SACSA Companion Document SERIES

DRAFT

R–10 Science

Teaching Resource

Available in Word format and PDF on the SACSA website: www.sacsa.sa.edu/companion

Government of South Australia

Department of Education and Children's Services

South Australian Curriculum Standards and Accountability

F R A M E W O R K

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INTRODUCTION

This draft *R–10 science teaching resource* is one in a series of companion documents to the South Australian Curriculum, Standards and Accountability (SACSA) Framework.

It has been written by junior primary, primary and secondary teachers with the support of and in collaboration with curriculum officers and professional associations. Their writing has been guided by educators' feedback to the draft R–7 English and mathematics teaching resources, which were released for trialling in January 2003.

Linking with the SACSA Framework

The purpose of this document is to provide a sample range of learning descriptors relating to the Key Ideas and Outcomes in science R–10. These descriptors, in dot point format:

- make explicit the knowledge, skills and understandings reflected in the Key Ideas and Outcomes
- make consistent the expectations for learning at specific year levels within and across sites
- support teachers in planning, programming and assessing using the SACSA Framework.

The descriptors are not prescriptive, as learning does not develop in a linear fashion. The dot points describe the possible growth points of learners as they progress towards demonstrating Outcomes to reach a Standard. Teachers will continue to use their professional knowledge, skills and judgment to provide the rich array of learning experiences that cater for the learners in their classrooms.

Planning for teaching and learning

When using this resource for planning teaching and learning, teachers will also need to engage with the following core principles:

- The Essential Learnings (including associated literacy, numeracy, and the use of ICTs), Equity Cross-curriculum Perspectives, Enterprise and Vocational Education (including Key Competencies) and a consideration of all the Learning Areas are vital components of program planning and learning development.
- Learning involves building on prior knowledge with learners active in constructing their own learning as they progress through cycles of growth.
- In the Early Years, when planning for teaching, learning and assessing children's progress, it is important that teachers refer to the Developmental Learning Outcomes. The *Overview of Key Ideas and Developmental Learning Outcomes* chart has been included at the beginning of the Early Years section, particularly for use by those teachers of Reception and Year 1 children.

The science Learning Area is organised into four conceptual strands, each with its characteristic knowledge and ideas. The strands are:

- **Earth and space; energy systems; life systems, and matter**.

The processes of working scientifically are interwoven into each of the conceptual strands and are the essence of science.

It is important to highlight that science should never be pursued in isolation from its application in the world. Consequently, planning for teaching and learning in science should involve elements of science investigation and study of the implications of science for people and our world.

Format of this resource

The format of this document has been developed:

- with consideration to the organisation of the SACSA Framework
- to ensure consistency across Curriculum Bands
- for practical use by teachers.

To meet these purposes the document:

- is organised in Curriculum Bands for the following year levels: Early Years (R–2), Primary Years (3–5), Middle Years (6–8) and in a combined Middle–Senior Years Band (8–10)
- has 'working scientifically' embedded in the descriptors and highlights the working scientifically processes in bold type
- provides a glossary of working scientifically terminology used in each Band
- has Year 8 descriptors duplicated in Middle Years and Middle–Senior Years to assist continuity from primary to secondary sectors
- includes cross-referencing to allow navigation between Bands and strands
- provides examples of content to illustrate science concepts at a particular level, while not constraining the possibilities to these examples
- provides some examples of resources including texts, websites, DECS equipment access and DECS Outreach Programs.

In many dot points there is a coded reference to a specific resource (eg R5–Resource 5, W1–Website 1, OR1–Outreach Program1). These resources are listed in full in the Early, Primary and Middle Years bibliographies. Their use is intended neither to be prescriptive, nor restricted to a particular dot point.

The teacher-writers have worked to embed the development of the Essential Learnings within the dot points where this applies. Further emphasis to highlight the development of Essential Learnings is being trialled in this document. This is by way of Essential Learnings examples at the end of each Key Idea section. It is important to note that these statements are not intended to describe the full depth of the Essential Learnings, but are possible starting points. Trialling and feedback will provide information about whether this aspect of the document is valuable and as to how it will be addressed in the revised edition.

Assessment Examples are intended to stimulate reflection and ideas about assessment as teachers undertake their planning of teaching, learning and assessing programs.

To further assist in planning, programming and assessing, a copy of this document in *Word* format is available on the SACSA website. This format allows teachers to cut, paste and modify the document to suit their needs. Go to <http://www.sacsa.sa.edu.au/companion>.

Feedback

You are encouraged to trial this draft resource during term 1, 2004. Your feedback will be most appreciated. In addition to a broader invitation for feedback, a number of consultations will be arranged for early term 2, 2004. Workshops involving teacher-writers are planned for term 2, 2004 to refine this document in response to the feedback.

In the meantime, if you wish to provide feedback or obtain further information, please contact:

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Overview of Key Ideas and Developmental Learning Outcomes: BIRTH to AGE 5

► BIRTH to AGE 3

LEARNING AREAS	KEY IDEAS	DEVELOPMENTAL LEARNING OUTCOMES
The psycho-social self	***In partnership with educators in respectful and caring environments:*** Children form secure attachments developing close bonds with one and then more educators. **Id • In** • KC4 Children begin to develop trust in themselves and others and their environments. **F • Id • In** • KC4 Children construct a secure sense of self and a confident personal and group identity within their family, their communities and their out-of-home care. **Id • In** Children develop self-awareness and a sense of being connected with others within the context of their environments. These connections foster increasing appreciation of caring relations and a basis for shared understandings. **F • In** • KC4 Children develop autonomy and a sense of agency, as well as dispositions and skills for self-regulation, decision-making and an understanding of their interdependence with others. **F • Id • In • T** • KC4 • KC6 Children explore and develop emotional wellbeing. **F • In** • KC1 Children begin to explore and develop understandings and strategies to effectively manage change. **F** • KC1 • KC6	***The Developmental Learning Outcomes are deliberately broad long-term accomplishments. They reflect the integration of learning and development through the Essential Learnings and all Learning Areas and allow for different developmental pathways*** *Children develop trust and confidence.* **F • Id** *Children develop a positive sense of self and a confident personal and group identity.* **Id • In** *Children develop a sense of being connected with others and their worlds.* **F • Id • In** *Children are intellectually inquisitive.* **F • T • C** *Children develop a range of thinking skills.* **F • T • C** *Children are effective communicators.* **T • C** *Children develop a sense of physical wellbeing.* **Id • In** *Children develop a range of physical competencies.* **Id**
The physical self	***In partnership with educators in safe and planned environments:*** Children use their sensory capabilities with increasing integration, skill and purpose to connect with, perceive, explore and respond to their world. **Id • In • T** • KC1 • KC2 Children explore a range of movement patterns involving strength, body control and coordination for increasingly skilled voluntary actions. **Id • In** • KC6 Children develop balance for stability and movement and an awareness of their body in space, in order to move with purpose, safety and expression. **Id • In • T** • KC1 Children develop an awareness of their body's needs and their routines for food, relaxation, activity and sleep, and develop increasing independence in their personal care. **In** • KC1	
The thinking and communicating self	***In partnership with educators in language-rich and thoughtful environments:*** Children accept challenges to wonder and find answers in their natural and socially constructed environments. **F • T • C** • KC6 Children ask questions, wonder, and discover a range of ways to explore and find answers to problems. **F • T** • KC6 Children discover a range of ways to recognise, investigate, manipulate, use, represent and invent phenomena in their natural and constructed environments. **In • F • T • C** • KC1 • KC2 Children begin to develop concern for, and appreciation of, others and their environments. **F • In** • KC4 Children develop and use a wide range of both non-verbal and verbal communication to convey and construct meaning and share in the enjoyment of language. **In • C** • KC1 • KC2	

► AGE 3 to AGE 5

LEARNING AREAS	KEY IDEAS	DEVELOPMENTAL LEARNING OUTCOMES
Self and social development	Children extend their sense of personal and group identity. **Id • In** Children develop autonomy and a sense of agency. **Id • In** • KC4 • KC6 Children contribute in a variety of ways as members of groups. **Id • In** • KC4	***The Developmental Learning Outcomes are deliberately broad long-term accomplishments. They reflect the integration of learning and development through the Essential Learnings and all Learning Areas and allow for different developmental pathways*** *Children develop trust and confidence.* **F • Id** *Children develop a positive sense of self and a confident personal and group identity.* **Id • In** *Children develop a sense of being connected with others and their worlds.* **F • Id • In** *Children are intellectually inquisitive.* **F • T • C** *Children develop a range of thinking skills.* **F • T • C** *Children are effective communicators.* **T • C** *Children develop a sense of physical wellbeing.* **Id • In** *Children develop a range of physical competencies.* **Id** . . . . . . ***The Birth to Age 5 Key Ideas and the Developmental Learning Outcomes complement and connect with the Reception to Year 2 Key Ideas and Curriculum Standards. Together they comprise the requirements for the Early Years Band.*** ***Reference to the Reception to Year 2 phase will support continuity in teaching and learning (see Learning Area overviews).***
Arts and creativity	Children explore arts forms including visual arts, drama, music, dance and media through symbolic and creative expression. **Id • T • C** • KC2 • KC6 Children develop processes, understandings and skills to support their artistic expression. **T • C** • KC1 Children interact with and respond to arts works. **In • C** • KC2	
Communication and language	Children continue to acquire and are supported in the language of their homes, families and communities. **Id • In • C** • KC2 Children are purposeful and effective users of communication and language. **Id • C** • KC2 Children increase their understanding of the power and complexity of language and communication. **T • C** • KC2	
Design and technology	Children examine, identify and critique processes, products and systems. **In • T • C** • KC1 Children use their imagination to generate ideas and participate in processes of design. **F • T • C** • KC3 • KC6 Children use materials, equipment and processes to design and develop products and systems. **In • T • C** • KC3 • KC7	
Diversity	Children develop a respect for, and appreciation of, the diverse nature of their communities. **In** • KC1 Children begin to develop an understanding of Aboriginal and Torres Strait Islander peoples as the indigenous inhabitants of Australia. **In** • KC1 Children begin to recognise and question the way society privileges or excludes particular ways of knowing and being. **F • In • T** • KC1 Children learn to take action to bring about change for a just society. **F • In • T** • KC4	
Health and physical development	Children extend their range of physical skills and strengthen their physical vitality. **Id** Children develop understandings about their physical capabilities through individual and shared activities. **Id • In** • KC1 • KC4 Children begin to develop responsibility for their personal health and safety. **Id • In**	
Understanding our world	Children develop a sense of responsibility for natural and social environments and an understanding that their world is shared. **F • In** • KC1 Children develop confidence through making sense of their world by thinking, acting and working scientifically. **Id • In • T** • KC6 Children develop and use mathematical skills and understandings to investigate their physical and social worlds, both natural and constructed. **In • T** • KC1 • KC5	

