

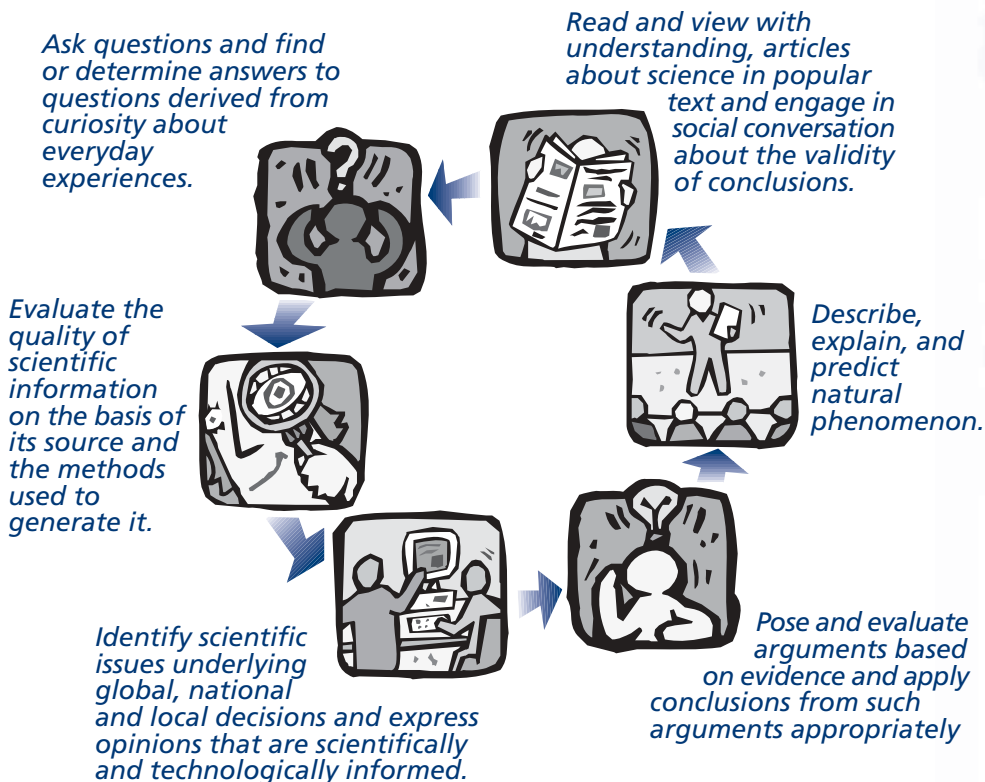
Science Learning Area

Introduction

The **Science Learning Area** is designed to develop scientific literacy that places a high priority on helping all citizens to be interested in and to understand the world around them. It also helps them to engage in the discourses of and about science, to be sceptical and to question other people's claims on scientific matters, to be able to identify questions and draw evidence-based conclusions, and to make informed decisions about the environment and their personal health and well-being. (Goodrum, Hackling and Rennie, 2000:vii)

Definition of scientific literacy

Scientific literacy means that a person can



Learning in and about Science

Science is presented within this framework from a social constructivist perspective.

Essentially this means that

- learners build on what they already know when developing new knowledge and understandings
- learners view, structure and transmit their knowledge of the world via multiple pathways, each with its insights and limitations
- construction of knowledge is an active and ongoing process
- science as a way of knowing is constructed in a socio-cultural context .

The Science Learning Area recognises that world views are socio-culturally-based and can be used to inform, enhance and extend peoples understanding about the living and physical world.

Science teaching combines developing concepts and acquiring facts. Learners need opportunities to experience genuine practical scientific investigations and time to re-work their ideas and develop rigorous conceptual understandings.

Strands

Science is simultaneously a creative problem-solving process, a communication system and a cultural system of making meaning of the world and beyond. The Science Learning Area is organised into two strands:

Working Scientifically

Working Scientifically is an effective way to generate understanding, test ideas and creatively solve problems. This stand has five elements:

- **Planning** - learners plan to test ideas about the natural and technological world
- **Investigating** - learners collect and record a variety of information relevant to their investigation, translate and analyse the information to find patterns and draw conclusions to share and extend their investigations
- **Evaluating** - learners reflect on their investigations, evaluate the process and generate further ideas
- **Acting Responsibly** - learners make decisions and take responsible action in their society
- **Science in Society** - learners examine and use the relationship between the nature and direction of science and society's perspectives and values.

Concepts and Contexts

Concepts and Contexts allows learners to develop a scientific understanding of their world. Science needs a foundation upon which new experiences and knowledge can be built. These foundations should form the context and knowledge through which teachers help learners achieve the outcomes in the Working Scientifically Strand. This strand encompasses scientific understandings, theories, ideas, and knowledge drawn from the four scientific disciplines - Natural and Processed Materials (Chemistry), Life and Living (Biology), Energy and Change (Physics), and Earth and Beyond (Geology).

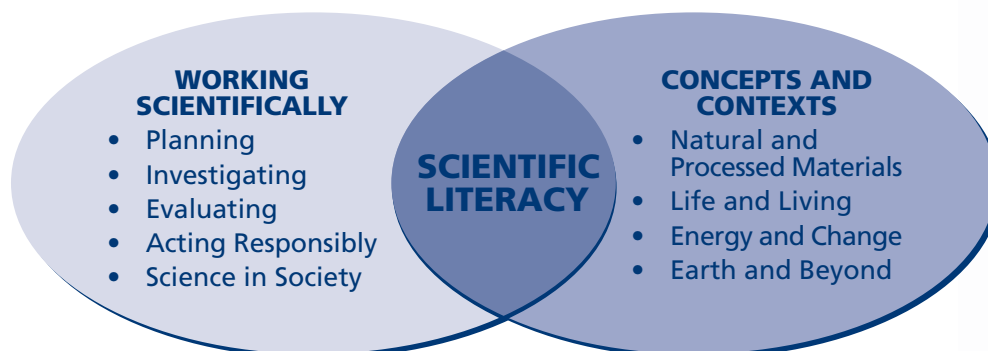
- **Natural and Processed Materials**
 - the properties and structure of materials are inter-related
 - patterns of interaction between materials can be identified and used to predict and control further interactions
 - the uses of material are determined by their properties, some of which can be changed.
- **Life and Living**
 - the characteristics of living things and its functioning are inter-related
 - evolutionary processes have given rise to a diversity of living things which can be grouped according to their characteristics
 - environments are dynamic and have living and non-living components which interact.
- **Energy and Change**
 - the forces acting on objects influence their motion, shape, behaviour and energy
 - in interactions and changes, energy is transferred and transformed but not created or destroyed
 - there are different ways of obtaining and utilising energy and these have different consequences.
- **Earth and Beyond**
 - the Earth, solar systems and universe are dynamic systems
 - events on Earth, in the solar systems and in the universe occur on different scales of time and space
 - living things use the resources of the Earth, solar system and universe to meet their needs and wants and these have different consequences

These elements can be informed by local material (issues or problems), learner needs and cultural contexts, enabling topics and pedagogy to be culturally relevant and providing the opportunity to involve local experts. This in turn will facilitate rich inquiry into different knowledge systems as well as foster collaboration, mutual understanding and respect.

The two strands are inter-related, working together to develop the scientific literacy of learners. When the strands are integrated in this way learners

- investigate and communicate in and about science
- investigate scientific contexts and concepts that are relevant and meaningful to them and their society, in a responsible way
- investigate scientific concepts in a range of contexts to question, extend or amend their personal constructions of scientific understandings and processes.

Figure 1: Inter-relationship between the two strands



Strands and Links	Learners demonstrating evidence of Key Growth Point 1	Learners demonstrating evidence of Key Growth Point 2	Learners demonstrating evidence of Key Growth Point 3	Learners demonstrating evidence of Band 1
<p>Working Scientifically</p> <p>Links</p> <p>EsseNTial Learnings: In 1, In 3, Cr 1, Cr 2, Col 3, Con 1, Con 2</p> <p>Learning Areas: HPE, SOSE, Technology and Design</p> <p>Perspectives: Literacy, Numeracy, Environmental, Learning Technology</p>	<p>WS KGP 1 Working Scientifically attend to, anticipate, explore and respond to sensory stimuli in their immediate environment.</p>	<p>WS KGP 2.1 Planning generate and communicate ideas about familiar experiences</p> <p>WS KGP 2.2/3 Investigating and Evaluating make choices and share observations about their experiences in their immediate environment</p> <p>WS KGP 2.4/5 Acting Responsibly and Science in Society participate in activities that increase their awareness of science in their daily life and identify how to take care of themselves and other living things in their immediate environment.</p>	<p>WS KGP 3.1 Planning list what is known and suggest questions for investigations about familiar situations</p> <p>WS KGP 3.2/3 Investigating and Evaluating carry out instructions and procedures involving a small number of steps, share observations and possible interpretations and relate observations to other situations</p> <p>WS KGP 3.4/5 Acting Responsibly and Science in Society carry out investigations with due care and share their own thinking about science in daily life.</p>	<p>WS 1.1 Planning ask questions and make suggestions to guide observations and investigations of familiar situations</p> <p>WS 1.2/3 Investigating and Evaluating conduct investigations, use information gathered to answer their own questions and collaboratively suggest possible improvements to investigations</p> <p>WS 1.4/5 Acting Responsibly and Science in Society describe some ways that scientific activities affect their community including ways that applications of science protect and enhance quality of life.</p>
<p>Concepts & Contexts</p> <p>Links</p> <p>EsseNTial Learnings: In 4, Cr 1, Con 1, Con 3, Con 4</p> <p>Learning Areas: HPE, SOSE, Technology and Design</p> <p>Perspectives: Literacy, Numeracy, Environmental, Indigenous</p>	<p>CC KGP 1 Concepts and Contexts recognise features and changes to themselves or objects in the immediate environment.</p>	<p>CC KGP 2.1 Natural and Processed Materials identify features and uses of familiar materials</p> <p>CC KGP 2.2 Life and Living recognise basic features of plants, animals and environments</p> <p>CC KGP 2.3 Energy and Change identify changes in their everyday environment</p> <p>CC KGP 2.4 Earth and Beyond recognise physical features of their immediate environment.</p>	<p>CC KGP 3.1 Natural and Processed Materials explain that different materials have basic properties and uses</p> <p>CC KGP 3.2 Life and Living identify the characteristics and basic needs of plants, animals and environments</p> <p>CC KGP 3.3 Energy and Change identify energy sources and their uses in everyday life</p> <p>CC KGP 3.4 Earth and Beyond identify physical features of their environment, including the sky, that affect them.</p>	<p>CC 1.1 Natural and Processed Materials explain that materials have many uses and properties and can undergo change</p> <p>CC 1.2 Life and Living describe how the needs, features and functions of living things are related to change over time</p> <p>CC 1.3 Energy and Change describe different energy forms, ways energy is used for different purposes, and changes in energy</p> <p>CC 1.4 Earth and Beyond describe changes in their physical environment including the sky and how they are affected.</p>

