhouse effect and variations in global temperature
  + nuclear waste problems
* investigate the development of alternative energy sources, for example: Critical and creative thinking icon Ethical understanding icon
  + wind generators
  + nuclear energy
* identify sources of energy that have the least impact on the environment, for example: Sustainability icon
  + solar energy
  + hydro-electricity
  + wind-generated electricity
* collect data on the uses of solar energy in the local environment, for example: Civics and citizenship icon
  + survey the use of solar hot-water systems in the local area
  + survey the use of solar pool heating in the local area
* demonstrate ethical and safe practices when collecting data on the uses of solar energy in the local environment Ethical understanding icon Work and enterprise icon
* explore the increasing importance and use of solar energy in everyday life, for example: Civics and citizenship icon
  + solar-powered calculators
  + solar batteries in satellites
  + solar cells for home electricity supply
  + solar hot-water systems
  + solar pool heating

#### Water Management

**Inquiry question:** How can humans contribute to improving water quality?

Students:

* explore models of the Earth to recognise the distribution of water Literacy icon
* identify ways in which water is used in a range of global environments, for example: Intercultural understanding icon
  + for consumption
  + for hygiene
* explore ways in which water can be polluted, for example: Sustainability icon
  + household activities
  + industrial activities
* participate in an investigation to test the quality of water in a local waterway Critical and creative thinking icon Numeracy icon Civics and citizenship icon
* demonstrate safe practices when testing the quality of water in a local waterway Work and enterprise icon
* explore how water can be purified for human consumption, for example: Critical and creative thinking icon
  + water filtration
  + desalination

#### Introduced Species

**Inquiry question:** How do introduced species impact on ecosystems?

Students:

* explore how and why species are introduced into particular ecosystems, for example:
  + rabbits
  + cane toads
* participate in an investigation to explore a local introduced species, for example: Sustainability icon Difference and diversity icon
  + reason for introduction
  + ecosystem affected by the species
  + human activity contributing to introduced species
  + control of introduced species
* demonstrate ethical practices when participating in an investigation of a local introduced species Ethical understanding icon
* explore how human activity can upset the balance of ecosystems when favouring introduced species Sustainability icon Critical and creative thinking icon Ethical understanding icon
* investigate the effect of introduced species on native Australian species Sustainability icon

## Module 3: Earth’s Processes and Hazards

### Outcomes

**A student:**

* poses questions and hypotheses for scientific investigation SCLS6-1
* participates in investigations individually or collaboratively to collect primary or secondary data and information SCLS6-3
* collects and represents qualitative or quantitative data and information using media as appropriate SCLS6-4
* develops conclusions from primary or secondary data and information SCLS6-5
* communicates information about an investigation using scientific language and terminology SCLS6-7
* uses patterns and trends in data to make observations and draw conclusions SCLS6-9
* investigates technologies used in science SCLS6-12

**Related Investigating Science outcomes:** INS11/12-1, INS11/12-3, INS11/12-4, INS11/12-5, INS11/12-7, INS11-9, INS12-13

### Content Focus

Students explore how the Earth has evolved over time. Through an exploration of climate variation and other geological processes, they develop an understanding of the occurrence and impacts of natural disasters. Students investigate how technologies can be used to predict and respond to these events.

### Working Scientifically

In this module, students recognise trends, patterns or relationships in data to communicate ideas about the evolution of the Earth. They participate in investigations to gather and represent qualitative or quantitative data about the evolving Earth.

### Content

#### Fossilisation

**Inquiry question:** What do fossils reveal about the age of the Earth?

Students:

* recognise fossils as remains of the past
* identify that fossils are found in rock
* explore what fossils can reveal about the past Critical and creative thinking icon
* participate in a practical investigation to explore how fossils are formed Critical and creative thinking icon
* demonstrate safe practices when participating in a practical investigation of fossils Work and enterprise icon
* relate fossils to humans’ understanding of the relative age of the Earth

#### Climate Science

**Inquiry question:** What are the impacts and evidence of climate variations?

Students:

* recognise a range of weather patterns, for example:
  + humidity
  + wind
  + rainfall
* explore the impact of climate on our environment Sustainability icon
* investigate evidence of variations in climate, for example: Critical and creative thinking icon
  + increase in concentrations of carbon dioxide in the atmosphere
  + variations in global temperature
  + changing distribution of glaciers
  + rising sea levels as a result of polar ice caps melting due to variations in global temperatures

**Inquiry question:** How do humans contribute to variations in climate?

Students:

* investigate human activity that contributes to climate variation, for example: Sustainability icon
  + burning of fossil fuels
* investigate ways to reduce climate variation, for example: Sustainability icon
  + reduce pollution from vehicle emission by using unleaded fuels or carpooling
  + increase the use of renewable energy sources to produce electricity

#### Geological Natural Disasters

**Inquiry question:** How do geological disasters occur?

Students:

* identify a range of natural disasters caused by geological processes, for example:
  + earthquakes
  + volcanic eruptions
  + tsunamis
* explore the geological processes that cause natural hazards, for example: Sustainability icon
  + earthquakes are the result of a movement in tectonic plates
  + volcanic eruptions are caused by magma building up beneath the Earth’s crust
  + tsunamis are caused by movement on the ocean floor
  + floods can be caused by heavy rainfall
* identify global weather events, for example: Sustainability icon
  + cyclones
  + drought
* identify natural disasters that occur because of weather or climate conditions, for example: Sustainability icon
  + floods
  + cyclones
  + hurricanes
  + bushfires
* explore technologies that are used to monitor and predict weather patterns, for example:  Information and communication technology capability icon
  + radar
  + satellites
  + atmospheric sensors