Learning Area: Science

Strand: Earth and space **Band: Early Years** **Standard: 1**

KEY IDEAS	*(refer p 7 for DLO overview)*		*(refer p 23 Primary Years)*	OUTCOMES
	Reception **Towards Standard 1**	**Year 1** **Towards Standard 1**	**Year 2** **Standard 1**	
Children collect, organise and share information online and offline about the aspects of their personal world that enable them and their family to live. **Id T C** KC1 KC2 **relating to outcome 1.1** **Developmental Learning Outcomes** Children develop a sense of being connected with others and their worlds. **F Id In** Children are intellectually inquisitive. **F T C** Children develop a range of thinking skills. **F T C**	• **Chooses** clothes (eg for a magnetic figure) suitable for the weather at the time and clarifies why they are suitable. • **Describes** weather according to features (eg stormy, rainy, windy, fine, sunny, cloudy, cold, hot, warm, cool). • **Discusses** how lifestyles are affected by the weather (eg clothes, activities). • **Finds** an assortment of natural and built objects on a nature walk and **sorts** them in different ways (eg prickly things, things from plants). • **Makes models** of structures made by people (eg a house from blocks). • **Discusses** ways that people can change environments (eg buildings, roads). • Participates in activities to take **care** of their environment (eg participates in litter clean-ups). • **Creates** landscapes of natural features or environments (eg in sand, using computer stamps, class collage).	• Contributes to **recording** on a daily weather chart, and relates weather of the day to other activities (eg explains why it is essential to wear sun screen or wear a hat). • **Discusses** why people change environments to suit needs (eg heating/cooling, dams, farms). • Takes responsibility in **caring** for their environment (eg saving water, cleaning up the school grounds). • **Uses their senses to sort** natural objects (eg the colour, shape and texture of rocks, soil, shells), and **hypothesises** on how others have sorted theirs. • **Identifies** differences between natural and built features and/or objects (eg draws a natural environment and adds cut out pictures of manufactured objects such as seats and cars. **R5**	• **Collects data** about daily weather for a week each term, and **compares** daily and seasonal changes (eg uses a class thermometer to **measure** the temperature at different times of the day, reads downloaded information from Bureau of Meteorology website). **W1** • **Discusses** how changing environments can have benefits and disadvantages (eg chopping down trees makes paper but loses habitat for birds). • **Uses observations or experiments to describe** and **classify** natural materials (eg rocks, soil, shells) by appearance, colour, smell, texture and composition (eg puts soils in water to test what floats or sinks and records as a table). • **Identifies** ways in which they can act to help their environment (eg makes suggestions and takes action on a local environmental issue—plants trees, joins Clean Up Australia). **R7**	**1.1** 1dentifies and shares information about features of their natural and built local environment that affect living things, including themselves. **Id T** KC1 KC2 *Possible topics:* • Weather • Natural or built environments • Shells • Rocks and soils • Local landforms (eg waterways, hills, sand dunes) • Environment action

Children collect, organise and share information online and offline about the aspects of their personal world that enable them and their family to live. **Id T C** KC1 KC2 **relating to outcome 1.1** **Developmental Learning Outcomes** Children develop a sense of being connected with others and their worlds. **F Id In** Children are intellectually inquisitive. **F T C** Children develop a range of thinking skills. **F T C**	ASSESSMENT EXAMPLE **Selects** items to add to a class collage of natural things.	ASSESSMENT EXAMPLE **Classifies** an assortment of objects and/or features as natural or made by people (eg jetty, reef) and explains their reasoning.	ASSESSMENT EXAMPLE **Makes** a poster that **identifies** ways of helping natural environments for living things other than humans.	**1.1** 1dentifies and shares information about features of their natural and built local environment that affect living things, including themselves. **Id T** KC1 KC2 *Possible topics:* • Weather • Natural or built environments • Shells • Rocks and soils • Local landforms (eg waterways, hills, sand dunes) • Environment action

An example of how **Identity** can be developed is to discuss how the natural world affects us personally.

Learning Area: Science

Strand: Earth and space **Band: Early Years** **Standard: 1**

KEY IDEAS	*(refer p 7 for DLO overview)*		*(refer p 24 for Primary Years)*	OUTCOMES
	Reception Towards Standard 1 ◄——►	**Year 1 Towards Standard 1** ◄——►	**Year 2 Standard 1**	
Children identify sequences and cycles of natural events which are connected to their daily lives **F T C** KC1 **relating to outcome 1.2** **Developmental Learning Outcomes** Children develop a sense of being connected with others and their worlds. **F Id In** Children develop a range of thinking skills. **F T C** Children are natural communicators. **T C**	• **Names** and **identifies** features of the seasons (eg animals, plants, weather). • **Names** and **identifies** common features of the day and night sky (eg clouds, sun, different shapes of the moon, stars), and discusses their personal activities at different times. **R4** ASSESSMENT EXAMPLE Paints pictures to **communicate** understanding of daytime and night time, including relevant features and corresponding activities.	• **Identifies** features of seasons or day and night (eg using art). **R2** • **Investigates** shadows indoors and outdoors (eg makes different shaped shadows; makes shadows using sunlight, artificial lights). • **Shows** that shadows are formed when an object blocks the passage of light (eg plays shadow games, makes shadow puppets). **R4** • **Identifies** a range of local environmental changes over the different seasons (eg in plants, river flow, length of daytime). ASSESSMENT EXAMPLE **Identifies** and **reports on** a range of local environmental changes over the different seasons (eg in plants, river flow, length of daytime).	• **Identifies** and **shows** (eg model, art) how the apparent position of the sun changes in the sky during the course of the day (eg sunrise, midday, sunset) and discusses the effect this has on temperature and activities (eg 'we'll do sport this morning, before it gets too hot'). • **Identifies** different responses to day and night cycles (eg **compares** the eating and sleeping patterns of nocturnal animals to their own). **R5** ASSESSMENT EXAMPLE Presents a **report** on a nocturnal animal, showing how it responds to day and night.	**1.2** **Compares** the apparent position of the sun to patterns of behaviour in everyday life. **F T** KC1 *Possible topics:* • Seasons • Day and night • Moon • Sun and shadows • Nocturnal animals

An example of how **Futures** can be developed is to examine the predictable patterns of change in nature.

Learning Area: Science

Strand: Energy systems **Band: Early Years** **Standard: 1**

KEY IDEAS	*(refer p 7 for DLO overview)*		*(refer p 25 for Primary Years)*	OUTCOMES
	Reception Towards Standard 1 ◄——►	**Year 1 Towards Standard 1** ◄——►	**Year 2 Standard 1**	
Children investigate and research how electrical, light, heat, sound and movement energies are used in their homes and at school. **T** KC1 **relating to outcome 1.3** **Developmental Learning Outcomes** Children are intellectually inquisitive. **F T C** Children develop a range of thinking skills. **F T C** Children are natural communicators. **T C**	• **Investigates** (through play) and talks about how everyday things move (eg musical instruments, wheeled toys, fanned paper, water toys). • **Discusses** how people need food to give them energy to do things. • **Identifies** things in the classroom that use energy to work (eg lights, fan, toys, pencil sharpener). ASSESSMENT EXAMPLE **Identifies** and **draws** things in the classroom that use energy.	• **Investigates** and **explains** how they believe everyday things work (eg musical instruments, elastic bands, windmills, marbles, wheeled toys, mirrors, dismantled machines such as a VCR, tape recorder, torches). **R7** • **Sorts** toys or machines into groups speculating on those that use batteries, springs, gears etc; justifies conclusions and finds ways to check accuracy. ASSESSMENT EXAMPLE **Explains** how energy is required to make things work (eg **explains** what is needed to make a toy move during discussion in show and tell).	• **Communicates** understanding of different sources of energy by: - **sorting** pictures into groups using different energy sources (eg transport pictures into wind powered (yacht), petrol powered (speed boat) - **finding** examples of different forms of energy (eg wind power, solar power, electricity, gas) - **locating** things in the classroom that use electricity, are hand powered, use a battery etc - **reporting** on home appliances that use gas, electricity, batteries, solar power. ASSESSMENT EXAMPLE **Makes** a poster **sorting** things that use the same energy source (eg electricity for electrical appliances, food for animals).	**1.3** **Identifies** sources of energy and describes the ways in which energy is used in daily life. **T C** KC1 KC2 *Possible topics:* • How things work • Light and colour • Sound • Moving toys

An example of how **Thinking** can be developed is to investigate through scientific inquiry how energy is used in everyday life.