Learners demonstrating evidence of
Band 2**WS 2.1****Planning**

suggest ways of doing investigations, giving consideration to fair testing, and make simple predictions based on personal experience

WS 2.2**Investigating**

organise and use equipment and resources consistently to gather and present information

WS 2.3**Evaluating**

justify conclusions on the basis of collected information and identify difficulties experienced in doing investigations

WS 2.4**Acting Responsibly**

explain how they and others use science responsibly in the community

WS 2.5**Science in Society**

describe how people of various socio-cultural and historical backgrounds construct and share their understandings of the world around them.

Learners demonstrating evidence of
Band 3**WS 3.1****Planning**

plan their own guided investigations, identifying factors to be considered to ensure a fair test

WS 3.2**Investigating**

collect and record information and draw conclusions as accurately as resources allow

WS 3.3**Evaluating**

review the extent to which conclusions are reasonable answers to the questions posed and processes used

WS 3.4**Acting Responsibly**

consider the underlying values and implications of scientific decisions in communities

WS 3.5**Science in Society**

examine how people and groups from various socio-cultural and historical backgrounds have contributed to the development and application of science.

Strands and Links**Working Scientifically****Links****EsseNTial Learnings:**

In 1, In 3, Cr 1, Cr 2, Col 3, Con 1, Con 2

Learning Areas: HPE, SOSE, Technology and Design

Perspectives:

Literacy, Numeracy, Environmental, Learning Technology, Indigenous, Studies of Asia

**CC 2.1****Natural and Processed Materials**

describe how properties, changes and uses of materials are related

CC 2.2**Life and Living**

organise features of living things into systems which determine their interaction with the environment

CC 2.3**Energy and Change**

describe patterns of energy usage and transfer between common sources and receivers

CC 2.4**Earth and Beyond**

link changes in the environment to physical processes on or beyond Earth and to human activities.

CC 3.1**Natural and Processed Materials**

describe properties, changes and uses of materials in terms of their substructure

CC 3.2**Life and Living**

explain that living systems can interact and that such interactions can lead to change

CC 3.3**Energy and Change**

compare energy options and trace sequences of energy transfers, identifying the processes and conditions under which they occur

CC 3.4**Earth and Beyond**

describe and predict, from a scientific perspective, the impacts of changes in the physical environment and the universe.

Concepts & Contexts**Links****EsseNTial Learnings:**

In 4, Cr 1, Con 1, Con 4

Learning Areas: HPE, SOSE, Technology and Design

Perspectives:

Literacy, Numeracy, Environmental, Indigenous, Learning Technology



Strands and Links

Learners demonstrating evidence of
Band 4

Learners demonstrating evidence of
Band 5

Learners demonstrating evidence of
Beyond Band 5

Working Scientifically

Links

EsseNTial Learnings:

In 1, In 3, Cr 1, Cr 2, Col 3
Constructive Learner

Learning Areas:

HPE, SOSE, Technology and Design

Perspectives:

Literacy, Numeracy, Environmental, Indigenous, Learning Technology, Studies of Asia

WS 4.1 Planning

assess a problem, formulate a hypothesis and plan a fair test that controls a number of variables, from a given focus question

WS 4.2 Investigating

select equipment and data processing techniques that will clarify patterns and allow generalisations

WS 4.3 Evaluating

assess the confidence of the conclusions drawn from their findings and make suggestions to improve an investigation

WS 4.4 Acting Responsibly

propose and implement responsible scientific actions when making decisions or taking action

WS 4.5 Science in Society

review the contributions to the development of scientific ideas made by individuals and groups, past and present, and consider the factors that assisted or hindered them.

WS 5.1 Planning

identify a problem, formulate a question and a hypothesis for testing and plan for a fair test

WS 5.2 Investigating

select instruments and data processing techniques to enhance the accuracy and reliability of investigations and draw conclusions consistent with data

WS 5.3 Evaluating

assess conclusions in relation to other evidence and scientific theory

WS 5.4 Acting Responsibly

make decisions and take action with consideration to the ethical, social and environmental implications

WS 5.5 Science in Society

identify a range of issues underlying global and local decisions and express opinions that are scientifically and technologically informed.

WS 5+1 Planning

identify advantages and limitations of controlled investigations and consider alternatives

WS 5+2 Investigating

investigate and consider the limitations of techniques and instruments and their influence on accuracy and reliability

WS 5+3 Evaluating

discuss the limitations of conclusions

WS 5+4 Acting Responsibly

critique proposed or existing scientific decisions and recommend responsible action

WS 5+5 Science in Society

investigate an area of current scientific activity and assess the accountability of this activity.

Concepts & Contexts

Links

EsseNTial Learnings:

Cr 1, Con 1, Con 4

Learning Areas:

HPE, SOSE, Technology and Design

Perspectives:

Literacy, Numeracy, Environmental, Indigenous, Learning Technology

CC 4.1

Natural and Processed Materials

examine scientific evidence for models and concepts used to explain microscopic structures of properties

CC 4.2

Life and Living

examine scientific evidence for models and concepts that are used to explain the processes that connect living systems and lead to change

CC 4.3

Energy and Change

use scientific models and concepts, including mathematical expressions, to explain energy transfer

CC 4.4

Earth and Beyond

use scientific ideas to explain changes in the physical environment in terms of cycles and human exploitation.

CC 5.1

Natural and Processed Materials

analyse concepts and principles used to explain physical and chemical change in systems and families of chemical reactions

CC 5.2

Life and Living

analyse concepts and principles relating to interactions, balance, continuity and change in living things

CC 5.3

Energy and Change

explain principles and concepts relating to transfers and interactions in energy systems

CC 5.4

Earth and Beyond

critically analyse scientific theories which explain differences and changes in the physical environment and universe.

CC 5+1

Natural and Processed Materials

evaluate and describe the role of science in developing knowledge about structure, change and use of materials

CC 5+2

Life and Living

analyse and map the development of scientific understandings about living systems and change

CC 5+3

Energy and Change

analyse the historical role of science in developing systems of energy transfer

CC 5+4

Earth and Beyond

analyse the impacts of humans on space and the physical resources of the Earth from a scientific perspective.

Working Scientifically

OUTCOMES

Learners demonstrating evidence of **Key Growth Point 1**

WS KGP 1 Working Scientifically

attend to, anticipate, explore and respond to sensory stimuli in their immediate environment.

INDICATORS

Learners demonstrating evidence of **Key Growth Point 1** for example

Planning

- anticipate familiar routines [HPE-PA]
- initiate exploration/experimentation with objects in their environment
- give sensory focus to a display or investigation, eg look, touch, smell, hear, taste. [Cr 2]

Investigating

- search for source of stimuli
- explore objects and materials using their senses, eg
 - smell and taste food during cooking
 - mouth objects during play or recreation
 - manipulate playdough, food, equipment
- respond to various environmental conditions, eg water, rain, light, temperature
- respond to sensory stimuli such as touch and sound, eg participate in waterplay/swimming activities to investigate effects of splashing, objects floating [HPE-PA]
- recognise and label familiar objects.

Evaluating [In 1] [In 2]

- indicate likes/dislikes through structured choice making [HPE-HP]
- pursue objects and materials that interest them.

Acting Responsibly [In 4] [HPE-HP] [T&D]

- respond to instruction related to caring for themselves
- initiate exploration of familiar and unfamiliar environments
- recognise familiar healthcare workers and equipment, eg
 - physiotherapist, nurse, support worker
 - wheelchair, glasses, communication board, hearing aid.

Science in Society

[Collaborative Learner] [Con 4] [SOSE-Soc]

- focus on the attributes, (eg colour, parts, shape) of objects during exploration
- participate in activities that help them develop an awareness of science in daily life, eg gardening, making paper.

Links

Essential Learnings:
Cr 1, Con 1

Learning Areas:
Technology and Design

Perspectives:
Literacy,
Environmental

Working Scientifically

Links

EsseNTial
Learnings:

In 1, Cr 1 Con 2

Learning Areas:
Technology and
Design

Perspectives:
Literacy,
Environmental

OUTCOMES

Learners demonstrating evidence of **Key Growth Point 2**

WS KGP 2.1 Planning

generate and communicate ideas about familiar experiences

WS KGP 2.2/3 Investigating and Evaluating

make choices and share observations about their experiences in their immediate environment

WS KGP 2.4/5 Acting Responsibly and Science in Society

participate in activities that increase their awareness of science in their daily life and identify how to take care of themselves and other living things in their immediate environment.