#### Environmental Impacts of Natural Disasters

**Inquiry question:** How do natural disasters impact on the environment?

Students:

* predict changes that result from the impact of specific natural disasters on native plants Sustainability icon
* explore how native plants survive natural disasters, for example: Sustainability icon
  + regrowing after a bushfire or flood
* investigate a natural disaster that has occurred in Australia to explore the impact on humans and the environment Sustainability icon

#### Prediction and Prevention of Natural Disasters

**Inquiry question:** How do technologies contribute to the prevention and minimisation of natural disasters?

Students:

* explore the difficulties in monitoring and predicting natural disasters
* investigate how disasters can be prevented or minimised, for example: Critical and creative thinking icon Civics and citizenship icon
  + the use of warning systems in the home, eg smoke detectors and fire alarms
  + emergency services
* explore how technological advancements have impacted on the ability to communicate warnings in relation to natural disasters  Information and communication technology capability icon

## Module 4: Resource Management

### Outcomes

**A student:**

* poses questions and hypotheses for scientific investigation SCLS6-1
* participates in investigations individually or collaboratively to collect primary or secondary data and information SCLS6-3
* collects and represents qualitative or quantitative data and information using media as appropriate SCLS6-4
* develops conclusions from primary or secondary data and information SCLS6-5
* uses strategies to solve scientific problems SCLS6-6
* recognises that scientific investigations can support or refute a hypothesis SCLS6-13
* investigates how science impacts on society SCLS6-14
* explores contemporary issues involving science SCLS6-15

**Related Investigating Science outcomes:** INS11/12-1, INS11/12-3, INS11/12-4, INS11/12-6, INS12-14, INS12-15

### Content Focus

Students explore a range of issues related to the Earth’s resources that impact on human life, including pollution and disposal of waste. Students also consider the importance of managing resources and waste sustainably and how this can improve the world’s future.

### Working Scientifically

In this module, students pose questions and develop hypotheses in relation to the use of Earth’s resources. They collect, represent and draw conclusions from primary or secondary data to communicate ideas about resource management.

### Content

#### Renewable and Non-renewable Resources

**Inquiry question:** What is the difference between renewable and non-renewable resources?

Students:

* recognise renewable resources as those that can be replaced naturally Sustainability icon
* identify a range of renewable resources used by humans, for example:
  + timber
  + water
  + leather
  + solar energy
* identify a range of non-renewable resources, for example:
  + oil
  + coal
  + gas
* classify resources as renewable or non-renewable Difference and diversity icon

**Inquiry question:** How can an understanding of renewable and non-renewable resources lead to the conservation of resources?

Students:

* collect and represent data on the use of renewable or non-renewable resources in the local area to draw conclusions, for example: Numeracy icon
  + at school
  + in the workplace
  + in a council area
* demonstrate ethical and safe practices when collecting data on the use of renewable or non-renewable resources in a local community Ethical understanding icon Work and enterprise icon
* predict the consequences of using non-renewable resources on the environment Sustainability icon
* explore ways to conserve non-renewable resources, for example: Sustainability icon Civics and citizenship icon
  + carpooling to use less petrol
  + using alternative sources of energy, eg solar energy
  + recycling glass, paper, plastic and metal wastes

#### Causes and Effects of Pollution

**Inquiry question:** How does human activity contribute to air and water pollution?

Students:

* identify some causes of pollution of air and water, for example: Sustainability icon
  + chemicals
  + burning
  + vehicle emissions
  + industrial or agricultural activity
  + litter in waterways
* identify household activities that may contribute to pollution, for example: Civics and citizenship icon
  + pouring fats or oils down the drain
  + using detergents
  + using pesticides or herbicides in the garden
  + burning garden waste
  + burning wood and fossil fuels, which emit carbon dioxide
* explore industrial and agricultural activity that may be a cause of pollution, for example: Ethical understanding icon
  + heavy metals in waterways
  + gas emissions
* participate in a practical investigation to monitor the quality of some aspects of the local environment, for example: Sustainability icon
  + use a water-testing kit to monitor water quality
  + record the reported air pollution index over a period of time
* demonstrate safe practices when investigating the quality of the local environment Work and enterprise icon
* collect and represent data about the effects of pollution on living things, for example: Numeracy icon
  + mercury poisoning in fish
  + pesticide poisoning in birds
  + pesticide spraying of crops
  + overuse of fertilisers
* explore the effects of pollution on human health, for example: Ethical understanding icon
  + skin diseases
  + allergies
  + breathing problems

**Inquiry question:** What happens to garbage?

Students:

* investigate where domestic garbage is disposed of in their local area Civics and citizenship icon
* investigate other methods of transferring and disposing of garbage Civics and citizenship icon
* explore the effect of garbage on the environment, for example: Sustainability icon
  + liquids seeping into nearby water sources
  + rotting materials
  + use of large areas of land

#### Recycling

**Inquiry question:** How can garbage be recycled to assist in the conservation of the environment?

Students:

* recognise that some materials can be recycled, for example:
  + paper
  + plastic
  + glass
* identify materials in the home that can be recycled, for example: Civics and citizenship icon
  + vegetable peelings
  + plastic bottles
  + aluminium cans
  + newspapers
* engage in processes to maximise recycling in a familiar context, for example: Personal and social capability icon Civics and citizenship icon
  + using bins for rubbish
  + using a divided bin for recycling
  + box container for plastics, papers, cans or glass
  + compost
* develop skills in responsible disposal of non-recyclable materials Personal and social capability icon Civics and citizenship icon
* identify recycling or garbage waste processes in the community, for example:
  + waste paper collection
  + garbage collection
  + collection bins for used clothing
  + council clean up services
* demonstrate safe practices when recycling materials Work and enterprise icon
* explore how recycling activities assist with the sustainable management of resources Sustainability icon