Learning Area: Science

Strand: Energy systems **Band: Early Years** **Standard: 1**

KEY IDEAS	*(refer p 7 for DLO overview)*		*(refer p 26 for Primary Years)*	OUTCOMES
	Reception Towards Standard 1 ◄——►	**Year 1 Towards Standard 1** ◄——►	**Year 2 Standard 1**	
Children pose questions, investigate and share ideas about the different ways in which simple devices operate. **T C** KC1 KC2 KC6 **relating to outcome 1.4** **Developmental Learning Outcomes** Children develop a sense of being connected with others and their worlds. **F Id In** Children are intellectually inquisitive. **F T C** Children develop a range of thinking skills. **F T C** Children are natural communicators. **T C**	• **Sorts** toys into how they move (eg spin, roll, fly) and experiments with alternative movements (eg 'Can you make a rolling toy spin?'). **R4** • **Constructs** and **investigates** moving objects using commercially produced or consumable materials (eg makes a car from Lego, makes a kite from paper). **R4** • **Makes** and **investigates,** through play, how toys move (eg up or down ramps) and **suggests reasons** for differences (eg 'This goes faster because its bigger'). **R5** ASSESSMENT EXAMPLE **Makes** and **uses** a model that moves.	• **Poses questions** about and **explores** how magnets move things. • **Makes**, **explores** and **uses** toys or models that use energy and **explains** their own ideas of how they work, including: - Energy creating movement (such as wind energy for a pinwheel or sailing boat) **R7** - Stored energy (eg pop-up card, batteries, springs) **R5** - light energy (eg colours, mirrors and reflections, torches) - sound energy (eg musical instruments). **R4** ASSESSMENT EXAMPLE **Makes** an object that moves and **explains** what is required to make it work.	• **Poses questions about, investigates**, **modifies**, **compares** and **shares ideas** about simple devices, including: - **investigating** sounds through the vibration of materials (eg string, rubber bands, rulers) - **varing** movement (eg changes the wing shape of a plane so it will fly further, makes a parachute fall more slowly) - **reflecting** images, comparing curved surfaces (eg spoon), flat surfaces or multiple shiny surfaces (eg 2 mirrors) - **investigating** simple machines (eg **uses** levers by making a puppet with split pin joints, alters a slope for toys or balls to roll/slide down) - **investigating** energy transfer (eg **uses** blocks to create the domino effect, places other objects in the path of something moving). ASSESSMENT EXAMPLE **Reports** to the class on how their modifications have changed or improved the performance of a moving toy.	**1.4** Poses questions and explores the ways in which different objects move. **T** KC2 *Possible topics:* • Musical instruments • Springs • Spinners • Magnets • Flight • Mirrors • Wind • Marble maze

An example of how **Thinking** can be developed is to encourage curiosity and understanding about how things work.

Learning Area: Science

Strand: Life systems **Band: Early Years** **Standard: 1**

KEY IDEAS	*(refer p 7 for DLO overview)*		*(refer p 27 for Primary Years)*	OUTCOMES
	Reception **Towards Standard 1**	**Year 1** **Towards Standard 1**	**Year 2** **Standard 1**	
Children investigate the features and behaviours of plants and animals through direct and virtual experience. They explain, and share with others, their understandings of the connections between living things, and between themselves and their natural environments. **In T KC1** KC2 **relating to outcome 1.5** **Developmental Learning Outcomes** Children develop trust and confidence. **F Id** Children develop a sense of being connected with others and their worlds. **F Id In** Children are intellectually inquisitive. **F T C** Children develop a range of thinking skills. **F T C**	• **Differentiates** between living/once living/nonliving (eg chair/tree). **R4 R6** • **Sorts** and names various living things (eg trees, flowers, fish, birds). • **Identifies** and uses their five senses (eg feely bag, mystery sounds). **R4** • **Observes** and develops confidence **handling** living animals and/or plants by: - going on a bug hunt - observing a pet at school - netting for pond insects - observing closely a mini beast (eg caterpillar, snail, insect) - growing a seed - contributing to a class garden project. ASSESSMENT EXAMPLE **Sorts** some objects or pictures into living/non-living and gives reasons for their choice (eg leaf, ant, seed, dog, ruler).	• **Recognises** and **investigates** the basic needs of living things (eg **predicts** and **tests** whether a seed would germinate if it has no sun, **lists** requirements to look after a pet). • Shares **observations** from **handling** and **caring for** living animals and/or plants such as: - a class pet - mini beasts (eg caterpillar, snail, insect) - indoor plants) • **Identifies**, **draws** and **labels** the features of living things (eg bones, teeth, head, legs, skin/fur, horns, tongue, roots, leaves, trunk). **R7 W2** ASSESSMENT EXAMPLE **Draws** observable features of a living thing (eg antennae, location of legs) before and after **observing** it closely, and **compares** changes in understandings.	• **Investigates**, **identifies** and **compares** features of living things (eg leaf shapes, horns/noses, ears/teeth, insects/spiders, dinosaurs) and discusses how they are used (eg sharp teeth for eating meat). **W2** • **Identifies** and discusses the function of some observable parts of living things (eg gills for breathing, roots to find food). • **Investigates**, through **observing** and **caring for** living animals and/or plants, how living things depend on each other and the environment (eg fish need water, ants live in groups). **R5** ASSESSMENT EXAMPLE **Applies understanding** of animal needs to design and construct models of enclosures for animals (eg a home for a mini beast, a zoo enclosure).	**1.5** **Investigates** the features and needs of living things, and demonstrates an understanding of their interdependence with each other and the physical world. **In T C** KC1 *Possible topics:* • Animal studies • Growing plants • Mini beasts • Water care • Pond life • Dinosaurs • Zoo animals

An example of how **Interdependence** can be developed is to examine how all life is interdependent and depends on healthy environments.

Learning Area: Science

Strand: Life systems **Band: Early Years** **Standard: 1**

KEY IDEAS	*(refer p 7 for DLO overview)*		*(refer p 28 for Primary Years)*	OUTCOMES
	Reception Towards Standard 1	**Year 1 Towards Standard 1**	**Year 2 Standard 1**	
Children reflect on the way people age in order to examine stages of growth and anticipate a range of preferred personal futures. They also explore the life cycles of other living things. **F Id** KC1 KC6 **relating to outcome 1.6** **Developmental Learning Outcomes** Children develop a positive sense of identity. **Id In** Children develop a sense of being connected with others and their worlds. **F Id In** Children develop a range of thinking skills. **F T C** Children are natural communicators. **T C**	• **Makes** (with assistance) a timeline from birth to present day (eg using photographs). • **Sequences** (with support) photographs or drawings showing the stages of growth when growing a seed or keeping an animal that undergoes rapid change (eg tadpoles, silkworms). ASSESSMENT EXAMPLE **Predicts** future growth and change (eg matches adult and baby (tadpole–frog, foal–horse).	• **Observes** and **illustrates** a life cycle when growing a seed or keeping an animal which undergoes rapid change (eg seeds, silkworms, chickens). **R7** • **Constructs** a personal timeline (eg through illustrations) showing milestones (eg rides a bike, loses a tooth). **R4** ASSESSMENT EXAMPLE **Demonstrates** stages of growth in the life of an observed living thing (eg creates a mime/dance from birth to death, draws a life cycle).	• **Predicts**, **orders**, **measures**, **records** and **describes** changes when growing a seed or keeping an animal which undergoes rapid change (eg as a bar graph, on a timeline, life cycles, using digital or traditional photographs. • **Measures**, **records** and **reflects** on their personal growth, changes and development over time (eg height, weight, losing teeth). ASSESSMENT EXAMPLE **Draws** a life cycle, writing sentences about each stage of development.	**1.6** Explores their own stages of growth and those of other living things. They develop personal future timelines. **F Id C** KC6 *Possible topics:* • Animal life cycles • Growing plants • Human development

An example of how **Futures** can be developed is to reflect on the predictable patterns in the life cycles of living things.

Learning Area: Science

Strand: Matter **Band: Early Years** **Standard: 1**

KEY IDEAS	*(refer p 7 for DLO overview)*		*(refer p 29 for Primary Years)*	OUTCOMES
	Reception Towards Standard 1 ◄——►	**Year 1 Towards Standard 1** ◄——►	**Year 2 Standard 1**	
Children look for patterns and properties in common materials, and use appropriate terminology to talk about how they use and reuse these materials. **T C** KC 2 KC5 **relating to outcome 1.7** **Developmental Learning Outcomes** Children are intellectually inquisitive. **F T C** Children develop a range of thinking skills. **F T C** Children are natural communicators. **T C** Children develop a range of physical competencies. **Id**	• **Makes** objects using a variety of materials including paper, plastic, fabric and wood. • **Sorts** common materials into groups, **investigating** and **identifying** properties (eg texture: smooth, rough; colour; material: what it is made of; properties: ability to float). **R4** ASSESSMENT EXAMPLE **Tests** and **sorts** floaters and sinkers into groups and **describes observations** orally or pictorially.	• **Applies** knowledge of properties **to choose** appropriate materials for making tasks (eg waterproof material for boat, cardboard for stronger sides on a house). • **Investigates** and **describes** ways of altering and reusing common materials (eg making wet things dry, sinking objects float, rough things smooth). **R5** ASSESSMENT EXAMPLE **Describes** how they made plasticine or alfoil float or sink, and gives their own **explanations** of why that worked.	• **Identifies** materials (eg jam, oil, ice cream, glass) as solid or liquid, and develops their own definitions (eg liquid cannot be placed in a heap). • **Investigates** and **discusses** properties of materials (eg air takes up space in a balloon, air can be moved, water takes the shape of its container). • **Conducts** simple investigations to **test** the effectiveness of materials for different purposes, participates in class **analysis** of results and draws their own **conclusions** (eg materials that keep us dry, stop an ice cube from melting, keep things warm, keep food fresh, are attracted to a magnet). **R4** ASSESSMENT EXAMPLE **Tests** the objects a magnet attracts or repels, **records** their **predictions** and results and draws **conclusions** based on the pattern they noticed.	**1.7** Identifies properties of materials that are observable though the senses and recognises the uses of these materials. **T C** KC1 *Possible topics:* • Natural and processed materials • Solids and liquids • Structures • Air • Float and sink • Magnets

An example of how **Communication** can be developed is to communicate information from experiments in different ways.