INDICATORS

Learners demonstrating evidence of **Key Growth Point 2** for example

Planning [Con 1]

- select materials to support the activity they are doing
- ask why, what if, how, and what questions about their immediate environment and natural/person-made products in it
- devise a simple plan through discussion with adults or peers
- predict, follow and describe daily routines using visual texts.

Investigating and Evaluating [In 2] [Con 1]

- follow two-step visual or spoken procedures
- select equipment or areas to play/work based on weather conditions, surface features and safety
- respond to cause-effect situations, eg lights on/off [HPE-PD]
- use materials for the purpose intended, eg glue to attach paper together
- label objects and features, eg built and natural features of their immediate environment
- describe the function of objects, materials and technologies in their immediate environment, eg 'We use glue for sticking paper.'
- respond to and begin to use everyday science-related words, eg push, pull, hot, cold, sink, float
- identify familiar features of living things, environments, materials and technologies in texts
- express feelings about a process or product they have been involved in [In] [HPE-PD]
- communicate when work is completed
- request actions and activities to experience desired effect, eg
 - turn volume up and down on a radio/CD player
 - stir ingredients during cooking
- recount information from an immediate experience using home language.

Acting Responsibly and Science in Society [In 4] [Collaborative Learner] [Con 3] [Con 4]

- follow pictograph/spoken sequence for simple tasks, eg caring for themselves
- relate science ideas in stories to their life, eg share what they do at night after reading *Bears in the night* [Lit-RV], talk about hunting trips, watching artists prepare materials from bush materials
- share equipment and resources during investigations
- recognise environmental symbols to enhance personal safety, eg tap colours, danger/warning signs on household products, dangerous animals, airport and generator signage
- demonstrate that objects have the same function in different environments [T&D] [Num-SS]
- identify areas of the school that have changed because of what people do in them, eg link the presence of litter to children playing in that area, shelters built for shade during ceremonies

Working Scientifically

OUTCOMES

Learners demonstrating evidence of **Key Growth Point 3**

WS KGP 3.1 Planning

list what is known and suggest questions for investigations about familiar situations

WS KGP 3.2/3 Investigating and Evaluating

carry out instructions and procedures involving a small number of steps, share observations and possible interpretations, and relate observations to other situations

WS KGP 3.4/5 Acting Responsibly and Science in Society

carry out investigations with due care and share their own thinking about science in daily life.

Links

Essential Learnings:

In 1, Cr 1, Con 2

Learning Areas:
Technology and Design

Perspectives:

Literacy,
Environmental



INDICATORS

Learners demonstrating evidence of **Key Growth Point 3** for example

Planning

- contribute what is known about familiar situations or topics to a class brainstorm
- ask questions about everyday occurrences, eg 'Where does the sun go at night?' 'Why is the sky blue?' 'What makes the tide go in and out?'
- offer and discuss their own explanations of everyday phenomena
- experiment with materials/objects before deciding how to go about an investigation.

Investigating and Evaluating [Cr 2] [Col 3]

- collaborate with others to carry out instructions and procedures involving a small number of steps
- explain their observations to others and suggest possible interpretations
- assemble a simple system, eg Lego vehicles, puppet **[LT-P]**
- classify natural and man-made materials
- tell, act out or draw what they did and observed **[Arts-CrA]**
- access information from learning technologies and written texts, eg simple picture dictionaries, encyclopaedias, children's websites, multimedia software, eg The Way Things Work **[LT-R]**
- make connections between investigations/ explorations and daily living, eg
 - relate home experiences of cooking during school cooking experiences
 - connect the movement of the Lego vehicle to a car/bike moving
 - discuss why some bush foods are edible and some are inedible **[ILC] [HPE-HP]** 
 - connect movement of tides with times for fishing/hunting 
- use simple generalisations when interpreting ideas and information, eg most, all, some
- explain why they like/dislike a product or process and how they could have done it better
- describe their investigation including the question/purpose, materials and most steps
- compare personal knowledge and experiences with information in texts or observations in investigations.

Acting Responsibly and Science in Society

[In 3] [Collaborative Learner] [Con 3] [Con 4] [HPE-HP] 

- show empathy towards the feelings of their peers during a group investigation, eg some people do not like handling earthworms or touching certain materials
- identify and implement practices to care for animals they are investigating, eg
 - show responsibility, under supervision, for the care of animals and plants and when following investigation procedures
 - decide what environment/food a class pet needs to survive
- identify items in the home/school/ community they think involve science
- report on discussions with family members about how they use science
- listen to and comment on explanations of everyday scientific phenomena from other learners and teachers
- share own ideas about science, eg how an appliance works, how materials work, why some animals have fur, how tides work, why seasons change.


Working Scientifically

Links

EsseNTial Learnings:

In 1, Cr 1, Con 2
Learning Areas:
Technology and Design

Perspectives:

Literacy,
Environmental 

OUTCOMES

Learners demonstrating evidence of **Band 1**

WS 1.1 Planning

ask questions and make suggestions to guide observations and investigations of familiar situations

WS 1.2/3 Investigating and Evaluating

conduct investigations, use information gathered to answer their own questions and collaboratively suggest possible improvements to investigations

WS 1.4/5 Acting Responsibly and Science in Society

describe some ways that scientific activities affect their community including ways that applications of science protect and enhance quality of life.

INDICATORS

Learners demonstrating evidence of **Band 1** for example

Planning [Con 1]

- list questions that can guide their investigations
- read, view or listen to a procedure for an investigation and explain what they have to do
- discuss alternative ways of finding answers to possible questions, with support
- plan ideas for an investigation before implementing using visual, spoken and written texts
- predict an outcome of their investigation.


Investigating and Evaluating

[Cr 2] [Col 3] [Num-MDS] [LT-P]

- collaboratively conduct simple tests and describe observations
- identify patterns and groupings in information to draw conclusions [Num-NS]
- explain findings in writing, simple graphs, models and drawings
- use simple, non-standard measurements, eg jugs, paces
- use pictures, words or numbers to record observations
- make connections between ideas stated directly in simple scientific texts to interpret a diagram and its labels, eg follow written and visual steps in a procedure, read a report about a lifecycle and interpret a lifecycle diagram
- compose written texts containing a few related ideas in sequence and use some specific scientific vocabulary, eg materials and steps involved in simple procedures, explanations, descriptions, opinions
- sequence a simple procedure, eg recipe, hygiene practice, gardening task
- interpret and use simple organisational and classification structures, eg semantic grids, webs
- share with others the reasons for doing an investigation in a particular way and compare observations and findings
- identify that different investigation conditions can cause different outcomes
- discuss how they could redesign their investigation
- state whether the outcome of an investigation was the same as the prediction/answered posed questions
- justify opinions with evidence from observation and personal experience.

Acting Responsibly and Science in Society

[In 3] [Collaborative Learner] [Con 3] [Con 4] [HPE-HP] 

- use equipment and materials safely
- illustrate ways that applications of science affect their daily lives in both positive and negative ways, eg toothpaste to help maintain dental health
- report on discussions with family and community members about how they use science
- identify some ways scientists think and work
- discuss how explanations and science ideas they hold have been influenced by particular peers, adults, TV programs and books, eg examine stereotypes in media and books about scientists
- identify aspects of our life that depend on scientific knowledge to ensure quality of life, eg street lighting, foods, shelter, medicine
- listen to Indigenous Dreaming stories which incorporate scientific knowledge about particular environments including appearance, features and/or behaviour of specific flora and fauna [Lit -LS] [SOSE-Soc]  .

Working Scientifically

OUTCOMES

Learners demonstrating evidence of **Band 2**

WS 2.1 Planning

suggest ways of doing investigations giving consideration to fair testing and make simple predictions based on personal experience

WS 2.2 Investigating

organise and use equipment and resources consistently to gather and present information

WS 2.3 Evaluating

justify conclusions on the basis of collected information and identify difficulties experienced in doing investigations

WS 2.4 Acting Responsibly

explain how they and others use science responsibly in the community

WS 2.5 Science in Society

describe how people of various socio-cultural and historical backgrounds construct and share their understandings of the world around them.

Links

EsSEnTial Learnings:

In 1, Cr 1, Con 1, Con 2

Learning Areas:
Technology and Design

Perspectives:
Literacy,
Environmental

INDICATORS

Learners demonstrating evidence of **Band 2** for example

Planning

- pose questions that can be investigated
- make predictions and produce hypotheses they can test
- attempt to control at least two variables, eg suggest what they keep the same and what they can measure
- suggest resources/equipment they could use to answer posed questions
- discuss the importance of selecting authoritative sources of information or accurate measurements.

Investigating [Num-MDS] [LT-P]

- use equipment in the same way for different trials or treatments
- make simple measurements using standard units
- extract key scientific information from texts to answer questions [LT-R]
- choose forms of data representations appropriate to data being collected, eg list, tables, diagrams, audio, videotape
- identify patterns in data, eg draw bar graphs to shown patterns
- summarise patterns in conclusions but not necessarily explain them
- use scientific language related to phenomenon being investigated
- interpret labelled and captioned illustrations and diagrams.

Evaluating

- identify difficulties with exact or approximate measurements
- identify external factors that influenced results, eg a break in taking measurements, different people measuring
- describe how a variable was controlled in an investigation and why
- compare ways of solving problems and finding explanations
- suggest interpretations of data or information collected
- report on their investigations, identifying key steps and results
- justify conclusions based on personal experience
- clearly state own point of view in a scientific discussion or evaluation of an investigation.