#### Personal and Community Responsibilities for Managing Resources

**Inquiry question:** How can resources be managed responsibly?

Students:

* recognise that individuals and the community have a responsibility to manage resources Sustainability icon Civics and citizenship icon
* identify responsibilities associated with resource use, for example: Sustainability icon Civics and citizenship icon
  + conservation of water
  + efficient use of fuels
  + recycling of materials
  + reduction in household waste
  + use of environmentally friendly products
* describe actions that an individual can take at home to manage resources responsibly, for example: Sustainability icon Personal and social capability icon Civics and citizenship icon
  + reduce household water consumption by turning off water while brushing teeth
  + reduce household energy consumption by turning off lights in rooms that are not being used
  + reduce household use of chemicals by using only a small amount of detergent when washing up
* explore actions a community can take to manage resources responsibly, for example: Civics and citizenship icon
  + reduce household waste
  + conserve natural bushland
  + use waterways responsibly
* investigate how the actions of individuals and communities can contribute to the future sustainability of resources Sustainability icon Civics and citizenship icon

# Living World Science Life Skills

## Course Structure

| **Year 11**  **(120 hours)**  **Year 12**  **(120 hours)** | **Working Scientifically Skills** | **Course** | **Suggested modules** | **Depth studies** |
| --- | --- | --- | --- | --- |
| Investigating Science Life Skills | Cause and Effect  Scientific Models  Science and Technology  Science and Society |
| Physical World Science Life Skills | Forces and Motion  Energy |
| Earth and Space Science Life Skills | Earth’s Resources  Human Impacts  Earth’s Processes and Hazards  Resource Management |
| Living World Science Life Skills | The Structure and Organisation of Living Things  Diversity and Ecosystems  Heredity and Genetics  Disease and Disorders |
| Chemical World Science Life Skills | Properties of Matter  Chemical Reactions |

For Science Life Skills:

* Students may complete one or more coursesto contribute up to six units of study towards their Preliminary or HSC pattern of study.
* Students are not required to address or achieve all the Science Life Skills outcomes.
* Students are not required to complete all of the content to demonstrate achievement of an outcome.
* Outcomes and content should be selected to meet the particular needs of individual students.
* The modules provide possible frameworks for addressing the Science Life Skills outcomes and content, and are suggestions only. Teachers have the flexibility to develop modules that will meet the needs and interests of their students.
* Examples provided under the content points are suggestions only. Teachers may use the examples provided or develop other examples to meet the particular needs of individual students.
* Working Scientifically outcomes and content are to be integrated into modules wherever students undertake an investigation.
* Depth studies may be undertaken within any course and can relate to any module in a course.

## Module 1: The Structure and Organisation of Living Things

### Outcomes

**A student:**

* poses questions and hypotheses for scientific investigation SCLS6-1
* plans an investigation individually or collaboratively to collect primary or secondary data and information SCLS6-2
* participates in investigations individually or collaboratively to collect primary or secondary data and information SCLS6-3
* collects and represents qualitative or quantitative data and information using media as appropriate SCLS6-4
* develops conclusions from primary or secondary data and information SCLS6-5
* identifies how primary or secondary data is used in scientific investigations SCLS6-8
* uses patterns and trends in data to make observations and draw conclusions SCLS6-9

**Related Investigating Science outcomes:** INS11/12-1, INS11/12-2, INS11/12-3, INS11/12-4, INS11/12-5, INS11-8, INS11-9

### Content Focus

Students develop an understanding of the importance of natural resources, including energy from the Sun, for the survival of living things. They investigate the ways in which living things use their environment to obtain the resources necessary for their survival.

### Working Scientifically

In this module, students participate in planning and conducting investigations to test questions, and to collect, represent and draw conclusions from data and information gathered.

### Content

#### Substances Needed for the Survival of Living Things

**Inquiry question:** What do living things need to survive?

Students:

* recognise resources needed by living things to survive, for example:
  + air
  + water
  + food
* recognise food and sunlight as sources of energy for animals and plants
* identify the Sun as the source of energy for photosynthesis in plants
* investigate the ways in which living things use food for energy and growth
* recognise and gather information about living things’ need for other inorganic nutrients, for example:
  + vitamins
  + minerals
* identify the importance of the Sun for plants and animals, for example: Critical and creative thinking icon
  + the Sun is a source of heat for humans and animals
  + growth rates of plants vary according to temperature
  + some animals are not active during the day
  + most humans sleep at night and are active during the day
* recognise the interdependence of plants and animals, for example: Difference and diversity icon
  + through creating food chains using visual representations
  + by recognising that all food chains start with plants
* investigate how the environment provides for the needs of living things Difference and diversity icon

#### Digestive System

**Inquiry question:** How do living things receive nutrients?

Students:

* recognise that living things have a digestive system
* identify that the digestive system is used to break down food and release nutrients
* participate in a practical investigation to develop an understanding of the process of digestion in animals and humans Critical and creative thinking icon
* use equipment safely when engaging in a practical investigation of the digestive system Work and enterprise icon

#### Factors that Influence Plant Growth

**Inquiry question:** How does the environment affect plant growth?

Students:

* identify the basic needs of plants for growth, for example:
  + Sun
  + water
  + soil
  + temperature
* observe the effects of water on plants, for example:
  + wilting when deprived of water
  + fungal disease due to excessive watering
* observe and recognise that plants can be affected by seasonal change, for example: Sustainability icon
  + winter - cold
  + spring - moist and warm
  + summer - hot and dry
  + autumn - changeable
* observe different types of soil, for example: Difference and diversity icon
  + sandy
  + clay
  + loam
* investigate how different types of soil affect plant growth and ways to improve soil structure, for example: Difference and diversity icon
  + adding organic matter, eg compost
  + aerating the soil by digging
  + adding sand to clay soil
* identify a range of plant nutrients, for example:
  + nitrogen
  + phosphorous
* participate in an investigation to identify and resolve a specific nutritional problem for a plant, for example: Sustainability icon Critical and creative thinking icon
  + investigating plant growth and the effect of varying quantities of fertiliser

## Module 2: Diversity and Ecosystems

### Outcomes

**A student:**

* poses questions and hypotheses for scientific investigation SCLS6-1
* plans an investigation individually or collaboratively to collect primary or secondary data and information SCLS6-2
* participates in investigations individually or collaboratively to collect primary or secondary data and information SCLS6-3
* identifies how primary or secondary data is used in scientific investigations SCLS6-8
* explores models and descriptions of phenomena SCLS6-10

**Related Investigating Science outcomes:** INS11/12-1, INS11/12-2, INS11/12-3, INS11-8,   
INS11-10, INS11-11

### Content Focus

Students investigate a range of past and present habitats and ecosystems to explore the diversity of living things. They consider the relationship between living things and their environment and how human impact can affect diversity within a habitat or ecosystem.

### Working Scientifically

In this module, students explore models as representations of ecosystems, and pose questions and hypotheses to plan and conduct investigations in order to explore interrelationships within an ecosystem.

### Content

#### Features of Habitats and Ecosystems

**Inquiry question:** What makes habitats and ecosystems unique?

Students:

* recognise that living things do not exist in isolation Difference and diversity icon
* recognise a range of habitats in their local area, for example: Difference and diversity icon
  + schoolyard
  + local park
  + local creek
* investigate a specific local habitat to identify the features of the habitat, for example: Civics and citizenship icon
  + soil
  + water
  + animal and plant species
* identify various types of ecosystems around the world, for example: Intercultural understanding icon Difference and diversity icon
  + oceans
  + forests
  + rivers
  + deserts
* identify different physical characteristics of ecosystems, for example: Difference and diversity icon
  + deserts are hot and dry
  + alpine environments are cold and mountainous
  + rainforests are dense and wet
* identify the diversity of plant and animal species that exist in different ecosystems, for example: Difference and diversity icon
  + desert ecosystems have small mammals and low-growing plants with small leaves
  + coastal ecosystems have shellfish, mangroves
* explore adaptations of living things that live in a specific habitat or ecosystem, for example: Difference and diversity icon
  + fish have fins and gills
* construct a model of an ecosystem to demonstrate its physical characteristics and the diversity of animal and plant species that live in it  Information and communication technology capability icon Literacy icon Difference and diversity icon
* investigate how different physical characteristics of habitats or ecosystems affect the diversity of animal and plant species that live there, for example: Difference and diversity icon
  + eucalypts have leaves with a thick waxy cuticle
* construct a habitat to suit a specific organism’s needs and features, for example: Critical and creative thinking icon  Information and communication technology capability icon Personal and social capability icon
  + helping regenerate a local bush area
  + constructing a terrarium
* engage in safe practices when constructing a habitat for a specific organism Work and enterprise icon

#### Interdependence of Species and their Environments

**Inquiry question:** How do living things depend on each other and their environment?

Students:

* recognise that living things use each other for food Intercultural understanding icon
* identify simple food chains in local area, for example: Difference and diversity icon
  + plant → snail → duck
  + weed → small fish → large fish
  + plant → caterpillar → bird
* recognise that dead plants and animals and waste products are a food source, for example:
  + maggots eat dead animals
  + fungus grows on rotting wood
* recognise that a change in the number of a species can affect the whole ecosystem, for example: Difference and diversity icon
  + the presence of carp in the rivers reduces the number of perch
  + blue-green algae in rivers kills fish
* investigate a local habitat to gather data in relation to changes in animal and plant species over time, for example: Critical and creative thinking icon Numeracy icon Civics and citizenship icon
  + number of fish in a local stream
  + number of types of birds in a local park
  + construct a food web to demonstrate the interdependence of species in a particular ecosystem
* demonstrate ethical and safe practices when gathering data on a local habitat Ethical understanding icon Work and enterprise icon

#### Importance of Human Action in Maintaining a Balance in Nature

**Inquiry question:** What are the consequences of human activity on a habitat or ecosystem?

Students:

* observe human-made changes to a local habitat, for example: Sustainability icon
  + playground equipment in a local park
  + boat ramp or pier at a local river
* recognise a range of human activities that can affect an ecosystem, for example: Sustainability icon
  + damming of rivers
  + farming
  + use of pesticides
  + deforestation
  + household chemicals in waterways
* investigate the effects on ecosystems of human activity, for example: Sustainability icon Ethical understanding icon
  + cutting down trees results in removing homes for birds and possums
  + spraying insects can poison birds’ food supply
  + heavy metal contamination, eg mercury, in water poisons fish
* explore land management practices of Aboriginal Peoples, for example: Aboriginal and Torres Strait Islander histories and cultures icon
  + using fire to plan and predict plant growth
  + fish traps that allow smaller fish to escape and capture larger fish

**Inquiry question:** How can humans contribute to the preservation of habitats and ecosystems?

Students:

* explore regulations to control the effect of human activity on ecosystems, for example: Sustainability icon Work and enterprise icon
  + fishing quotas
  + regulations to prevent the dumping of oil/petrol/waste in sewers
  + regulations to prevent the dumping of toxic waste in landfill
  + regulations to prevent the dumping of tyres in bushland
* investigate ways in which damage to ecosystems can be reduced, for example: Sustainability icon
  + buying and using biodegradable detergents
  + growing native plant species
* examine how humans can assist in maintaining a balance in nature, for example: Personal and social capability icon
  + fishing only for personal use
  + locking up cats at night
  + using only the amount of material that is required
  + disposing of waste appropriately
  + using biodegradable detergents
* investigate a local habitat or ecosystem to predict changes as a result of human activity, for example: Ethical understanding icon Civics and citizenship icon
  + a reduction in the number of particular species of plants and animals

#### Impact of Human Activity on Garden Habitats

**Inquiry question:** How can humans demonstrate responsible garden management?

Students:

* explore a garden or model of a garden to recognise the physical characteristics and diversity of plants and animal species Difference and diversity icon
* identify and classify pests that can damage a garden, for example: Difference and diversity icon
  + insects (aphids, locusts, beetles)
  + birds (cockatoos, parrots)
  + mammals (flying foxes, possums)
  + fungi (rust, black spot)
* investigate different ways of controlling pests in the garden
* recognise a range of chemicals used on gardens, for example:
  + fertilisers
  + white oil
  + weed killers
  + herbicides
  + insecticides
* explore why chemicals are used on gardens, for example:
  + to prevent insect infestation
  + to prevent discolouration of leaves
* predict some dangers associated with chemical use on or in a garden, for example: Sustainability icon Ethical understanding icon
  + spray may be carried by breeze
  + danger of breathing in fumes
  + airborne spray may contaminate the wrong plants
  + fungus may be present in potting mix
* explore how chemicals can be used safely and appropriately in the garden, for example: Ethical understanding icon
  + wearing a face mask when spraying
  + wearing gloves when handling potting mix
  + checking quantities of a chemical when mixing it with water
* demonstrate the ways in which garden chemicals are stored safely, for example: Ethical understanding icon Personal and social capability icon
  + store in a locked cupboard/locked garden shed
  + keep containers dry
  + not placing chemicals in unmarked containers
* investigate environmentally friendly methods to control garden pests, for example: Sustainability icon
  + string deterrents over tomatoes
  + cloth cover over ferns
  + companion planting

## Module 3: Heredity and Genetics

### Outcomes

**A student:**

* poses questions and hypotheses for scientific investigation SCLS6-1
* collects and represents qualitative or quantitative data and information using media as appropriate SCLS6-4
* develops conclusions from primary or secondary data and information SCLS6-5
* recognises that scientific investigations can support or refute a hypothesis SCLS6-13
* investigates how science impacts on society SCLS6-14
* explores contemporary issues involving science SCLS6-15

**Related Investigating Science outcomes:** INS11/12-1, INS11/12-4, INS11/12-5, INS12-14,   
INS12-15

### Content Focus

Students recognise observable genetic traits and identify common genetic traits within their family. They develop an understanding of the difference between inherited traits and traits that are learned or passed on in social and cultural contexts. They also consider the ethics of selecting and producing genetic traits in a range of living things.

### Working Scientifically

In this module, students collect and represent data in relation to genetic traits and use this data to draw conclusions about heredity.

### Content

#### Inherited and Learned Traits

**Inquiry question:** What is the difference between inherited and learned traits?

Students:

* recognise things that make people unique, for example: Difference and diversity icon
  + physical attributes
  + personality
  + likes and dislikes
* recognise traits as distinguishing characteristics Difference and diversity icon
* identify that traits can be visible and invisible
* classify personal traits as visible or invisible
* recognise that the way they look is different to others Difference and diversity icon
* observe traits among a group of people, for example: Difference and diversity icon
  + gender
  + eye colour
  + hair colour
  + detached earlobes
  + tongue rolling
  + freckles
  + being right-handed
  + curly hair
* investigate the most common and least common traits of classmates by taking an inventory and recording data in a table or graph Numeracy icon Difference and diversity icon
* investigate traits shared by family members and record data Numeracy icon
* use a model, for example a tree diagram, to demonstrate how traits are passed down from family members Numeracy icon
* recognise that twins may or may not have the same traits
* recognise the transfer of traits from one generation to the next as heredity
* identify the difference between inherited traits and learned traits, for example: Intercultural understanding icon
  + physical attributes, eg eye colour and hair colour are inherited traits
  + favourite foods or sports may be learned traits
* explore the ways in which our cultural and social environments can lead to learned traits, for example: Aboriginal and Torres Strait Islander histories and cultures icon Asia and Australia’s engagement with Asia icon Intercultural understanding icon
  + a favourite sport can come from living with family members who have a passion for that particular sport
* identify that living things are made up of cells that contain DNA
* recognise that deoxyribonucleic acid (DNA) provides the recipe for the traits inherited by a living thing
* recognise that all living things have both inherited and learned traits
* investigate the inherited and behavioural traits of an animal species, for example: Critical and creative thinking icon Difference and diversity icon
  + physical attributes of the red kangaroo
  + licking forearms on a hot day increases evaporation and cooling

#### Genetic Selection

**Inquiry question:** How does an understanding of genetics impact on people’s lives?

Students:

* explore how an understanding of human genetics has led to scientific advancements, for example:  Information and communication technology capability icon
  + increased understanding of the link between genetics and diseases, eg cancer, heart disease and diabetes
* identify some ethical issues associated with an increased understanding of human genetics, for example: Ethical understanding icon
  + choosing gender for personal choice
  + reducing the chance of diseases or disabilities
  + creating donors for siblings
* explore examples of genetic selection in animals, for example: Ethical understanding icon
  + selecting the temperaments of parent dogs for breeding dogs for different purposes, eg herding and guard dogs
  + using genetic selection to increase milk production in cows or wool production in sheep

## Module 4: Disease and Disorders

### Outcomes

**A student:**

* collects and represents qualitative or quantitative data and information using media as appropriate SCLS6-4
* develops conclusions from primary or secondary data and information SCLS6-5
* communicates information about an investigation using scientific language and terminology SCLS6-7
* uses patterns and trends in data to make observations and draw conclusions SCLS6-9
* investigates technologies used in science SCLS6-12

**Related Investigating Science outcomes:** INS11/12-4, INS11/12-5, INS11/12-7, INS11-9, INS12-13

### Content Focus

Students investigate infectious and non-infectious diseases and disorders to develop an understanding of the treatment, prevention and control of diseases and disorders in our society. They explore issues relating to human health, including the use of technologies in treating diseases and disorders.