Learning Area: Science

Strand: Matter **Band: Early Years** **Standard: 1**

KEY IDEAS	*(refer p 7 for DLO overview)*		*(refer p 31 for Primary Years)*	OUTCOMES
	Reception Towards Standard 1 ◄——►	**Year 1 Towards Standard 1** ◄——►	**Year 2 Standard 1**	
Children use past experiences and understandings to contribute ideas for 'fair tests' to investigate changes in common materials. **In T** KC1 KC6 **relating to outcome 1.8** **Developmental Learning Outcomes** Children develop a sense of being connected with others and their worlds. **F Id In** Children are intellectually inquisitive. **F T C** Children develop a range of thinking skills. **F T C** Children are natural communicators. **T C**	• **Predicts** and **observes** changes from liquid to solid (eg makes jelly, freezes a drink bottle). • **Investigates** how things change when water is added (eg pours water on sand, adds articles made of different materials such as fabric, wood and plastic to **discover** which things get wet or stay dry). • **Discusses observed** changes during and after cooking processes (eg mixing ingredients, baking cakes). ASSESSMENT EXAMPLE **Draws** a change flow chart (eg **records** steps in jelly making).	• **Investigates** how some changes can be reversed (eg melting and resetting chocolate or ice). • **Predicts** and **experiments** with dissolving common products in water (eg sugar, coffee, jelly crystals, sand, soil, rocks) and **records** changes (eg colour, smell, solubility). **R4** • **Uses** past experiences to **suggest** ways to change materials (eg suggests baking to change biscuit dough into biscuits). ASSESSMENT EXAMPLE **Records** changes **observed** (eg in colour, texture, smell, solubility) when processing materials (eg heating, dissolving).	• **Poses questions** about**, predicts**, carries out **investigations** into and **records results** of changes that will occur when substances are processed by: - heating, cooling, freezing - mixing (eg adding water) - being left in the sun, in a cupboard or buried - composting (eg paper, plastic, food scraps, tin can) - changing the ingredients in a recipe (eg substituting plain flour for self raising flour) - using the same material different ways (eg heating, cooling jelly). **R5 R7 R8** • **Discusses** ways of making investigations fairer (eg stirring a solution the same number of times). ASSESSMENT EXAMPLE **Presents findings** of **investigations** that **identify** both the process used and the results.	**1.8** Identifies and predicts materials that change and do not change. **T C** KC1 *Possible topics:* • Dissolving • Kitchen chemistry • Wet and dry • Paper making

An example of how **Thinking** can be developed is to analyse how and why materials change.

GLOSSARY

Working scientifically

Acts responsibly: Acts to achieve a positive outcome for environments and the global community

Analyses: Studies something critically to identify the elements or relationships between the elements

Applies: Uses ideas, processes or skills in new situations

Cares: Provides what a living thing needs to keep it healthy, and ensures it does not come to any harm

Classifies: Analyses properties to group objects or events

Classification: The way in which scientists make sense of the world by grouping things that look, behave or reproduce etc in similar ways

Collects, records and interprets data: The collection and analysis of information, using skills such as comparing, helps children to make accurate assessments about their investigations and to hypothesise or make predictions about particular phenomena

Communicates: Indicates understanding by giving and/or receiving information orally, pictorially and/or in writing

Compares: Examines objects for similarities and differences

Concludes: Uses data, evidence or observations from an investigation to explain the results

Conducts: Directs, manages and undertakes a scientific process

Constructs: Applies knowledge to build

Creates: Reorganises elements into a new structure, makes

Data: Factual information used as a basis for reasoning, discussion and calculation

Demonstrates: Explains with the use of examples, experiments

Describes: Tells or writes about, shows an understanding of

Designs: Creates a picture (mentally or by drawing) from which a model can be built

Differentiates: Distinguishes between objects on the basis of visual differences

Discovers: Uses research or investigation to find out information

Discusses: Considers something from different points of view, by talking or writing about it

Distinguishes: Considers differences between objects to tell them apart, sees or shows the differences

Draws: Communicates ideas through pictures, patterns or diagrams

Examines: Looks at closely and carefully using tools of inquiry and/or apparatus

Explains: Interprets; gives reason for; makes meaning plain or clear (eg 'explain how' usually asks for the sequence, 'explains why' usually asks for the cause)

Explanation: The skill of communication in which an interpretation of information is given

Experiments: Performs a scientific test to prove a theory or make a discovery

Fair test: An experiment whose results can be reasonably trusted for basing conclusions because it has been performed in an identical way for each item

Findings: Information gained or conclusions drawn as a result of investigations

Hypothesises: Speculates, generates a 'best guess' based on a synthesis of their current knowledge or information

Identifies: Uses prior knowledge to recognise patterns, facts or details

Illustrates: Makes clear by examples or drawings, compares, designs

Investigation: To observe or study by using a systematic inquiry approach

Investigates: Uses scientific methodology that systematically employs many inquiry skills (eg performs experiments and communicates results, analyses and/or summarises information)

Locates: Finds where something is, applies knowledge to find examples

Makes: Applies knowledge to build, create, construct or produce

Measures: Compares objects to arbitrary units that may or may not be standardised

Modifies: Alters a design based on understanding of factors influencing performance

Observes/Observation: Gathers information by direct evidence of the properties of an object or event by using senses and/or basic measuring instruments

Orders: Applies knowledge to sort in a particular sequence (eg large to small)

Organises: Analyses information to determine how parts fit together within a structure

Plans: Decides in detail what they are going to do and how they are going to do it

Poses questions: Asks questions to guide investigations and research and to encourage inquiry

Predicts: Tells about an event or an outcome before it occurs

Recognises: Applies knowledge from long–term memory to identify patterns and understanding

Records: Puts information into a permanent form for reference

Reports: Communicates accurate or relevant information in a variety of formats (eg role-play, written, oral, visual)

Reflects: Considers ideas, thoughts and opinions

Relates: Connects or associates in thought or meaning

Researches: Collects and analyses facts and information to gain new knowledge and understanding

Science: An activity which uses observation, inference and experimentation to develop knowledge and understanding of how the world works

Scientific literacy: The knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity.

Selects: Chooses between options based on certain criteria

Shows: Illustrates or demonstrates ideas or knowledge

Sequences: Applies understanding to place things in correct order

Sorts: Separates into different groups, orders, organises

Technology: The scientific application of knowledge to solve practical problems and to make new inventions

Tests: Finds out what something is like by using and observing it over time or under different conditions

Understands: Constructs meaning from instructional messages, including oral, written and graphic communication

Uses: Applies understanding or a procedure to a task, utilises

GLOSSARY

SCIENTIFIC CONCEPTS

Strand: Earth and space

Apparent movement of the sun: The way it appears on earth that the sun is moving across the sky
Climate: The atmospheric conditions for a long period of time, and generally refers to the normal or mean course of the weather.
Nocturnal: Being primarily active at night
Weather: Day–to–day variation in atmospheric conditions

Strand: Energy systems

Domino effect: Where one change ripples through an entire system, chain reaction
Energy: The ability to cause matter to move or change, the ability of an object to do work
Force: A push or pull between two objects
Machine: Simple machines have few, if any, moving parts. Simple machines include the lever, the screw, the wheel and axle, the inclined plane, the pulley, and the wedge
Complex machines have two or more moving parts

Strand: Life systems

Environment: The physical surroundings of an organism that include the living and non–living components that could affect its life, development and survival
Interdependence: The relationships between or among organisms necessary for their survival

Strand: Matter

Liquid: The state in which a substance flows and takes up the shape of its container
Magnetism: The field of force produced by a magnet or an electric current
Solid: A form of matter that has shape and hardness
Solution: Homogeneous mixture of two or more substances. A saturated solution is a solution in which no more solute will dissolve
Variable: Part of the experiment that changes in some way. Ideally, the factor being compared is the only variable that will be changed

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- Department of Education, Training and Employment (2002) *South Australian Curriculum, Standards and Accountability Framework—English as a Second Language (ESL), Scope and Scales*. Adelaide, DETE.
- Education Department of South Australia (1985) *Evaluating R–7 science at the classroom level.* Adelaide: Education Department of South Australia.
- Department of Education, Training and Employment (1998) *Assessment and recording in R–10 science*. Adelaide: DETE.
- Pohl M (2000) *Teaching complex thinking. Critical, creative, caring.* Hawker Brownlow Education Australia.

SUGGESTED RESOURCES

It is expected that most schools will have resources available to support aspects of Science content in the Early Years Band. The following texts are cited as examples only of recently published materials and should not be seen as restrictive in use to a particular learning descriptor.

R1 Haydon J (2002) *Day and night diary.* Thomson Nelson.

R2 Hammonds H (2002) *The four seasons.* Thomson Nelson.

R3 Haydon J (2002) *Your amazing senses.* Thomson Nelson.

R4 R I C. Publications (2002) *Primary science book A.* R I C. Publications.

R5 R I C. Publications (2002) *Primary science book B.* R I C. Publications.

R6 Powel J & Jakob C (2002) *Rigby science files.* Australia: Rigby Reed Education Australia.

R7 Rathbone M & Gordon M (2002) *Nelson focus. Teacher's guide. Levels 12-16.* Nelson Thomson Learning.

R8 Rathbone M & Gordon M (2002) *Nelson focus. Teacher's guide. Levels 21-24.* Nelson Thomson Learning.

OUTREACH AND DECS SERVICES

OR1 Aboriginal Education Unit, 5 Harewood Avenue, Enfield, South Australia 5085
Phone (08) 8343 6500 Fax (08) 8343 6515
http://www.aboriginaleducation.sa.edu.au/pages/educators

OR2 SA Maritime Museum, 126 Lipson Street, Port Adelaide, South Australia 5015
Phone (08) 8270 6255 Fax (08) 8270 6266
http://www.oac.schools.sa.edu.au/outreach/oes/maritime

Technology Education Centre, 32a Dew Street, Thebarton SA 5031.
Phone (08) 8354 4000. Fax (08) 8354 4088. E-mail teched@adelaide.on.net
Catalogue available online http://www.teched
Technology resources for Australian classrooms. A comprehensive range of technology and science resources and advice for the classroom.