Acting Responsibly

[In 3] [Con 3] [Con 4] [HPE-HP] 

- give examples of how their own knowledge influences their actions, eg 'I put plastic things in the recycle bin because they take 100 years to break down and before they break down they kill animals.'
- identify ways science is used in protecting and sustaining their community, eg how problems such as pollution, endangered species and introduced animals are tackled
- suggest ways to ensure safe investigations.

Science in Society

[Collaborative Learner] [Con 3] [SOSE-Soc] 

- describe ways that people learn about science
- investigate the ways people from various cultures identify scientific concepts, eg naming of stars/constellations, creation of the earth, features of plants and animals 
- identify ways people from diverse socio-cultural groups represent their beliefs and values about science, eg some Indigenous groups share beliefs about the land/country through art, dance, song, stories; Western and some Eastern science is recorded in writing
- investigate ways different groups use science in tackling community problems, eg pollution, endangered species, community access for people with disabilities.

Working Scientifically

Links

EsseNTial Learnings:

In 1, Cr 1, Con 1, Con 2

Learning Areas:
Technology and Design

Perspectives:
Literacy, Environmental

OUTCOMES

Learners demonstrating evidence of **Band 3**

WS 3.1 Planning

plan their own guided investigations, identifying factors to be considered to ensure a fair test

WS 3.2 Investigating

collect and record information and draw conclusions as accurately as resources allow

WS 3.3 Evaluating

review the extent to which conclusions are reasonable answers to the questions posed and processes used

WS 3.4 Acting Responsibly

consider the underlying values and implications of scientific decisions in communities

WS 3.5 Science in Society

examine how people and groups from various socio-cultural and historical backgrounds have contributed to the development and application of science.

INDICATORS


Learners demonstrating evidence of **Band 3** for example

Planning

- identify the variable to be changed, the variable to be measured and those to be controlled
- make appropriate suggestions about relevant observations, equipment and data collection techniques
- give a reason why a test within an experiment is or is not fair
- explain the need for safety precautions during scientific investigations
- suggest equipment and resources that will allow for accuracy
- formulate interview or survey questions that will elicit data required for an investigation
- define scientific vocabulary and terminology related to the naming of processes and ideas.

Investigating

[Cr 2] [Lit-RV] [Num-MDS] [LT]

- select and accurately use appropriate measuring instruments or research tools and strategies
- use accurate standardised measurements when collecting data
- use an observation routine that takes into account what, where and how it is to be done
- make more than one measurement or use more than one source of information during an investigation
- use simple calculations to analyse results, eg calculate averages from repeated trials [Num-NS]
- plot data as bar or line graphs where appropriate
- make conclusions that summarise and explain patterns in data based on information gathered
- make inferences and review their ideas in light of their results
- interpret scientific diagrams and illustrations, eg food webs, ecosystem maps, flow charts
- use online sources, oral histories, literature, elders, scientists to research historical and diverse cultural scientific theories, eg *Yellow Eye* by David Spillman and Mark Wilson .

Evaluating

- make general suggestions for improving an investigation, eg quality and use of equipment, sources of information, techniques
- justify conclusions based on data collected
- report on how their findings satisfy the posed questions of the investigation
- explain the difference, if any, between their hypothesis and findings.


Acting Responsibly

[In 3] [Con 3] [Con 4] [HPE-HP]

- identify the steps to be taken to formulate an effective plan of action on a social scientific issue
- identify community values to be considered when working scientifically, eg 'Think globally, act locally!'
- review, evaluate and implement environmentally friendly processes, eg recycling, re-using, disposal
- use materials/strategies that promote sustainability and conservation when investigating the natural environment.

Science in Society

[Collaborative Learner] [Con 4] [SOSE-Soc]

- review alternate explanations for and historical understandings of observed phenomena
- identify the ways various cultures apply science to meet their needs
- analyse the short/long term effects, costs and benefits of the applications of science for individuals/communities, eg pollution, habitat loss, greenhouse effect
- research the past and present traditional environmental management practices of Indigenous people .

Working Scientifically

OUTCOMES

Learners demonstrating evidence of **Band 4**

WS 4.1 Planning

assess a problem, formulate a hypothesis and plan a fair test that controls a number of variables, from a given focus question

WS 4.2 Investigating

select equipment and data processing techniques that will clarify patterns and allow generalisations

WS 4.3 Evaluating

assess the confidence of the conclusions drawn from their findings and make suggestions to improve an investigation

WS 4.4 Acting Responsibly

propose and implement responsible scientific actions when making decisions or taking action

WS 4.5 Science in Society

review the contributions to the development of scientific ideas, made by individuals and groups, past and present, and consider the factors that assisted or hindered them.

Links

EsseNTial Learnings:

In 1, Cr 1, Con 1, Con 2

Learning Areas:

Technology and Design


Perspectives:

Literacy, Numeracy, Environmental, Learning Technology

INDICATORS

Learners demonstrating evidence of **Band 4** for example

Planning

- write a hypothesis to focus the planning of an investigation
- list variables important in an investigation and plan to control several of these
- plan data collection procedures and techniques
- structure investigable questions with clarity
- identify and analyse the purpose, audience and effectiveness of scientific texts
- identify the world view of scientific texts and reconstruct/compare/reshape the meaning to establish another viewpoint 

Investigating

- select and use equipment appropriate to the task
- use preliminary trials of the investigative procedure to improve the procedure or technique
- organise data into tables and graphs to reveal trends and relationships
- take enough measurements to gauge reliability
- record conclusions that reflect the patterns in the data
- explain patterns or relationships in the data in terms of scientific knowledge
- make generalisations from information/ data collected, background research and personal experience
- use language that qualifies, (eg always, sometimes, never) quantifies, (eg numerical data) describes, expresses cause and effect, (eg as a result of, due to, this leads to).

Evaluating


- suggest specific changes that would improve the techniques used, or design of the investigation
- suggest further investigations that would clarify questions/ hypotheses posed
- identify limitations in the reliability of data and relate this to conclusions made
- identify and analyse qualities of valid arguments, challenging ideas in debates/ discussions on scientific issues.

Acting Responsibly [In 3] [Cr 2] [Con 3] [Con 4] [HPE-HP]

- list alternative responsible ways to achieve a particular outcome or produce alternative solutions to a scientific problem
- examine the different science based technologies used to perform the same task
- examine and debate local and national scientific issues, eg drugs, protective equipment, environmental sustainability
- analyse the methods used and decisions made by scientists in different contexts
- identify the safety aspects of a scientific investigation and adopt safe practices.

Science In Society

[Collaborative Learner] [Con 3] [Con 4] [SOSE-Soc]

- research the work of scientists, identifying the cultural/historical/social context in which they worked
- explore history of the development of scientific concepts to understand the evolution of knowledge and the way it is applied
- analyse the relationship between social attitudes and decisions about the applications of science
- investigate how and why Aboriginal people and Western scientists can learn from each other and work together to research flora, fauna, land management, site management, health care 
- examine the effect of new technologies on people and their environment, eg biotechnology in reducing disease, robotics in industry and at home, reproductive technologies
- examine and debate issues associated with species biodiversity, eg rates of species loss.

Working Scientifically

Links

EsseNTial Learnings:

In 1, Cr 1, Con 1, Con 2

Learning Areas:
Technology and Design

Perspectives:

Literacy,
Numeracy-
SM/CD,
Environmental,
Learning
Technology

OUTCOMES

Learners demonstrating evidence of **Band 5**

WS 5.1 Planning

identify a problem, formulate a question and a hypothesis for testing and plan for a fair test

WS 5.2 Investigating

select instruments and data processing techniques to enhance the accuracy and reliability of investigations and draw conclusions consistent with data

WS 5.3 Evaluating

assess conclusions in relation to other evidence and scientific theory

WS 5.4 Acting Responsibly

make decisions and take action with consideration to the ethical, social and environmental implications

WS 5.5 Science in Society

identify a range of issues underlying global and local decisions and express opinions that are scientifically and technologically informed.

INDICATORS

Learners demonstrating evidence of **Band 5** for example

Planning [Con 4]

- identify a real-world problem worthy of scientific investigation and formulate questions to guide investigations
- use reference material and own scientific knowledge to develop an understanding of the problem
- conduct preliminary investigations into the importance of different variables or to preview information sources
- plan for precise measurements to an appropriate degree of accuracy
- design a hypothesis that relates the independent and dependent variables.


Investigating

- devise and justify measurement procedures that improve precision and accuracy
- use appropriate mathematical calculations and graphical procedures to analyse their data
- question whether the data is sufficient to draw conclusions
- draw conclusions which are consistent with information collected and explain these in relation to scientific knowledge, eg evaluate the questions/hypothesis in terms of data or information collected
- organise information on a scientific issue using different texts
- use scientific models, on-line resources, simulations to investigate large scale issues, eg desalination of land.

Evaluating



- identify main sources and magnitude of error
- suggest changes to design or technique that would minimise or eliminate error
- compare results and conclusions with other sources of information
- explain how their conclusions might apply in other contexts
- link their conclusions to related scientific ideas
- construct a range of viewpoints on scientific texts and issues and respond by modifying or developing personal opinions.