### Working Scientifically

In this module, students collect, represent and draw conclusions from data to communicate information in relation to disease.

### Content

#### Infectious and Non-infectious Diseases and Disorders

**Inquiry question:** What is the difference between infectious and non-infectious disease?

Students:

* recognise common examples of diseases and disorders, for example:
  + influenza
  + measles
  + heart disease
  + diabetes
  + cancer
* recognise that infectious disease can be spread between people through direct contact or the air Civics and citizenship icon
* recognise that non-infectious diseases and disorders are caused by genetic, lifestyle or environmental factors
* classify a range of diseases and disorders as infectious or non-infectious Difference and diversity icon
* explore why it is important to know whether a disease or disorder is infectious or non-infectious Civics and citizenship icon
* recognise that plants and animals can both be affected by disease

#### Causes of Infectious Disease

**Inquiry question:** How are infectious diseases spread?

Students:

* recognise causes of infectious disease, for example:
  + direct contact, eg from person to person or animal to person
  + indirect contact, eg touching a doorknob after someone who is sick has touched it
  + insect bites, eg Malaria
  + food and water contamination
* recognise that infectious diseases come from microorganisms, viruses or macroorganisms, for example worms and tick bites
* participate in an investigation into the transfer of infectious disease through direct contact, for example: https://lh6.googleusercontent.com/EdvWh_GyIWeWkoGzdGdG9BqJEgLeSCWG-ycm_Ma_NHT-SdquLmMhWNsXEBePNJdnyi80i2boeVBa6HKHOXPlb8dY9U3FQdu17gGxh2NIB93Ce9_NblFf7MPQ2sow38VEV8vn-tit
  + an experiment involving the transfer of coloured paint on hands through handshakes
  + exploring the signs and symptoms of a common infectious disease
* participate safely in an investigation to compare the transfer of germs from different surfaces Critical and creative thinking icon
* participate safely in an investigation to identify hygienic food storage practices Critical and creative thinking icon Work and enterprise icon

#### Prevention, Treatment and Control of Infectious Disease

**Inquiry question:** How can the spread of infectious diseases be controlled?

Students:

* participate in an investigation to explore the prevention of infectious diseases transferred by direct contact, for example: Civics and citizenship icon
  + using a variety of substances to wash the coloured paint off hands from the above handshake experiment
  + varying the time and substances used to wash hands and recording the results
* recognise risks and strategies to minimise risks when participating in an investigation to explore the transfer of infectious diseases Ethical understanding icon Work and enterprise icon
* explore data relating to the prevalence of infectious diseases in global populations, for example: Intercultural understanding icon Literacy icon Difference and diversity icon
  + Malaria or Dengue Fever
  + tuberculosis
  + measles
* draw conclusions from data relating to the prevalence of infectious disease around the world Intercultural understanding icon Literacy icon
* explore procedures that can prevent the spread of disease, for example: Ethical understanding icon
  + hygiene practices
  + vaccinations
  + public health campaigns
* investigate the effectiveness of one or more procedures used to prevent the spread of disease, for example: Critical and creative thinking icon
  + childhood immunisation program to prevent measles
  + influenza public health campaigns in Australia
* explore a case study of a disease outbreak in humans, plants and/or animals to investigate causes, signs, symptoms, effects and treatment or control, for example: Critical and creative thinking icon Intercultural understanding icon
  + Black Death in England (1348–1349), Zika virus in Brazil (2016)
  + late blight of potato in Ireland (1845–1860), Panama disease of banana in Central America (1900–1965)
  + white-nose syndrome in bats in North America (2006), foot and mouth disease in livestock in Britain (2001)
* explore traditional methods used to control or treat infectious diseases, for example: Aboriginal and Torres Strait Islander histories and cultures icon Asia and Australia’s engagement with Asia icon Intercultural understanding icon
  + use of honey, lard and lint by Egyptians to dress infected wounds
  + drinking of tea made from wormwood leaves by the Chinese to cure chills and fevers
  + the use of tea tree oil by Aboriginal people for wounds and in tea for throat ailments

#### Prevalence of Non-infectious Disease

**Inquiry question:** Do non-infectious diseases cause more deaths than infectious diseases?

Students:

* investigate data for a range of infectious and non-infectious diseases across specified regions and time periods to draw conclusions about the prevalence and mortality rates of infectious and non-infectious diseases

#### Prevention of Non-infectious Disease

**Inquiry question:** How can non-infectious diseases be prevented?

Students:

* recognise some lifestyle factors that may be linked to non-infectious diseases, for example: Personal and social capability icon
  + diet and nutrition
  + exercise and physical activity
  + alcohol consumption
  + smoking
* identify some environmental factors that may be linked to non-infectious diseases or disorders, for example:
  + heavy metal poisoning, eg lead or mercury
  + cancers caused by the use of some pesticides, eg agent orange, DDT
* explore educational programs and campaigns for a range of non-infectious diseases Civics and citizenship icon
* investigate an educational program or a campaign for a specific non-infectious disease Critical and creative thinking icon
* create an educational program or a campaign to increase people’s awareness of a specific non-infectious disease Literacy icon