R–7 Science Materials Catalogue.
Phone (08) 82261603 Fax (08) 82261177 Courier R11/07 E-mail **Turnbull.Peter@saugov.sa.gov.au**
A wide range of science materials and equipment available year round at contract prices. For a catalogue, further information or advice contact Peter Turnbull.

The Nature Education Centre. Norwood Primary School 39 Osmond Terrace Norwood SA 5067
Phone (08) 8363 0238 Fax (08) 8362 0102
Live animals and collections for hire to schools.

WEBSITES

W1 Bureau of Meteorology
http://www.bom.gov.au
Glossary, Australian weather forecasts, charts, and warnings.

W2 Enchanted Learning
http://www.enchantedlearning.com
Educational web sites and games that support learning across learning areas, including science.

W3 Aboriginal Education, Department of Education and Children's Services, South Australia
http://www.aboriginaleducation.sa.edu.au
Resources, lesson notes, Dreaming stories to assist implementing Aboriginal perspectives.

Learning Area: Science

Strand: Earth and space **Band: Primary Years** **Standards: 2 & 3**

KEY IDEAS	*(refer p 8 for Early Years)*		*(refer p 39 for Middle Years)*	OUTCOMES
	Year 3 **Towards Standard 2**	**Year 4** **Standard 2**	**Year 5** **Towards Standard 3**	
Students analyse how the earth sustains life and understand and report that the earth is continually changing. **F In T C** KC1 KC2 **relating to outcome 2.1** Students investigate through fieldwork and research, the central importance of the earth's role in sustaining life and how changes impact on life; and understand the interaction of the atmosphere, the oceans and the earth's surface. **F In T** KC1 KC3 **relating to outcome 3.1**	• **Investigates** (using concrete materials) environmental change through erosion and weathering (eg placing sand into a container and washing away with different rates of water flow; comparing the effect of running water over turf, leaf litter and sand). • **Identifies** and **compares** the features of different soil samples collected from the schoolyard (eg using touch, smell, appearance). **R4** • **Researches** changes in and uses of soils (eg interviews community member about practices that degrade or improve soils, builds a composting system). • **Draws** a simple diagram of a water cycle (eg evaporation, clouds, rain, rivers, sea). **R5** ASSESSMENT EXAMPLE **Uses** labelled diagrams with accompanying short text to **explain** erosion and weathering.	• **Discusses** and **analyses** the effects of a current issue that highlights sudden environmental change (eg bushfire, flooding, sand dune erosion due to a king tide, drought, storm). **R6** • **Describes** some natural changes to the earth's surface using books, videos and websites. • **Designs** and **makes** instruments to compare and show aspects of weather (eg wind speed and direction, rainfall). **R5** • **Monitors** and **describes** changing weather conditions (eg describes cloud patterns, compares wind speeds, accesses Bureau of Meteorology website). **W1** • **Compares** present environments with those of the past using art works, visits to natural environments, maps, electronic images, photographs etc. and discusses changes that have taken place. **R5** ASSESSMENT EXAMPLE Makes an oral presentation of their **comparison** of past and present environments.	• **Plans** and **conducts investigations** into natural materials or environments, including: - the water holding capacity of a range of soil types (eg sand, clay, loam, compost), **hypothesising** on the effect that would have on the growth of plants - the nature of rocks, **analysing** their possible uses (eg soft rocks can write on pavers) and their origins (eg crystals are igneous) - the effect of weather on local communities (eg designing and making or researching instruments that show aspects of weather such as wind speed and direction, rainfall, temperature, air pressure), using the information to **predict** the weather the next day). **R3** • **Researches** natural materials that they and their communities need (eg uses the internet to find out about water, forestry, mining). ASSESSMENT EXAMPLE Writes a report about our use of natural materials (eg minerals and timber) and analyses possible impacts on the environment.	**2.1** Expresses ideas about changes that occur in their local environment, and considers implications for sustainable environments. **F In** KC1 KC2 **3.1** Describes the characteristics that sustain life on the earth and changes to these characteristics and their impact over time. **F In T** KC2 *Possible topics* • Rocks • Soils • Composting • Weather • Water cycle • Volcanoes

An example of how **Futures** can be developed is to examine how today's actions have consequences for the future.

Learning Area: Science

Strand: Earth and space **Band: Primary Years** **Standards: 2 & 3**

KEY IDEAS	*(refer p 10 for Early Years)*		*(refer p 41 for Middle Years)*	OUTCOMES
	Year 3 **Towards Standard 2**	**Year 4** **Standard 2**	**Year 5** **Towards Standard 3**	
Students use information and communication technologies and a variety of other resources to develop their own explanations about the relationship between the earth, sun and moon. **In T C** KC2 KC7 **relating to outcome 2.2** Students select and use observational instruments and digital technologies to develop understandings about structures and events in the universe. They appraise, and share opinions about, the ethics of space exploration. **F In C** KC2 KC7 **relating to outcome 3.2**	• Begins to **demonstrate** the relationship between the sun, and earth (eg uses role-play to show how day and night are formed). • **Monitors** the effects of the earth's rotation (eg temperature changes from day to night and over seasons). • **Investigates** shadows at different times of the day (eg traces and measures classmate's shadow at regular intervals during the day, makes a sun dial). **R4** • **Explains** why shadows change shape and size during a day (eg the shade within a veranda, people's shadows). ASSESSMENT EXAMPLE **Demonstrates** knowledge of size and direction of shadows at different times of the day through simple drawings.	• **Demonstrates** the relationship between the sun, moon and earth by: - **investigating** shadows at different times of the year (eg uses a digital camera to photograph a schoolyard feature at the same time of the day every month) - **collecting data** and **presenting findings** showing how the evaporation rates of water are affected by temperature and making links to water restriction regulations). • **Researches** historical and other cultural models that explain the relationship of the earth, sun and moon (eg shares stories by indigenous people) and values the many purposes of such stories/models. • **Compares** the conditions for life on earth with the moon (eg notes differences and similarities). **W6** ASSESSMENT EXAMPLE **Presents findings** about evaporation or shadows as a table and graph.	• **Analyses** the historical aspects of space exploration (eg constructs a timeline of significant events, writes an information report on a particular event). **R3** • **Investigates**, using models and other strategies, the characteristics of the seasons (eg rainfall, temperature, length of day, equinox, solstice). **R6** • **Discusses** a range of astronomical features (eg stars, constellations, comets). • **Researches** and **reports** through **role-play** information about the solar system (eg order of planets, relative size, distances apart, properties). **R3** • **Researches** the seasonal changes that affect plant and animal populations (eg migration of animals, reproductive cycles, agricultural practices). ASSESSMENT EXAMPLE **Uses** ICT programs such as *Hyperstudio* or *Inspiration* to **demonstrate** their understanding of the seasons.	**2.2** Explores the apparent motion of the sun in relation to the earth and develops models of their understanding. **In T C** KC6 **3.2** Describes various components of the solar system and the effects of these on our everyday lives. **In F C** KC2 *Possible topics* • Solar system • Shadows • Animal migration • Space exploration • Climates • Time

An example of how **Interdependence** can be developed is to examine how conditions for life on earth are dependent on the relationship between the earth, sun and moon.

Learning Area: Science

Strand: Energy systems **Band: Primary Years** **Standards: 2 & 3**

KEY IDEAS	*(refer p 11 for Early Years)*		*(refer p 42 for Middle Years)*	OUTCOMES
	Year 3 **Towards Standard 2**	**Year 4** **Standard 2**	**Year 5** **Towards Standard 3**	
Students identify some energy sources, critically analyse current patterns of energy use and write scenarios to describe how they and others could better use energy in the future. **F Id C** KC1 KC2 **relating to outcome 2.3** Students collect data about, and critique, their own patterns of energy use in terms of its environmental impact. **F Id C** KC1 KC5 **relating to outcome 3.3**	• Begins to **distinguish** the difference between energy sources (eg renewable such as solar and wind, or non-renewable such as fossil fuels and batteries). • **Identifies** energy sources and **compares** energy use in their home (eg graphs the number of electrical appliances). **R4** • **Acts responsibly** in relation to energy use (eg class appoints light monitors). • **Surveys** and **analyses** the ways they or other local people and businesses use energy (eg local businesses, farms, community facilities). **R7** • **Recognises** that different human activities require different amounts of energy (eg sleeping, running, riding in a car, digging the garden). ASSESSMENT EXAMPLE **Presents findings** from a **survey** on the use of energy, as a table and graph.	• **Identifies** and **classifies** different energy sources (eg renewable such as solar and wind, or non-renewable such as fossil fuels and batteries). • **Identifies** and **analyses** patterns of energy use (eg at home, school, work places, local businesses) and suggests ways of reducing wastages. • **Compares** current energy use with energy use in the past (eg surveys parents and grandparents about electrical appliances in use during their childhoods). **OR2** • **Researches** foods and identifies the major energy sources (eg investigates packaging information for kj content, researches dietary requirements of high energy activities) and discusses what happens to the excess kj. **W2** • **Analyses** why obesity and declining fitness levels are becoming more prevalent in Australia. ASSESSMENT EXAMPLE **Presents** orally in groups survey results on the use of energy in the past through the lives of our grandparents and parents and compares to present day use.	• **Analyses** and **debates** the consequences of using non-renewable and renewable energy sources (eg cost of production, transportation, environmental implications). • **Collects data** on energy use (eg seasonal, weekend, holiday use). • **Investigates** efficient energy use in the home (eg lighting dark corners). • **Investigates** the effects of building design on energy use at home and school (eg verandas, two-storey buildings, curtains, landscaping). **W3** • **Compares** energy used by people throughout their lifetime (eg the needs of young children, teenagers, elderly) and the importance of low glycaemic foods and exercise. • **Researches** different sources of energy to **select** the most suitable for their home or school. ASSESSMENT EXAMPLE Draws from **observation** or **collects** illustrations of buildings and **analyses** design features that enhance or limit efficient energy use.	**2.3** Identifies plans and acts on ways in which they can better use energy in their lives. **F In C** KC1 KC2 **3.3** Investigates and reports on patterns of energy use in the home, school and other places. **F Id C** KC1 KC2 KC5 *Possible topics* • Energy efficient house • Energy use survey • Solar power • Food

An example of how **Communication** can be developed is to explore how a range of methods can be used to share understandings with an audience.