Acting Responsibly [In 3] [Cr 2] [Con 3] [Con 4] [HPE-HP] [T&D-De]

- consider the intended and unintended science-related consequences of actions
- identify the long and short-term effects of an investigation or scientific application
- consider ethical issues related to the application of findings [SOSE-Soc]
- critically analyse two alternative scientific approaches, report on which is more socially responsible and why
- analyse the different perspectives of Indigenous and non-Indigenous people in relation to an environmental issue, eg mining at Jabiluka, Ok Tedi [SOSE-Env] 

Science in Society

[Collaborative Learner] [Con 3] [Con 4] [SOSE-Soc]

- identify parallels between their own procedures and the work of professional scientists
- consider the costs and benefits of applications of science
- analyse the effects of Indigenous and non-Indigenous land management on the environment 
- consider emerging scientific ideas and theories and recognise their origin, eg cloning
- examine the processes involved in developing, implementing and monitoring scientific research
- link scientific ideas to government initiatives, eg effects of smoking: smoking bans, laws of motion: speed limits and traffic calming devices, suggest community action to improve, sustain or develop an idea or to solve a problem,
- research the traditional knowledge of Indigenous peoples about a specific scientific area, eg astronomy, seasonal changes, plant uses for food and medicines, protection of species through totems, sustainable use of resources; and explain the importance of this knowledge for Australia's future 

Working Scientifically

OUTCOMES

Learners demonstrating evidence of **Beyond Band 5**

WS 5+.1 Planning

identify advantages and limitations of controlled investigations and consider alternatives

WS 5+.2 Investigating

investigate and consider the limitations of techniques and instruments and their influence on accuracy and reliability

WS 5+.3 Evaluating

discuss the limitations of conclusions

WS 5+.4 Acting Responsibly

critique proposed or existing scientific decisions and recommend responsible action

WS 5+.5 Science in Society

investigate an area of current scientific activity and assess the accountability of this activity.

Links

EsseNTial

Learnings:

In 1, Cr 1, Con 1, Con 2

Learning Areas:

Technology and Design


Perspectives:

Literacy, Numeracy-SM/CD, Environmental, Learning Technology

INDICATORS

Learners demonstrating evidence of **Beyond Band 5** for example

Planning [In 3] [Con 3]

- design investigations for situations where the control of variables is not practical
- describe and analyse modes of investigating, (eg models, computer simulations, case studies) and assess their applicability
- discuss the need for scientific investigations
- report on the legal, social, financial and ethical constraints of some forms of experimentation **[SOSE-Soc]**
- explore at least two perspectives on a current scientific issue and choose a format to deliver detailed information about it
- explore and design protocols for working for scientists working in partnership with Indigenous elders 

Investigating

- report results within the accuracy limitations of instruments and techniques
- examine the underlying assumption or reasons why control of variables is not possible
- assess the reliability and accuracy of the investigation
- discuss precision, design and limitations of instruments and techniques
- maintain a collection of current media items with a scientific interest and comment on the viewpoints presented in these media texts
- examine the difference in the way a science topic is presented in the popular media and the way the same topic is presented in a scientific text
- investigate appropriate ways of explaining a Western scientific topic to people from other cultural backgrounds, eg cloning, voluntary euthanasia.

Evaluating

- identify the assumptions underlying their investigations and comment on their validity
- discuss the influences of their prior understandings on their observations and investigations
- suggest evidence or further experiments that would lead them to change their conclusions.


Acting Responsibly

[In 3] [Con 3] [Con 4] [HPE-HP]

- discuss contributions scientists can make to decisions about situations, eg the annexing of an area for mining or tourism from a World Heritage area or on Aboriginal land
- analyse an example of conflicting scientific opinion being an important part of the debate
- take the role of a scientist in a debate on a community issue where different groups represent different community issues
- initiate a school or community science-related project to improve quality of life
- explain the considerations scientists need to make when investigating.

Science in Society

[Collaborative Learner] [Con 4] [SOSE-Soc]

- identify the scientific aspects of different countries' responses to issues such as waste management or mining
- compare the Indigenous and Western scientific views of an aspect of science and explain how each complements the other, eg astronomy, medicine 

Concepts and Contexts

Links

EsseNTial
Learnings:
Con 4

Learning Areas:
HPE-PD, SOSE-
Env, Tech-Pr,
Arts-CrA

Perspectives:
Literacy,
Environmental

OUTCOMES

Learners demonstrating evidence of **Key Growth Point 1**

CC KGP 1 Concepts and Contexts

recognise features and changes to themselves or objects in the immediate environment.

INDICATORS

Learners demonstrating evidence of **Key Growth Point 1** for example

Concepts and Contexts

- use their senses to explore differences between familiar objects, eg
 - texture: food, fabrics, floor coverings, clothing
 - smells: food, flowers, body odour, cosmetics
- attend to features of themselves, others and their immediate environment, eg
 - focus on a moving body part
 - recognise self in mirror/photo
 - attend to another person moving in the room
 - observe objects that move
- recognise aspects of their school/home environment, eg classroom, toilet, swimming pool, garden, bush
- recognise personal belongings and familiar environments according to an observable feature
- focus on the attributes, (eg colour, parts, shape) of objects during exploration **[Cr 1]**
- make some objects or themselves move, eg
 - place objects near running water
 - push or pull an object to meet a need/want
 - move various body parts within their abilities
- participate in activities that help them develop an awareness of science in daily life, eg gardening, making paper, bush trips **[Cr 1] [Collaborative Learner]**
- attend and respond to local environmental factors that change, eg respond to
 - light and dark, day and night
 - the effects of a weather change
 - temperature changes
 - different sounds
 - tactile stimuli: massage, food textures, movement.

Concepts and Contexts

OUTCOMES

Learners demonstrating evidence of **Key Growth Point 2**

CC KGP 2.1 Natural and Processed Materials

identify features and uses of familiar materials

CC KGP 2.2 Life and Living

recognise basic features of plants, animals and environments

CC KGP 2.3 Energy and Change

identify changes in their everyday environment

CC KGP 2.4 Earth and Beyond

recognise physical features of their immediate environment.

Links

EsseNTial Learnings:

In 4, Cr 1, Con 1, Con 4

Learning Areas:
SOSE-Env

Perspectives:

Literacy,
Num-NS,
Environmental

INDICATORS

Learners demonstrating evidence of **Key Growth Point 2** for example

Natural and Processed Materials [T&D]

- identify observable properties of common materials, eg smell, taste and texture of a food
- group familiar materials according to an observable property, eg physical state: wet or dry, hard or soft; size: same or different, big or small **[Num-SS]**
- combine different materials to create something new, eg jelly crystals and water
- observe and report on changes that occur to materials, eg dissolving, mixing, burning
- identify uses of common materials, eg glue to stick paper, nails to join wood, soap to clean hands
- select materials appropriate for a task, eg clay for modelling, paint for art, wood for spear making.

Life and Living [HPE-PD]

- identify common features of living and non-living things and differentiate between the two
- identify basic needs of plants and animals, eg water, food
- recognise observable changes in their body
- identify familiar living things in their immediate environment, their roles and uses, eg dogs can be pets, trees give us shade, the environment gives us food
- recognise dangerous animals or plants, eg inedible bush foods
- identify the roles of different animals and plants, eg dogs can be pets, some trees give us shade.

Energy and Change

- recognise association between an action and event (cause-effect), eg appliances operating
- identify an object after it has been changed, eg ice-cube after melting
- label and recognise the parts of common equipment, eg respond to requests to turn on/off lights, taps
- demonstrate that objects have the same function in different environments **[Num-SS]**
- use simple tools to complete tasks.

Earth and Beyond

- label some natural and built features in the local environment
- ask questions about features in day and night sky
- identify local environmental factors that influence daily life, eg weather
- identify areas of the school that have changed because of what people do in them, eg link the presence of litter to children playing in that area
- identify features of the day/night sky that cause changes in personal routines or feelings.

Concepts and Contexts

Links

EsseNTial Learnings:

In 4, Cr 1,
Constructive
Learner

Learning Areas:

SOSE-Env

Perspectives:

Literacy,
Num-NS,
Environmental

OUTCOMES

Learners demonstrating evidence of **Key Growth Point 3**

CC KGP 3.1 Natural and Processed Materials

explain that different materials have basic properties and uses

CC KGP 3.2 Life and Living

identify the characteristics and basic needs of plants, animals and environments

CC KGP 3.3 Energy and Change

identify energy sources and their uses in everyday life


CC KGP 3.4 Earth and Beyond

identify physical features of their environment, including the sky, that affect them.


INDICATORS

Learners demonstrating evidence of **Key Growth Point 3** for example


Natural and Processed Materials [T&D]

- explore properties and behaviour of common liquids, eg honey, water, milk
- describe and classify properties and uses for familiar materials
- report on observed changes to materials, eg how food has changed during cooking
- experiment with combining different materials, eg suggest a different ingredient when making a cake or damper
- identify materials used in daily life and choose appropriate materials for completing a task
- talk about materials used to make various traditional objects, eg baskets, spears, didgeridoo 


Life and Living [HPE-PD]

- label external parts of plants and animals and identify the function of some observable parts of living things, eg fur, beaks, fins, trunk of a tree
- classify objects into living and non-living groups
- describe how animals and plants change over time
- describe places where living things are found
- identify sources of food and shelter for animals found in the local area
- identify people's relationships with animals, eg working animals, totems, Dreaming, food, pets  
- identify the needs of themselves and other living things, eg investigate plants needs, compare needs of baby animals, list sources of food and shelter for different animals, describe relationships with pets
- demonstrate safe behaviours in relation to animals and plants in the wider environment
- describe changes to plants due to seasonal change 

Energy and Change

- explore ways different objects move
- show energy transfers in simple actions, eg rubbing hands together to make heat, clicking fingers to make noise
- sequence picture cards to show the steps in a process where energy is transferred, eg cooking, eating, riding a scooter, throwing a fishing spear
- explore and discuss sources of energy for common devices, eg battery in a torch, rider on a scooter
- use simple problem solving strategies when electrical appliances do not work
- describe where they get energy from, eg sleeping
- explore common phenomena, eg freezing/melting, echoes, rainbows
- explore traditional way of lighting fire with fire sticks 

Earth and Beyond

- identify the features of their wider environment, eg playground, community, backyard, day and night sky, beach, mangroves, bush
- make connections between rain and cloudy skies
- explain changes they see in the sea/rivers/billabongs and the need for safety when using waterways
- describe features of the day and night sky
- relate and share changes in the day/night sky to routines/activities/clothing/food eaten, by themselves, their family and peers
- describe plants or animals that change their behaviour at night, eg animals that are active at night
- demonstrate appropriate behaviours in different environments, eg stay with group on an excursion, going hunting with family
- choose appropriate equipment for changes in weather
- observe changes in weather patterns from season to season 

Concepts and Contexts

OUTCOMES

Learners demonstrating evidence of **Band 1**

CC 1.1 Natural and Processed Materials

explain that materials have different uses and properties and can undergo change

CC 1.2 Life and Living

describe how the needs, features and functions of living things are related to change over time

CC 1.3 Energy and Change

describe different energy forms, ways energy is used for different purposes and energy changes



CC 1.4 Earth and Beyond

describe changes in their physical environment including the sky and how they are affected.