#### Technologies and Disorders

**Inquiry question:** How can technologies be used to assist people with disorders?

Students:

* recognise a range of physical disorders, for example:
  + sensory disorders, eg hearing and visual loss
  + cerebral palsy
  + muscular dystrophy
  + kidney or heart disorders
* engage with models of body parts to explore how they can be affected by a disorder, for example:  Information and communication technology capability icon Literacy icon
  + ears
  + eyes
  + kidneys
* identify how technology can be used to assist with the effects of some disorders, for example:  Information and communication technology capability icon
  + hearing aids and cochlear implants for hearing loss
  + spectacles and laser surgery for vision loss
  + dialysis for loss of kidney function

# Chemical World Science Life Skills

## Course Structure

| **Year 11**  **(120 hours)**  **Year 12**  **(120 hours)** | **Working Scientifically Skills** | **Course** | **Suggested modules** | **Depth studies** |
| --- | --- | --- | --- | --- |
| Investigating Science Life Skills | Cause and Effect  Scientific Models  Science and Technology  Science and Society |
| Physical World Science Life Skills | Forces and Motion  Energy |
| Earth and Space Science Life Skills | Earth’s Resources  Human Impacts  Earth’s Processes and Hazards  Resource Management |
| Living World Science Life Skills | The Structure and Organisation of Living Things  Diversity and Ecosystems  Heredity and Genetics  Disease and Disorders |
| Chemical World Science Life Skills | Properties of Matter  Chemical Reactions |

For Science Life Skills:

* Students may complete one or more coursesto contribute up to six units of study towards their Preliminary or HSC pattern of study.
* Students are not required to address or achieve all the Science Life Skills outcomes.
* Students are not required to complete all of the content to demonstrate achievement of an outcome.
* Outcomes and content should be selected to meet the particular needs of individual students.
* The modules provide possible frameworks for addressing the Science Life Skills outcomes and content, and are suggestions only. Teachers have the flexibility to develop modules that will meet the needs and interests of their students.
* Examples provided under the content points are suggestions only. Teachers may use the examples provided or develop other examples to meet the particular needs of individual students.
* Working Scientifically outcomes and content are to be integrated into modules wherever students undertake an investigation.
* Depth studies may be undertaken within any course and can relate to any module in a course.

## Module 1: Properties of Matter

### Outcomes

**A student:**

* participates in investigations individually or collaboratively to collect primary or secondary data and information SCLS6-3
* develops conclusions from primary or secondary data and information SCLS6-5
* communicates information about an investigation using scientific language and terminology SCLS6-7
* explores models and descriptions of phenomena SCLS6-10

**Related Investigating Science outcomes:** INS11/12-3, INS11/12-5, INS11/12-7, INS11-10,   
INS11-11

### Content Focus

Students explore properties of matter, and recognise the relationship between these properties and their uses in everyday contexts.

### Working Scientifically

In this module, students recognise a range of models as representations of matter. They use models to communicate ideas about how matter is used in everyday contexts.

### Content

#### Properties of Matter

**Inquiry question:** How does matter change its state?

Students:

* recognise the states of matter (solid, liquid, gas)
* classify a range of everyday materials according to their state Critical and creative thinking icon
* explore how matter can change state Critical and creative thinking icon
* observe matter changing state to recognise that heat energy or pressure needs to be applied or removed for the change to occur
* explore processes required for a matter to change state, for example boiling, melting, freezing, sublimation
* investigate the temperature and/or pressure required for changes in state, for example: Critical and creative thinking icon
  + melting a solid, eg metal
  + changing a liquid into a solid, eg ice
  + changing a solid to a gas, eg dry ice

#### Use of a Substance Depends on its Physical and Chemical Properties

**Inquiry question:** What are mixtures used for?

Students:

* observe the result of mixing a range of substances
* participate in practical investigations to mix a range of substances to form solutions, suspensions or colloids, for example: Critical and creative thinking icon
  + dissolving carbon dioxide into water to make a carbonated drink (solution)
  + mixing soil and water (suspension)
  + mixing vinegar and oil to make a salad dressing (colloid)
* demonstrate safe practices when mixing a range of substances to form solutions, suspensions or colloids
* identify a range of household products as solutions, suspensions or colloids

**Inquiry question:** How do the chemical properties of a substance influence its use?

Students:

* explore how the chemical properties of a range of everyday substances influence their use, for example: Difference and diversity icon
  + corrosive properties of acid used in cleaning products
  + anti-inflammatory properties of clothing worn by electricians or firefighters

#### Separating Mixtures

**Inquiry question:** How are separation techniques applied to mixtures in everyday contexts?

Students:

* explore a range of separation techniques, for example:
  + filtration
  + chromatography
  + distillation
* identify common uses of separation techniques, for example: Civics and citizenship icon
  + tea straining
  + chromatography in forensic testing
  + distillation of salt water to form fresh water
* investigate how separation techniques are selected according to the properties of the substances being separated Difference and diversity icon

## Module 2: Chemical Reactions

### Outcomes

**A student:**

* poses questions and hypotheses for scientific investigation SCLS6-1
* plans an investigation individually or collaboratively to obtain primary or secondary data and information SCLS6-2
* participates in investigations individually or collaboratively to collect primary or secondary data and information SCLS6-3
* uses strategies to solve scientific problems SCLS6-6
* uses patterns and trends in data to make observations and draw conclusions SCLS6-9

**Related Investigating Science outcomes:** INS11/12-1, INS11/12-2, INS11/12-3, INS11/12-6, INS11-9

### Content Focus

Students investigate a range of common chemical reactions and relate these to actions or products in everyday life.