Learning Area: Science

Strand: Energy systems **Band: Primary Years** **Standards: 2 & 3**

KEY IDEAS	*(refer p 12 for Early Years)*		*(refer p 43 for Middle Years)*	OUTCOMES
	Year 3 **Towards Standard 2**	**Year 4** **Standard 2**	**Year 5** **Towards Standard 3**	
Students analyse and chart sequences of energy transfer through items such as toys, home appliances and personal transport. **T C** KC1 KC5 **relating to outcome 2.4** Students use the concepts of force, energy and transfer of energy to investigate and explain phenomena and changing patterns of events in the natural world. **In T** KC1 KC2 **relating to outcome 3.4**	• **Investigates** various forms of energy and **show**s the sequence of how it is transferred from source to receiver including: - the properties of sound (eg vibration, pitch, loudness, musical instruments) R6 - the properties of motion (eg bouncing balls, toy cars, flying things, simple machines) **OR2** - the properties of light (eg mirrors, rainbows). ASSESSMENT EXAMPLE **Shows,** orally or diagrammatically, the pathway of energy from the source to the receiver, through household appliances.	• **Identifies** how energy exists in many forms and that it can be changed (eg electrical energy changes to heat and light energy in a light bulb). • **Uses fair tests** to **analyse** the factors that affect movement of objects, including: - design (eg wing design of paper aircraft) **R5** - surface type (eg toys on an inclined plane, friction) - thrust or energy source (eg throwing, stored energy in elastic bands). • **Analyses** and **charts** energy transfer (eg through simple electrical circuits, using simple machines). **R2 R6 OR2** ASSESSMENT EXAMPLE **Records** the **results** of their fair tests and contributes to group or class discussions on their **conclusions**.	• **Investigates** the movement of energy (eg effects of insulation on sound, heat or electrical energy) through **fair tests**. **R8** • **Predicts**, **tests**, **observes**, **analyses** and **reports** on the properties of energy transfer through movement (eg length of string, mass of bob and amplitude affect the swing of a pendulum; changing the shape of a boomerang to affect flight; investigating how simple machines reduce effort required). **R7** ASSESSMENT EXAMPLE **Analyses** and **reports** on the factors that affect energy transfer through movement.	**2.4** Identifies, observes and describes energy transfer such as light, sound heat or movement through common objects. **T C** KC1 KC2 **3.4** Uses the idea of force to describe and explain different ways of transferring energy. **T In** KC2 *Possible topics* • Pendulums • Simple circuits • Flight • Sound • Rainbows • Friction • Simple machines

An example of how **Thinking** can be developed is to analyse the results of investigations to gain deeper understanding of the movement of energy.

Learning Area: Science

Strand: Life systems **Band: Primary Years** **Standards: 2 & 3**

KEY IDEAS	*(refer p 13 for Early Years)*		*(refer p 44 for Middle Years)*	OUTCOMES
	Year 3 **Towards Standard 2**	**Year 4** **Standard 2**	**Year 5** **Towards Standard 3**	
Students pose questions and seek explanations about the internal and external features of living things in order to better understand the supports of life in particular environments. **In T C** KC6 **relating to outcome 2.5** Students develop a shared understanding of the characteristics and behaviour of living things and how they are interrelated and interdependent. They appreciate and report on the place of humans in the earth's ecology, and develop their understanding of, explore future possibilities for, and act to contribute to, sustainable environments. **F In** KC1 KC2 KC3 **relating to outcome 3.5**	• **Poses questions** about, **investigates** and **describes** the features, habitat and lifestyle of an animal or plant. R4 • **Classifies** plants and animals (eg flowering/non-flowering, insect/not insect, vertebrates/non-vertebrates). **R6** • **Reports** how features of plants and/or animals aid in their survival (eg fat leaves for storing water, beak shape for eating seed). **R6** • **Recognises** that relationships between living things exist (eg constructs a food chain, observes that a schoolyard tree hosts many life forms, observes the interrelationship of birds in their natural environment). **W5 R8** ASSESSMENT EXAMPLE **Identifies** examples of features that aid the survival of animals or plants in their particular environment.	• **Poses questions** about, **investigates** and **describes** the function of some internal and/or external features of living things and how these features enable them to survive (eg sonic guidance of bats help them navigate at night, leaf shape and colour, camouflage). **R5** • **Classifies** plant and animal species into introduced and native (eg feral animals, weeds). • **Recognises** and **investigates** the variety of relationships that exist between living things (eg clown fish are able to survive in sea anemones, mistletoes are parasitic and attach themselves to other plants, cuckoos lay their eggs in other birds' nests.) ASSESSMENT EXAMPLE Writes an information **report** that **analyses** the survival features of a particular plant or animal.	• **Investigates** interrelatedness and interdependence of living things (eg food webs). **R3** • **Identifies** and **describes** sensory organs (eg eye, ear, nose, skin, tongue). • **Identifies** and/or takes action on local environmental issues, reporting on their impact on living things (eg waterways, litter, condition of beaches, effects of rural and urban development, salinity). • **Summarises** information from an invited guest (eg writes a report or an argument to support a study as a result of a visit from a representative from Landcare, Waterwatch, Greening Australia or KESAB). **W7 W8 W9** ASSESSMENT EXAMPLE **Analyses** an environmental issue and writes a letter detailing concerns.	**2.5** Explores relationships between living things by posing investigable questions about features and functions. **In T** KC6 **3.5** Explains the interrelationships between systems within living things, and between living things in ecological systems. They relate these ideas to the health of individuals and to threats to the sustainability of ecological systems**.** **F In Id** KC1 KC2 *Possible topics* • Plant or animal study • Waterwatch • Food chains • Camouflage • Ear or eye

An example of how **Interdependence** can be developed is to investigate the relationship of the features of living things with their ability to survive in particular environments.

Learning Area: Science

Strand: Life systems **Band: Primary Years** **Standards: 2 & 3**

KEY IDEAS	*(refer p 14 for Early Years)*		*(refer p 46 for Middle Years)*	OUTCOMES
	Year 3 **Towards Standard 2**	**Year 4** **Standard 2**	**Year 5** **Towards Standard 3**	
Students construct and explain their ideas about the diversity of living things and how they reproduce and grow. They identify and communicate the importance of maintaining diversity of living things in order to sustain life on earth. **F C** KC2 **relating to outcome 2.6** Students examine the ways organisms reproduce, grow and change over generations. They engage with, and appreciate different positions on, ethical issues such as those associated with ecological sustainability and gene technologies. **F In T C** KC1 **relating to outcome 3.6**	• **Investigates** the life cycles of some common plants and animals (eg flowering plants, insects, frogs, spiders). R5 • **Compares** the life span of common living plants and animals (eg presents findings on a timeline). • **Recognises** that environmental change will impact on the diversity of plants and animals (eg removal of trees will reduce nesting sites, construction of a small pond will provide a habitat for frogs). ASSESSMENT EXAMPLE Writes a report on the life cycle of a common plant or animal.	• **Investigates** the diversity of living things and how they reproduce and grow (eg the life cycles of flowering plants or non-flowering plants such as moss, lichen, liverworts). • **Identifies** and **communicates** the importance of diversity (eg the diverse roles of animals in an ecosystem as scavengers, predators, carnivores and herbivores). • **Examines** Indigenous peoples' knowledge and uses of plants and animals (eg medicinal use of tea-tree oil, hardwood trees for weapons, plants for weaving). **R9 R10** ASSESSMENT EXAMPLE Presents a poster **analysing** the impact of a feral animal.	• **Investigates** the impact of natural environmental change on plant and animal existence (eg seed germination following bushfires, frogs and fish burrowing in times of drought, flooding of Central Australia resulting in the breeding of many bird species). • **Investigates** the impact of human induced environmental change (eg plant and animal extinction or endangerment due to land clearing; construction of marinas, reservoirs and dams; the impact of feral animals on a natural environment, such as donkeys and camels in the Australian desert and possums in New Zealand). **R2 R11** • **Classifies** common Australian plants and animals into recognised scientific groups (eg eucalypts, mammals, amphibians). **W6** ASSESSMENT EXAMPLE **Identifies** the characteristics of a plant or animal classification and gives specific examples.	**2.6** Communicates understandings of life cycles and the importance of diversity for the future. **F T C** KC2 **3.6** Identifies, analyses and communicates confidently the similarities and differences in the ways that living things reproduce and considers the ethics of related issues. **F T C** KC1 KC2 *Possible topics* • Endangered animals • Animal groupings (eg mammals reptiles) • Ecosystems (eg (wetlands, deserts, sea) • Fungi • Indigenous plant use

An example of how **Futures** can be developed is to examine how today's actions have consequences for the future.