INDICATORS

Learners demonstrating evidence of **Band 1** for example

Natural and Processed Materials [T&D]

- describe materials using appropriate adjectives, eg hard/soft, cold/wet, smooth/slippery/rough
- classify materials by their visible structure, eg classify objects as a solid, liquid, gas
- predict which changes can and can not be reversed, eg melting, evaporation
- predict changes that occur in food during the storage, preparation and cooking process
- sort objects such as paper, metals, plastics and glass on the basis of their 'parent' material
- investigate the effectiveness of materials used in everyday life, eg food packaging in keeping food fresh
- compare the effectiveness of different products that can be used for the same purpose, eg glues, sticky tapes
- investigate the ways different local plants can be used [ILC] 
- talk about changes when processing bush materials, eg cycad nuts, dying pandanus 


Life and Living [HPE-PD]

- describe plants and animals in terms of growth, reproduction, food sources and physical features
- describe the features of animals that help them adapt to their environment, eg explain how a bat's ears help it locate food, identify the use of fins in fish
- describe how a living thing may change over time, eg seedling growth, life cycles, describe own milestones from birth to present and predict possible markers for their futures
- take into account the needs of living things when designing and constructing animals enclosures or garden beds, addressing issues such as shelter, need for space, food, water and interactions
- describe how living things depend on each other for food and shelter, how different ways humans use the land and sea, how living things live in social groups - colonies, herds, families
- describe the relationships between living things and people [ILC]
- talk about Indigenous local plant and animal classifications 

Energy and Change

- contribute to brainstorming on how particular toys might move
- explore and compare motion of similar toys, eg battery operated, spring operated, hand pushed [Num-MDS]
- describe properties of light, eg reflection, direction it travels, shadows, passes through air, water, glass and other materials
- describe properties of sound, eg volume, tone, pitch
- explore ways to use different sources to heat objects, eg stove top, sun, microwave, fire
- describe changes that occur when two objects interact, eg explore ways to give motion to a balloon, experiment with magnets
- sort and classify pictures of devices into groups that use similar sources of energy to operate them, eg batteries, wind, springs, fuels
- identify foods which are major energy sources for people
- investigate different ways people use alternative energy, eg solar energy to heat water, wind energy to sail boats or generate electricity
- identify different ways energy is used by them and their family, how to avoid wasting energy and why this is important.

Earth and Beyond

- use simple instruments to collect information on the weather
- describe changes that occurs in the local environment, eg to a creek after building, to desert after rain
- observe and record patterns in shadow, eg describe own shadow at different times during the day
- explain features of the day and night sky, eg explain how we get night and day
- measure the ways temperature and sunshine change during the day and how this influences living things
- illustrate how various groups manage their lives with respect to the effects of the daily and seasonal positions of the sun 


Links

EsSEnTial Learnings:

In 4, Cr 1,
Constructive
Learner

Learning Areas:
SOSE-Env

Perspectives:

Literacy,
Num-NS,
Environmental 

Concepts and Contexts

Links

EsseNTial Learnings:

In 4, Cr 1,
Constructive
Learner

Learning Areas:

SOSE-Env

Perspectives:

Literacy,
Num-NS,
Environmental

OUTCOMES

Learners demonstrating evidence of **Band 2**

CC 2.1 Natural and Processed Materials

describe how properties, changes and uses of materials are related

CC 2.2 Life and Living

organise features of living things into systems which determine their interaction with the environment

CC 2.3 Energy and Change

describe patterns of energy usage and transfers between common sources and receivers


CC 2.4 Earth and Beyond

link changes in the environment to physical processes on or beyond Earth, and to human activities.


INDICATORS

Learners demonstrating evidence of **Band 2** for example

Natural and Processed Materials [T&D]

- analyse the properties of common materials, eg the flammability, absorbency, and strength of fabrics; the alignment of fibres in wood, pandanus leaves and wool
- identify how everyday materials are made and used, eg fabrics from natural fibres used to make clothing, paper from wood used for stationery, metals from ores used to make buildings and jewellery
- describe how the structure of common materials affects their properties and uses, eg why wool would make excellent insulation, why layers in plywood make it strong, why a sponge can absorb water, why lycra is used for swimwear
- describe a variety of reversible and irreversible changes in common substances, eg identify the differences in mixing, dissolving, melting, boiling, evaporating; grow crystals from common substances
- investigate variables which determine the rate of change of everyday materials, eg heating, cooling, stirring, increasing/decreasing quantity
- select a property, design and conduct tests for this property on different materials, eg test stretchability of different fabrics
- present information about a material and how its properties make it valued by society/group, eg gold is difficult to extract which makes it valuable; pandanus plant fibres are strong and therefore are used to make baskets
- predict, plan and safely conduct an experiment to investigate which materials will compost
- devise ways of combining different substances to produce useful materials and consider how these are used in homes and workplaces, eg concrete, waterproof paper, self raising flour **[Arts-SkP]**
- describe the consequences of processing materials on people and the environment
- examine traditional resources used by Indigenous people and how they are processed for use .

Life and Living [HPE-PD]

- describe the structure and function on major body systems of animals and plants
- describe the functions of various features of living things, eg the shell of a snail provides protection and shelter, waxy leaves on some plants prevent water loss, heart pumps blood
- classify living things according to their systems, eg discriminate between grasses and trees in terms of roots, mammals and fish in terms of reproduction/body covering
- represent the sequence of stages of a lifecycle
- give reasons for observable behaviours of living things, eg nocturnal/diurnal behaviour of quolls, hibernation of frogs in the desert, how different animals care for their young
- explain why some living things have become extinct or endangered, eg consequences of mangrove clearing, introduction of non-native species
- describe how environmental changes can change the behaviour of living things, eg ants changing behaviour when the weather changes
- report on a unique feature of Australia's biodiversity through a study of a local area
- gather evidence on the effects of particular lifestyles on human body systems, eg effects of smoking
- explain connections among living things, other living things and/or the environment, eg why certain species rely on each other for survival and reproduction
- explain an example of sustainable plant or animal use by Indigenous people past and present
- investigate the reduction of diversity in the local area and participate in actions to support ecological diversity, eg if loss of birds/wildlife construct nesting boxes, ponds
- compare Indigenous and non-Indigenous plant and animal classifications .

Concepts and Contexts

Links

EsseNTial Learnings:

In 4, Cr 1,
Constructive
Learner

Learning Areas:

SOSE-Env


Perspectives:

Literacy,
Num-NS,
Environmental


INDICATORS

Learners demonstrating evidence of **Band 2** for example

Energy and Change

- identify actions of forces on everyday objects, eg recognise that a force is a push or a pull, attraction and repulsion forces between the ends of two bar magnets
- describe the effects of different forces on objects, eg magnetic, electrostatic
- analyse and explain how various objects work, eg how musical instruments produce sounds
- investigate and report on the energy transfers/transformations in familiar objects, eg toys, scooters, household appliances
- identify how sound and light are processed by organs in the human body
- identify the major energy sources in their daily life and classify objects as sources or receivers of energy
- design and build a model that demonstrates a push/pull force or transforms energy, eg rubber band car, simple circuit
- devise investigations to explore properties of light, sound and heat, eg how they are produced, changed and used
- report on patterns of energy use in the home, school and community
- identify areas where energy wastage could occur and communicate ways of reducing this
- investigate various Indigenous techniques for creating and controlling warmth and heat, eg traditional processes for making fire, use of paperbark structures as mortuaries .

Earth and Beyond

- collect information on the local landscape over a period, eg features of a billabong/creek, soil samples
- collect information about the weather using simple, standardised instruments, (eg thermometer, gauges) and discuss emerging patterns
- explore the relationship between the Earth, sun and moon
- describe how features of the landscape are altered by physical (wind, water, weather) and human processes (farming, mining, urbanisation)
- demonstrate the passing of a day/month/year in terms of the motions of the Earth and moon
- measure shadows using sticks or sundials, at different times of the day and year **[Num-MDS]**
- investigate how people's explanations of day/night and the seasons have changed over time and differ between cultures
- describe the consequences on the environment of different methods of farming/mining/building and the steps taken to reduce degradation
- investigate ways different groups use science in tackling community problems, eg pollution, species loss
- identify ways people from diverse socio-cultural groups represent their beliefs and values about science, eg some Indigenous groups share beliefs about the land/country through art, dance, song and stories
- describe how we monitor and use information about changes to the Earth, eg explore different methods for weather forecasting or for predicting natural disasters, look at tide timetables to plan a fishing trip
- investigate the ways people from various cultures identify scientific concepts, eg naming of stars/constellations, creation of the Earth
- investigate local Indigenous seasonal calendars **[Num-MDS]** .