### Working Scientifically

In this module, students plan and conduct investigations to observe chemical reactions and their effects. They pose questions, participate in investigations and solve problems to draw conclusions.

### Content

#### Chemical Reactions in Everyday Contexts

**Inquiry question:** What is a chemical reaction?

Students:

* recognise that chemical reactions change matter into new products
* identify cooking and cleaning as common examples of chemical reactions
* investigate a range of common chemical reactions, for example: Critical and creative thinking icon
  + photosynthesis
  + combustion
  + rust
  + cooking
  + batteries
  + digestion
  + acid–base reactions
  + soaps and detergents
* use equipment safely when investigating chemical reactions Work and enterprise icon
* participate in a practical investigation to answer a question in relation to a common chemical reaction, for example: Critical and creative thinking icon
  + Which dishwashing detergent cleans the best?
  + What chemical reactions occur when baking a cake?
* identify risks in participating in an investigation involving chemical reactions and describe ways to minimise these risks Ethical understanding icon Work and enterprise icon
* identify processes that can be involved in chemical reactions, for example heating

#### Acids and Bases

**Inquiry question:** How are acid-base reactions present in everyday contexts?

Students:

* recognise that liquids have acidic or basic traits
* recognise that water can be both an acid and a base
* identify that the term pH represents the acidity of a substance Literacy icon
* conduct investigations to measure the pH level of a range of skin care and hair products Numeracy icon
* identify the pH levels of substances that are appropriate for contact with the skin
* explore a range of acid-base neutralisations in everyday contexts, for example: Critical and creative thinking icon
  + baking soda for relief of indigestion
  + neutralisation of food in the stomach
* identify that pollutants can cause acid rain Sustainability icon
* explore the effects of and problems arising from ocean acidification Sustainability icon

# Glossary

| **Glossary term** | **Definition** |
| --- | --- |
| **Aboriginal and Torres Strait Islander Peoples** | Aboriginal Peoples are the first peoples of Australia and are represented by over 250 language groups each associated with a particular Country or territory. Torres Strait Islander Peoples whose island territories to the north east of Australia were annexed by Queensland in 1879 are also Indigenous Australians and are represented by five cultural groups.  An Aboriginal and/or Torres Strait Islander person is someone who:   * is of Aboriginal and/or Torres Strait Islander descent * identifies as an Aboriginal person and/or Torres Strait Islander person, and * is accepted as such by the Aboriginal and/or Torres Strait Islander community in which they live. |
| **Conclusion** | A judgement based on evidence. |
| **controlled variable** | A variable that is kept constant (or changed in constant ways) during an investigation. |
| **Country** | An area that is traditionally owned and looked after by an Aboriginal language group or community or certain people within that group. The term may indicate more than simply a geographical area – it is also a concept that can encompass the spiritual meanings and feelings of attachment associated with that area. |
| **dependent variable** | A variable that changes in response to changes to the independent variable in an investigation. |
| **digital technologies** | Systems that handle digital data, including hardware and software, for specific purposes. |
| **environment** | All surroundings, both living and non-living. |
| **hypothesis** | A tentative explanation for an observed phenomenon, expressed as a precise and unambiguous statement that can be supported or refuted by investigation. |
| **Indigenous cultural and intellectual property** | Includes objects, sites, cultural knowledge, cultural expression and the arts, that have been transmitted or continue to be transmitted through generations as belonging to a particular Indigenous group or Indigenous people as a whole or their territory. |
| **independent variable** | A variable that is changed in an investigation to see what effect it has on the dependent variable. |
| **investigation** | A scientific process of answering a question, exploring an idea or solving a problem, which requires activities such as planning a course of action, collecting data, interpreting data, reaching a conclusion and communicating these activities. Investigations can include practical or secondary-sourced data or information. |
| **law** | A statement describing invariable relationships between phenomena in specified conditions, frequently expressed mathematically. |
| **model** | A representation that describes, simplifies, clarifies or provides an explanation of the workings, structure or relationships within an object, system or idea. |
| **pareidolia** | A psychological phenomenon involving a stimulus (an image or a sound) where the human mind perceives a familiar pattern of something where none actually exists. |
| **Place** | A space mapped out by physical or intangible boundaries that individuals or groups of Torres Strait Islander Peoples occupy and regard as their own. Places are spaces with varying degrees of spirituality. |
| **practical investigation** | An investigation that involves systematic scientific inquiry by planning a course of action and using equipment to collect data and/or information. Practical investigations include a range of hands-on activities, and can include laboratory investigations and fieldwork. |
| **primary sources/primary data** | Information created by a person or persons directly involved in a study or observing an event. |
| **reliability** | An extent to which repeated observations and/or measurements taken under identical circumstances will yield similar results. |
| **risk assessment** | The determination of quantitative or qualitative estimate of risk related to a well-defined situation and a recognised threat (also called hazard). |
| **secondary-sourced investigation** | An investigation that involves systematic scientific inquiry by planning a course of action and sourcing data and/or information from other people, including written information, reports, graphs, tables, diagrams and images. |
| **technology** | All types of human-made systems, tools, machines and processes that can help solve human problems or satisfy needs or wants, including modern computational and communication devices. |
| **theory** | A set of concepts, claims and/or laws that can be used to explain and predict a wide range of related observed or observable phenomena. Theories are typically founded on clearly identifiable assumptions, are testable, produce reproducible results and have explanatory power. |
| **validity** | An extent to which tests measure what was intended, orto which data, inferences and actions produced from tests and other processes are accurate. |
| **variable** | In an investigation, a factor that can be changed, maintained or measured, eg time, distance, light, temperature. |