Learning Area: Science

Strand: Matter **Band: Primary Years** **Standards: 2 & 3**

KEY IDEAS	*(refer p 15 for Early Years)*		*(refer p 47 for Middle Years)*	OUTCOMES
	Year 3 **Towards Standard 2**	**Year 4** **Standard 2**	**Year 5** **Towards Standard 3**	
Students plan, design and carry out investigations to determine the properties of materials, and present their findings. **T C** KC3 **relating to outcome 2.7** Students communicate understandings about the properties and personal uses of materials. They research future availability of earth materials for human use, and explore possible sustainable alternatives to current patterns of use. **F In T C** KC1 KC2 KC6 **relating to outcome 3.7**	• **Sorts** and **classifies** common materials using a **classification tree** or **Venn diagram** (eg recognises that buttons can be sorted according to the presence or absence of a particular characteristic). • **Investigates** the suitability of materials for specific uses (eg waterproof qualities of different fabrics, effectiveness of soap for cleaning). **R1** • **Investigates** the properties of materials (eg magnets, strong shapes). **R1 R5**	• **Plans** an **investigation** to **identify** the visible structure of some common materials (eg identifies sugar, salt, flour and fabrics by colour, shape, size and texture). **R4** • **Plans**, **designs** and **carries out investigations** using fair tests to compare properties of common materials, including: - strength of threads, sticky tapes, glues, plastic bags, rubber bands, papers, woods - flexibility of paper, rubber, wire - solubility of common kitchen substances like salt, sugar, flour and bi-carb soda in a range of solutions like water, vinegar and milk - bouncing ability of rubber, balls etc **R7** - absorbency of kitchen towels and fabrics.	• **Compares properties** of different forms of the same edible material (eg wholemeal and white flour, caster sugar and brown sugar, wild rice and white rice) and discusses which is better for health and why. • **Designs** and **carries out an investigation** into the effects of the external environment factors on common materials (eg heat on colours, wind drying out moisture, light bleaching colour) and **communicates conclusions**. • **Designs** and **carries out an investigation** into the effects of different processes on properties of materials (eg compares weaving strength of rushes when fresh, dried or dried then dampened overnight) and discusses sustainable technologies. **R9 R10** • **Investigates** the properties of household products (eg properties and uses of detergents and their effects on the environment).	**2.7** Designs an investigation to explore properties of common materials, explaining why they have particular uses. **T C** KC2 KC3 KC6 **3.7** Describes the structure of some common materials, explains how materials are used for different purposes, and understands their impact on the environment. **F In T C** KC1 KC2 *Possible topics* • Mystery powders • Mixtures • Magnets • Fabrics • Crystals • Straw towers

Students plan, design and carry out investigations to determine the properties of materials, and present their findings. **T C** KC3 **relating to outcome 2.7** Students communicate understandings about the properties and personal uses of materials. They research future availability of earth materials for human use, and explore possible sustainable alternatives to current patterns of use. **F In T C** KC1 KC2 KC6 **relating to outcome 3.7**	ASSESSMENT EXAMPLE **Draws** a classification tree or a **Venn diagram to classify** common materials**.**	• **Raises questions** about and **investigates** the suitability of materials for construction of everyday objects, including: - why particular packaging materials are chosen for products (milk cartons, glass, boxes) - how the height of a tower depends on the size of the base - what kind of paper is best for a paper plane. **R2** ASSESSMENT EXAMPLE **Presents findings** orally from one fair test on the properties of common materials.	ASSESSMENT EXAMPLE **Organises**, **performs** and **demonstrates** an **experiment** showing the effect of the environment on common materials.	**2.7** Designs an investigation to explore properties of common materials, explaining why they have particular uses. **T C** KC2 KC3 KC6 **3.7** Describes the structure of some common materials, explains how materials are used for different purposes, and understands their impact on the environment. **F In T C** KC1 KC2 *Possible topics* • Mystery powders • Mixtures • Magnets • Fabrics • Crystals • Straw towers

An example of how **Communication** can be developed is to communicate investigations and conclusions in different ways.

Learning Area: Science

Strand: Matter **Band: Primary Years** **Standards: 2 & 3**

KEY IDEAS	*(refer p 16 for Early Years)*		*(refer p 49 for Middle Years)*	OUTCOMES
	Year 3 **Towards Standard 2**	**Year 4** **Standard 2**	**Year 5** **Towards Standard 3**	
Students study and report on the stability and changes that occur in materials in and around their homes and relate these to processes, attitudes and future needs. **F C** KC2 **relating to outcome 2.8** Students pose questions to investigate ways in which physical and chemical processes can be altered in order to achieve desirable outcomes, such as food preservation. **T C** KC1 **relating to outcome 3.8**	• **Identifies** and **compares** the properties of different states of matter (eg the solid, liquid, gas states of water). **R5** • **Investigates** and **researches** changes caused through: - heating (eg popping corn, melting wax) - cooling (eg prolonging usable life of food, growing crystals). **R7** ASSESSMENT EXAMPLE Writes a procedure for popping corn, and **describes** changes.	• **Investigates** and **describes** reversible and irreversible changes to material states (eg liquid to solid such as water to ice, cream to whipped cream; liquid to gas such as water to steam). **R6** • **Predicts**, **contributes ideas** to **planning** and **conducts experiments** to show how different conditions can affect change (eg dissolving sugar in cold and hot water, stirring salt into water for various amounts of time). **R6** ASSESSMENT EXAMPLE **Devises** an experiment where one variable is changed (ie a fair test) such as the temperature or quantity of solution.	• **Investigates** simple ways to separate substances through a range of methods (eg evaporation to get salt from seawater, filtration to remove pollution from water). • **Identifies** and **acts** on issues with environmental implications by: - **creating** posters to address schoolyard litter, paper and cardboard recycling, use of calico bags etc - **analysing** and **describing** the safety measures in place to ensure the safe handling and disposal of chemicals in a range of settings - **examining** ways that common household materials can be reduced, reused and recycled (eg bottles, cans, plastic bags, paper, cardboard, food scraps). **R4** • **Poses questions** to **investigate** some methods of food preservation (eg bottling, salting, smoking, drying, freezing). ASSESSMENT EXAMPLE Creates a poster that **identifies** the chemicals held onsite and the safety measures in place for their handling.	**2.8** Predicts, investigates and describes changes in common materials when acted upon in various ways. **F C** KC6 **3.8** Uses the changes in properties and uses of materials in product life cycles. **T C** KC1 *Possible topics* • Kitchen chemistry • Solid, liquid and gas • Preserving food • Dissolving • Separating substances • Crystals

An example of how **Communication** can be developed is to use a range of methods to share understandings with an audience.

GLOSSARY

WORKING SCIENTIFICALLY

Acts responsibly: Acts to achieve a positive outcome for environments and the global community

Analyses: Studies something critically to identify the elements or relationships between the elements

Applies: Uses ideas, processes or skills in new situations

Cares: Provides what a living thing needs to keep it healthy, and ensures it does not come to any harm

Classifies: Analyses properties to group objects or events, including using graphic organisers such as Venn Diagrams

Classification: The way in which scientists make sense of the world by grouping things that look behave or reproduce etc in similar ways

Classification tree: A model used for classification when the response to a classifying question (eg What colour is it?) can have a number of variables, and where each of these groups can then be sub-grouped (eg by size)

Collects, records, interprets data: The collection and analysis of information, using skills such as comparing, helps children to make accurate assessments about their investigations and to hypothesise or make predictions about particular phenomena

Communicates: Indicates understanding by giving and/or receiving information orally, pictorially and/or in writing

Compares: Examines objects for similarities and differences

Concludes: Uses data, evidence or observations from an investigation to explain the results

Considers: Thinks about carefully, taking all facts into account

Conducts: Directs, manages and undertakes a scientific process

Constructs: Applies knowledge to build

Creates: Reorganises elements into a new structure, makes

Data: Factual information used as a basis for reasoning, discussion and calculation

Debates: Justifies personal opinions, and listens to alternative points of view

Demonstrates: Explains with the use of examples, experiments

Describes: Tells or writes about, shows an understanding of

Designs: Creates a picture (mentally or by drawing) from which a model can be built

Devises: Applies knowledge to innovate or create

Differentiates: Considers differences between objects to distinguish between them, distinguishes relevant from irrelevant

Discovers: Finds out through study or investigation

Discusses: Considers something from different points of view, by talking or writing about it

Distinguishes: Considers differences between objects to tell them apart, sees or shows the difference in

Draws: Communicates ideas through pictures, patterns or diagrams

Examines: Looks at closely and carefully using tools of inquiry and/or apparatus

Explains: Interprets; gives reason for; makes meaning plain or clear (eg '**explain** how' usually asks for the sequence, '**explain why'** usually asks for the cause)

Explanation: The skill of communication in which an interpretation of information is given

Experiments: Performs a scientific test to prove a theory or make a discovery

Fair test: An experiment whose results can be reasonably trusted for basing conclusions because it has been performed in an identical way for each item

Findings: Information gained or conclusions drawn as a result of investigations

Hypothesises: Speculates, generates a 'best guess' based on a synthesis of their current knowledge or information

Identifies: Recognises patterns, facts, or details

Illustrates: Makes clear by examples or drawings, compares, designs

Investigation: To observe or study by using a systematic inquiry approach

Investigates: Uses scientific methodology that systematically employs many inquiry skills (eg performs experiments and communicates results, analyses and/or summarises information)

Locates: Finds where something is, applies knowledge to find examples

Makes: Applies knowledge to build, create, construct or produce

Measures: Compares objects to arbitrary units that may or may not be standardised

Modifies: Alters a design based on understanding of factors influencing performance

Monitors: Regularly checks how something is changing or progressing over a period of time

Observes/Observation: Gathers information by direct evidence of the properties of an object or event by using senses and/or scientific instruments

Orders: Applies knowledge to sort in a particular sequence (eg large to small)

Organises: Analyses information to determine how parts fit together within a structure

Plans: Decides in detail what they are going to do and how they are going to do it

Poses questions: Asks questions to guide investigations and research and to encourage inquiry

Predicts: Tells about an event or an outcome before it occurs

Recognises: Applies knowledge from memory to identify patterns and understanding

Records: Puts information into a permanent form for reference

Reports/Presents: Communicates accurate or relevant information in a variety of formats (eg role-play, written, oral, visual)

Reflects: Considers ideas, thoughts and opinions

Relates: Connects or associates in thought or meaning

Researches: Collects and analyses facts and information to gain new knowledge and understanding

Science: An activity which uses observation, inference and experimentation to develop knowledge and understanding of how the world works

Scientific literacy: The knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity.