Concepts and Contexts

Links

EsseNTial


Learnings:

In 4, Cr 1,
Constructive
Learner

Learning Areas:

SOSE-Env

Perspectives:

Literacy,
Num-NS,
Environmental 

OUTCOMES

Learners demonstrating evidence of **Band 3**

CC 3.1 Natural and Processed Materials

describe properties, changes and uses of materials in terms of their substructure

CC 3.2 Life and Living

explain that living systems can interact and that such interactions can lead to change

CC 3.3 Energy and Change

compare energy options and trace sequences of energy transfers, identifying the processes and conditions under which they occur

CC 3.4 Earth and Beyond

describe and predict, from a scientific perspective, the impacts of changes in the physical environment and the universe.


INDICATORS

Learners demonstrating evidence of **Band 3** for example

Natural and Processed Materials [T&D]

- demonstrate the behaviour of particles in solids, liquids and gases, eg explain why water flows, why elastic bands stretch, why helium balloons float
- identify the properties of materials and link these to their uses, eg hardness, flexibility, solubility, strength, conductivity, viscosity
- describe how changes in materials affect their properties, eg dissolving substances in water
- identify observable signs of chemical change (eg production of heat and gas) and describe the difference between reactants and products
- describe separation procedures and their application, eg filtration, evaporation, crystallisation
- identify ways to modify rates of change, eg stirring, cooling
- identify properties of materials that make them useful, eg identify why gold/silver are used in jewellery, why copper is used in electrical cable/as a base in saucepans, why certain fabrics are used to make sports clothes
- combine different substances to produce useful materials, eg make recycled paper
- describe processes under which phenomena occur, eg rusting, discolouration of fruits, dough rising
- investigate the effects of common materials on environments, eg impact of detergents/oil on the environment
- predict and set up a 'fair test' to determine which materials would be best suited to a job, eg absorbency, cooling, heating
- make links between Western scientific theories and the natural world, eg where chemicals come from in nature, bush food and medicine, practical examples of physics used by Indigenous people in the past and present such as spear throwers  .

Life and Living [HPE-PD]

- explain the functioning of systems within living things and their relationship to each other, eg functioning of the digestive systems and relationship to the cardiovascular system
- use appropriate terminology when describing reproduction, eg sperm, ova, fertilise
- collect or survey and compare plants found in the local environment, using strategies promoting conservation
- compare lifecycles of plants and animals, describing stages of growth and means of reproduction
- describe a process that shows how living things may have changed over time, eg explain why dinosaurs no longer roam the Earth
- identify and classify relationships between living things which help them survive in a habitat, eg food chains, relate feeding relationships to survival, identify interdependent relationships within a group of animals
- research ways of keeping human organ systems healthy, eg investigate impact of low fat diet and exercise on the cardiovascular system; impact of nose blowing on ear health
- report on relationships between living things in an observed ecosystem **[LT-P]**
- describe the factors that led to disturbance in a local ecosystem, and explore alternatives for the future **[Cr 2]**
- investigate interconnections of Indigenous people and living systems, eg connections between rain and ceremony, protection of species through totems **[ILC]**  .

Concepts and Contexts

Links

EsseNTial Learnings:

In 4, Cr 1,
Constructive
Learner

Learning Areas:

SOSE-Env

Perspectives:

Literacy,
Num-NS,
Environmental




INDICATORS

Learners demonstrating evidence of **Band 3** for example

Energy and Change

- identify forces involved in energy transfers in such things as electrical currents, musical instruments, simple machines, falling objects, movement of planes and parachutes
- describe electrical and mechanical devices using such terms as source, receiver, force, energy, absorber, conductor and efficiency
- describe different ways of enabling or impeding the transfer of energy, eg compare the effectiveness of different materials as sound absorbers, explain the function of protective clothing in some industries
- describe how different forms of energy interact with different substances, eg how surface features, (eg colour, texture) affect an object's ability to absorb heat/sound **[LT-P]**
- compare sources of energy in terms of ease of use, cost and effects on the environment
- trace energy changes, eg from food to movement of the body, power station to the microwave
- design and build a device that transfers energy for a specific purpose, eg working torch, a toy that will entertain a young child **[LT-P]**
- design a survey procedure and measuring instrument for patterns of energy use, eg traffic survey
- argue for and against the use of different energy sources, eg compare the cost of using gas and electricity, use of battery powered cars/scooters.

Earth and Beyond

- describe the interaction between changes in the Earth's surface and catastrophic events, eg volcanic eruptions, earthquakes, weathering
- describe interactions between atmospheric changes and catastrophic events, eg cyclones, floods, drought
- make connections between physical changes to the surface of the Earth and physical processes, eg why Australia does not have many high mountains, river drying up in the dry season and a lowering of the water table
- collect rocks and use their properties to sort, classify and suggest possible uses
- compare and contrast features of the Earth with those of other planets
- map the position of a constellation, such as the Southern Cross or the moon, over a period of time **[Num-SS]**
- relate changes on Earth to patterns of nearby astronomical bodies, eg why it is relatively dark during an eclipse, why we have seasons, why solar panels are positioned in certain ways
- describe ways information is gathered about the Earth and its resources, eg how satellite imaging contributes to our understanding of the Earth, ways in which geologists collect information, the process that meteorologists use to gather information about and predict weather pattern
- describe processes used for extracting and processing materials from the Earth and the positive and negative impacts of these
- suggest what they would need in order to migrate to, and survive on another planet
- link phases of the moon to events, behaviours of different social or cultural groups, eg fishing on high tide
- explore the possibility of the convergence of Indigenous and Western science knowledge in relation to changes to the physical environment .

Concepts and Contexts

Links

EsseNTial Learnings:

In 4, Cr 1,
Constructive
Learner

Learning Areas:

SOSE-Env

Perspectives:

Literacy,
Num-NS,
Environmental

OUTCOMES

Learners demonstrating evidence of **Band 4**

CC 4.1 Natural and Processed Materials

examine scientific evidence for models and concepts used to explain the microscopic structures of properties

CC 4.2 Life and Living

examine scientific evidence for models and concepts that are used to explain the processes connecting living systems and that lead to change

CC 4.3 Energy and Change

use scientific models and concepts, including mathematical expressions, to explain energy transfer

CC 4.4 Earth and Beyond

use scientific ideas to explain changes in the physical environment in terms of cycles and human exploitation.


INDICATORS

Learners demonstrating evidence of **Band 4** for example

Natural and Processes Materials [T&D]

- use concepts and models to explain microscopic structures and properties, eg explain how water changes to ice, why metals expand when heated, why pressure decreases with increasing height in the atmosphere
- explain the separation of mixtures through a variety of processes, eg filtration, decanting, magnetism
- use models of atoms and molecules to represent elements, compounds and simple chemical reactions, eg identify sodium and chlorine as elements and sodium chloride as a compound
- explain why simple chemical equations need to be balanced, eg $2H_2 + O_2 > 2H_2O$
- recognise patterns in chemical reactions, eg combustion reactions produce heat, some, such as precipitation reactions produce solids
- recognise conditions that influence reactions, eg concentration, surface area, temperature, catalyst
- investigate ways in which physical and chemical processes can be altered to achieve sought after outcomes including materials modification, eg reducing metal corrosion
- determine the suitability of materials for particular purposes by performing chemical tests, eg pH testing of various drinks, phosphate levels in water samples, nutrient analysis of foods.
- investigate and research industrial processes, describing and classifying physical and chemical changes in manufacturing, eg mining and processing of minerals, food processing, plastics manufacture
- research and organise information on the chemical properties of materials to determine appropriate means of storage, recycling and disposal, eg plastics, oils, solvents.

Life and Living [HPE-PD]

- present evidence that plants and animals are made up of cells, eg identify similarities and differences in specimens of cells, use a microscope to identify the structure of different cells
- explain the interaction between systems and the external environment, eg effects of temperature on waste elimination and transport of nutrients, role of the immune system in fighting disease, how temperature is regulated in the human body
- investigate the effect of lifestyle on body systems and suggest implications for themselves, eg exercise regime on cardiovascular system
- examine the effect of new technologies on people and their environment, eg biotechnology in reducing disease, reproductive technologies
- investigate and report on the common features of living organisms that help them interact successfully with their environment, eg adaptations of desert plants or aquatic animals
- investigate how scientists use evidence to suggest links between extinct organisms and those of the present day, eg fossil and genetic evidence
- research reproductive technologies and communicate own and others opinions on the impact of these, eg IVF, genetic counselling
- investigate different reproductive strategies and evaluate their effectiveness in ensuring survival of the offspring, eg sexual and asexual reproduction
- explain the role of living things in cycling and transferring energy and matter, eg role of decomposers, producers and consumers in food webs
- examine and debate issues associated with species biodiversity, eg contemporary rates of species loss, human use of natural environments, introduction of exotic species
- research the traditional and contemporary environmental management practices of Indigenous peoples for their preferred futures .

Concepts and Contexts

Links

EsseNTial Learnings:

In 4, Cr 1,
Constructive
Learner

Learning Areas:

SOSE-Env

Perspectives:

Literacy,
Num-NS,
Environmental

INDICATORS

Learners demonstrating evidence of **Band 4** for example

Energy and Change

- describe the function of simple machines and compare their efficiencies, eg levers, pulleys
- define common forces acting on everyday objects by writing mathematical expressions, eg gravity and friction, use diagrams to illustrate the size and direction of forces in certain situations
- describe how factors affecting friction influence the design of machines, eg bicycle, aircraft, car
- examine and assess the forms and interactions of energy in energy transfer systems, eg in a power station, as food is converted to energy for use by muscles
- identify common energy sources and the benefits of specific alternative energy sources
- investigate the relationship between forces and efficiency of devices that transfer energy, eg riding a bicycle as opposed to a scooter
- apply the concept of energy and work in various contexts, eg lifting a weight off the ground, abseiling, getting a car out of a bog
- report on the source and availability of fuels for the future, eg nuclear, fuel cells.

Earth and Beyond

- interpret evidence and examine causes of the depletion of the ozone layer
- use models to explain the formation and geological history of the Earth
- describe the formation or causes of geological features, eg intrusive and extrusive rocks, mountain ranges, earthquakes
- identify patterns of global wind, air and ocean currents and how these are monitored, eg thermal imaging
- locate, identify and investigate differences between celestial bodies, eg stars, planets, moons, black holes, meteors, comets
- explain the effect of orbit, gravitational forces, rotational speed and tilt of axis on everyday phenomena on the Earth, eg tides, seasons
- compare and contrast the conditions that support life on Earth with those of other planets and our moon
- interpret information about wind direction, sun position and geological information needed for engineering constructions, eg building homes, roads, bridges
- explain how a particular system of mining is related to the nature of the ore
- investigate the ways that science has contributed to reducing the impact of mining on a community, eg technology used to extract ore, revegetation schemes
- illustrate the use of science ideas to monitor and guide the establishment of national parks and heritage areas, and manage resources in fishing/forestry/farming
- explain how present day features, events and methods can be used to make inferences about changes in the Earth and beyond, eg wind, air and ocean currents used in weather forecasting; use of fossil and satellite evidence
- research relationships between technological advances and space exploration, and their positive and negative effects on natural and social environments
- analyse the concept of sustainability in relation to Indigenous lifestyles and environments over many thousands of years

Concepts and Contexts

Links

EsseNTial Learnings:

In 4, Cr 1,
Constructive
Learner

Learning Areas:

SOSE-Env

Perspectives:

Literacy,
Num-NS,
Environmental

OUTCOMES

Learners demonstrating evidence of **Band 5**

CC 5.1 Natural and Processed Materials

analyse concepts and principles used to explain physical and chemical change in systems and families of chemical reactions

CC 5.2 Life and Living

analyse concepts and principles relating to interactions, balance, continuity and change in living things

CC 5.3 Energy and Change

explain principles and concepts relating to transfers and interactions in energy systems

CC 5.4 Earth and Beyond

critically analyse scientific theories which explain differences and changes in the physical environment and universe.

INDICATORS

Learners demonstrating evidence of **Band 5** for example

Natural and Processed Materials [T&D]

- use the particle theory to explain physical and chemical processes and apply this to chemical systems, eg change of state and diffusion as it applies to the distillation of crude oil,
- explain how reactions occur using scientific models of atoms and molecules, eg write balanced chemical equations for a variety of chemical reactions
- classify substances into families and relate this to their chemical structure, eg reactive metals (sodium & lithium), noble gases, acids, bases, metals, non metals, carbonates
- use chemical formulae and equations to represent, describe and predict chemical changes, eg write balanced chemical equations for a variety of chemical reactions such as acid and metal carbonate, plan for safe chemical storage and disposal
- use scientific models to explain the structure of the atom and how it can be used to explain bonding processes, eg ionic and covalent bonding
- explain properties of materials in terms of atomic structure showing different types of bonding, eg hydrogen is a gas at room temperature while sodium chloride is a solid
- explain important reactions used to produce materials for present and future applications, eg mining extraction processes
- assess the suitability of materials for particular purposes, from a chemical perspective, and consider social and environmental sustainability, eg cleaning products
- investigate and assess the social implications of the use of processed materials, considering manufacture, disposal and sustainability, eg fossil fuel use, paper manufacture
- develop, trial and evaluate personal plans to reduce the use of environmentally harmful chemicals in the school or home, eg cooking oils, chlorine, pesticides.

Life and Living [HPE-PD]

- analyse and report on the associations between different systems in living organisms, eg circulatory and respiratory in vertebrates/invertebrates, photosynthetic tissues and transport systems in plants
- investigate the effect of external environmental changes on the internal functioning of organisms, eg effect of temperature changes on blood flow, response of plants to light
- investigate the effects of extreme environmental conditions on interactions within an ecosystem, eg fire, flood, cyclones
- explain and quantify how the interactions of the natural and physical components of an ecosystem affect its viability
- use theories and scientific models to describe how genetic continuity is maintained from generation to generation naturally and artificially, eg reduction of genetic material in gametes, recombination, inheritance of characteristics, the role of breeding programs for specific characteristics in pets and agriculture, the role of genetic counselling in reducing genetically inherited diseases
- analyse the effects of environmental change on living things and ecosystems, eg the use of a species for biological control of a pest, the effects of introducing herbicides or pesticides on ecosystems
- compare and describe how different animals and plants respond to changes in environmental conditions to ensure their survival over time, eg physical, behavioural or functional adaptations.

Concepts and Contexts

Links

EsseNTial Learnings:

In 4, Cr 1,
Constructive
Learner

Learning Areas:

SOSE-Env

Perspectives:

Literacy,
Num-NS,
Environmental




INDICATORS

Learners demonstrating evidence of **Band 5** for example

Energy and Change

- use scientific theories to explain and quantify changes that occur from energy transfer, eg use Ohms Law to determine the power usage of electrical circuits, calculate energy released from food in a calorimeter, calculate and compare amount of light energy released from different sources, explain how different forces act together to effect the motion of objects
- investigate transfer of electrical energy in systems, eg describe the effect electrical components have on the operations of electrical and electromagnetic devices
- investigate and explain the application of energy conservation techniques in systems, eg compare energy conservation techniques in different social and cultural contexts, explain the energy efficiency of two different methods of transporting a load
- explain the application of energy transfer systems and its affect on society, eg explain how the application of the principles and behaviour of light has affected our society
- appraise the energy efficiency of energy transfer systems, eg electrical motors and fuel motors, perpetual motion machines
- investigate the consequences of energy use on the planet, eg pollution, Greenhouse effect, sustainable energy sources, renewable and non renewable sources.

Earth and Beyond

- describe the theories of plate tectonics and continental drift to explain geological features of the Earth's surface
- explain the lifecycle of stars, including the Sun
- research and explain scientific techniques used to monitor the Earth and stellar objects
- use scientific theories to explain how events over time have led to catastrophic events on Earth
- explain techniques to better monitor and manage natural disasters
- explain how theories and scientific models of astronomy have improved our understanding of the universe
- predict future outcomes for life on Earth, eg as our sun grows older, new planets are discovered
- research global Indigenous scientific theories which explain changes to the environment .

Concepts and Contexts

Links

EsseNTial Learnings:

In 4, Cr 1,
Constructive
Learner

Learning Areas:

SOSE-Env

Perspectives:

Literacy,
Num-NS,
Environmental

OUTCOMES

Learners demonstrating evidence of **Beyond Band 5**

CC 5+.1 Natural and Processed Materials

evaluate and describe the role of science in developing knowledge about structure, change and use of materials

CC 5+.2 Life and Living

analyse and map the development of scientific understandings about living systems and change

CC 5+.3 Energy and Change

analyse the historical role of science in developing systems of energy transfer

CC 5+.4 Earth and Beyond

analyse the impacts of humans on space and the physical resources of the Earth from a scientific perspective.

INDICATORS

Learners demonstrating evidence of **Beyond Band 5** for example

Natural and Processed Materials [T&D]

- compare and evaluate scientific concepts used in the development and testing of new materials, eg biodegradable plastics
- research and summarise the world's demand for the development and application of new materials, eg polymers
- identify and summarise key developments in scientific theories regarding the structure and properties of elements and how they can be used to predict periodic trends, eg graph trends in atomic radii looking for trends across periods and down groups, predict formula of barium oxide knowing formula of calcium oxide
- investigate ways scientists have applied their understanding of the structure of molecules to alter their properties, eg soaps, detergents and additives
- investigate how the properties of reactants can be used to predict the products of unfamiliar chemical reactions, eg metal oxides can behave as acids in reactions with bases
- compare and assess the effectiveness of current scientific approaches being used to improve and monitor the quality of our environment, eg mine site rehabilitation, bio-indicators
- evaluate the depth of understanding that can be reached through combining knowledge of Western scientific names and categories, common names and Indigenous names and categories

Life and Living [HPE-PD]

- identify the historical developments of cellular structure/processes and evaluate their significance, eg microscope development, bio-technological use of microbes
- research scientific interventions into life processes and assess their impacts on society, eg use and development of artificial tissues and organs, transplantation, vaccination, gene therapy
- evaluate current scientific evidence for theories of evolution, eg fossil, DNA, anatomical and embryological
- compare the Indigenous and Western scientific views of an aspect of science, eg medicine
- evaluate the long term effects of human activities on different ecosystems and the effectiveness of measures used to minimise human impact, eg biodiversity decline, habitat destruction, environmental impact statements, conservation plans, captive breeding programs, environmental action plans
- explore and compare/contrast Indigenous and Western paradigms concerning nature

Energy and Change

- evaluate how scientific developments have influenced energy production and use, eg development of 'alternative energy' industries
- analyse and compare experiments to demonstrate the conservation of energy
- evaluate scientific theories and qualitative data to make recommendations for reducing energy loss
- argue different concepts of thermal energy and heating
- research and report on how scientists estimate global energy resources.

Earth and Beyond

- analyse and evaluate how scientific techniques are used to extract and process natural resources
- evaluate the application of scientific knowledge to assess the impact of human intervention on the natural and physical processes of Earth
- argue possibilities of life on other planets based on contemporary theories and current scientific evidence
- evaluate possible scientific solutions to problems for supporting life in space
- critically analyse how theories of astronomy have contributed to our understanding of the creation of the universe and in predicting its possible fate
- analyse new scientific techniques that have made it economically viable to extract a particular material
- explore possible convergence of Indigenous and non-Indigenous scientific understandings about astronomy