Selects: Chooses between options based on certain criteria

Shows: Illustrates or demonstrates ideas or knowledge

Sequences: Applies understanding to place things in correct order

Sorts: Separates into different groups, orders, organises

Suggests: Makes proposals based on understanding

Surveys: Collects sample opinions, facts or figures in order to estimate the overall situation

Technology: The scientific application of knowledge to solve practical problems and to make new inventions

Tests: Finds out what something is like by using and observing it over time or under different conditions

Understands: Constructs meaning from instructional messages, including oral, written and graphic communication

Uses: Applies understanding or a procedure to a task, utilises

GLOSSARY

SCIENTIFIC CONCEPTS

Strand: Earth and space

Climate: The atmospheric conditions for a long period of time, and generally refers to the normal or mean course of the weather
Composting system: A mixture of decaying organic matter, used to improve soil structure and provide nutrients
Equinox: The point at which the ecliptic intersects the celestial equator. Days and nights are most nearly equal in duration
King tide: A high tide well above average height
Meteor: A meteoroid that has entered the earth's atmosphere, usually making a fiery trail as it falls. It is sometimes called a shooting star. Most burn up before hitting the earth
Meteorite: A meteor that has fallen to earth
Meteoroids: Tiny stones or pieces of metal that travel through space
Rock type: Igneous: Rocks formed by the solidification from a molten or liquid state (eg quartz crystals, pumice)
Metamorphic: Rock that has been changed by pressure (eg slate)
Sedimentary: Rock produced by mechanical or chemical weathering processes (sandstone, fossils)
Revolution: When an object moves in orbit around another object
Rotation: Spin (earth rotates on axis)
Seasons: Spring, summer, autumn and winter. The seasons are caused by the tilt of the earth's axis
Solstice: Either of the two times of the year when the sun is at its greatest distance from the celestial equator (winter solstice is the shortest day of the year)
Weather: Day-to-day variation in atmospheric conditions

Strand: Energy systems

Conductor: A thing that transmits heat, electricity, light, sound or other form of energy
Energy: The ability to cause matter to move or change, the ability of an object to do work
Energy forms: Forms of energy include sound, light, heat, electrical, kinetic (the energy of motion), mechanical (the total amount of kinetic and potential energy in a system) and stored or potential energy (the object currently isn't doing any work, but could)
Energy receiver: The object that receives the energy (eg a light globe receives electrical energy)
Energy source: Where the energy comes from (eg the sun)
Energy patterns of use: Use of energy varies over a day (eg need for lighting in evening) and over the year (air conditioning in summer)
Energy Renewable: An energy resource replenished continuously or that is replaced after use through natural means. Includes solar energy, wind energy, geothermal power and hydropower
Energy: Non-renewable: Non-renewable resources have been built up or evolved over a geological time-span and cannot be used without depleting the stock and raising questions of ultimate exhaustibility, since their rate of formation is so slow as to be meaningless in terms of the human life-span
Force: A push or pull between two objects
Friction: The resistive force acting between bodies that tends to oppose and damp out motion
Machine: **Simple** machines have few, if any, moving parts. Simple machines include the lever, the screw, the wheel and axle, the inclined plane, the pulley, and the wedge
Complex machines have two or more moving parts
Pendulum: Amplititude: The magnitude of an oscillation, or swing. The **bob** is the weight
Thrust: A reaction force described quantitatively by Newton's Second Law when a system expels or accelerates mass in one direction to propel an object in the opposite direction

Strand: Life systems

Diversity: The number and variety of species present in an area in a given place at a given time
Ecosystem: The dynamic and interrelating complex of plant and animal communities and their associated non-living environment
Extinction: Complete disappearance of a species because of failure to adapt to environmental change
Endangered: Having so few individual survivors that the species could soon become extinct in all or part of its region
Feral animal: Living in a wild, self-maintaining state after having escaped, or been released, from captivity
Food chain: A series of links between plants and animals expressed as feeding relationships in linear form
Food web: All the interconnecting food chains in a community
Interrelatedness: Mutual or reciprocal relationship
Interdependence: The relationships between or among organisms necessary for their survival
Parasite: An organism that grows, feeds and is sheltered on or in a different organism while contributing nothing to the survival of its host
Salinity: Measure of the concentration of dissolved salts in seawater, normally expressed as parts per thousand (‰). Freshwater is regarded as < 0.5 ‰, seawater as > 30 ‰
Scavenger: Any animal that feeds on refuse and other decaying organic matter

Strand: Matter

Filtration: A separation technique that uses a filter to separate objects of different sizes in a mixture
Irreversible change: Change that cannot be changed back to return matter to its original state (eg cooked food), chemical change
Reversible change: Change that can be changed back to return matter to its original state (eg ice to water), physical change
Solute: The dispersed (dissolved) phase of a solution
Solution: Homogeneous mixture of two or more substances. A saturated solution is a solution in which no more solute will dissolve.

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- Department of Education, Training and Employment (2002) *South Australian Curriculum, Standards and Accountability Framework—English as a Second Language (ESL), Scope and Scales*. Adelaide, DETE.
- Education Department of South Australia (1985) *Evaluating R–7 Science at the classroom level.* Adelaide: Education Department of South Australia.
- Department of Education, Training and Employment (1998) *Assessment and recording in R–10 Science*. Adelaide: DETE.
- Pohl M (2000) *Teaching complex thinking. Critical, creative, caring.* Hawker Brownlow Education Australia.

SUGGESTED RESOURCES

It is expected that most schools will have resources available to support aspects of Science content in the Primary Years Band. These following texts are cited as examples only of published science materials and should not be seen as restrictive in use to a particular learning descriptor.

R1 R I C Publications (1990, 1995, 1998*) Simply science. Level 3.* R I C Publications.

R2 R I C Publications (1990, 1995, 1998) *Simply science. Level 5*. R I C Publications.

R3 R I C Publications (1990, 1995, 1998) *Simply science. Level 7.* R I C Publications.

R4 R I C Publications *Primary science book C.* R I C Publications.

R5 R I C Publications *Primary science book D.* R I C Publications.

R6 R I C Publications *Primary science book E.* R I C Publications.

R7 Rathbone M & Gordon M (2002) *Nelson focus. Teacher's guide. Levels 21-1.* Nelson Thomson Learning.

R8 Petheram L & Jakob C (2002) *Rigby science files. File C.* Rigby.

R7 Jones P (1999) *Boomerangs echoes of Australia* CD-ROM. Alternative Publishing Company.

R8 Department of Education Training and Employment (2001). *Ngarrindjeri people and environment: Past, present and future.* Adelaide: DETE.

R9 Richardson H (editor) (1989) *Fibre basketry: Home grown and hand made.* Published Fibre basket weavers. SA Kangaroo Press Kenthurst NSW.

R10 Clare Primary School *A piece of string Aboriginal perspectives across the curriculum.* Adelaide*:* DETE.

R11 R I C Publications *Primary science. Book G.* R I C Publications.

OUTREACH AND DECS SERVICES

OR1 Aboriginal Education Unit, 5 Harewood Avenue, Enfield, South Australia 5085
Phone (08) 8343 6500 Fax (08) 8343 6515
http://www.aboriginaleducation.sa.edu.au

OR2 SA Maritime Museum, 126 Lipson Street, Port Adelaide, South Australia 5015
Phone (08) 8270 6255 Fax (08) 8270 6266
http://www.oac.schools.sa.edu.au/outreach/oes/maritime

Technology Education Centre, 32a Dew Street, Thebarton SA 5031.
Phone (08) 8354 4000. Fax (08) 8354 4088. E-mail teched@adelaide.on.net
Catalogue available online http://www.teched
Technology resources for Australian classrooms. A comprehensive range of technology and science resources and advice for the classroom.

R–7 Science Materials Catalogue.
Phone (08) 8226 1603 Fax (08) 8226 1177 Courier R11/07 E-mail Turnbull.Peter@saugov.sa.gov.au
A wide range of science materials and equipment available year round at contract prices. For a catalogue, further information or advice contact Peter Turnbull

The Nature Education Centre. Norwood Primary School 39 Osmond Terrace Norwood SA 5067
Phone (08) 8363 0238 Fax (08) 8362 0102
Live animals and collections for hire to schools.

WEBSITES

W1 Bureau of Meteorology http://www.bom.gov.au/
Glossary, Australian weather forecasts, charts, and warnings.

W2 Science and Technology http://www.sofweb.vic.edu.au/Steps/students/5-6Years/energy/counter.htm
Education in Primary Schools, includes energy counter.

W3 Science and Technology http://www.sofweb.vic.edu.au/Steps/students/5-6Years/energy/pie.htm
Education in primary schools, energy efficient house.

W4 Aboriginal Education. Department of Education and Children's Services, South Australia. http://www.aboriginaleducation.sa.edu.au

W5 Aboriginal Dreaming Stories http://www.aboriginaleducation.sa.edu.au/files/links/Dreaming_stories_and_bird_1.pdf
Birds and the local environment PDF download. Resources, lesson notes, Dreaming stories to assist implementing Aboriginal perspectives.

W 6 Enchanted Learning http://www.enchantedlearning.com/Home.html
Produces children's educational web sites and games that support learning across learning areas, including science.

W7 Streamwatch http://www.streamwatch.org.au/main
Macroinvertebrate identification chart.

W8 Waterwatch http://www.sa.waterwatch.org.au/educatio.htm
Information and availability of Waterwatch education sessions run by Waterwatch education officers.

W9 Landcare South Australia http://www.landcaresa.org.au/education.html
Education Officer Rob Wallace.

Learning Area: Science

Strand: Earth and space **Band: Middle Years** **Standards: 3 & 4**

KEY IDEAS	(*refer p 23 for Primary Years)*		*(refer p 58 for Middle–Senior Years)*	OUTCOMES
	Year 6 **Standard 3**	**Year 7** **Towards Standard 4**	**Year 8** **Standard 4**	
Students investigate, through fieldwork and research, the central importance of the earth's role in sustaining life and how changes impact on life; and understand the interaction of the atmosphere, the oceans and the earth's surface. **F In T** KC1 KC3 **relating to outcomes 3.1, 4.1**	• **Explains** causes of changes and their impact on life forms (eg the implications of greenhouse gases, climatic change and ozone depletion; air, water and soil pollution). • Collects and **classifies** rocks (eg sedimentary, igneous, metamorphic). **R1** • **Describes** features of the earth's structure with emphasis on the crust and how it changes (eg mountains, rivers, valleys, erosion). **R1 R3** • **Measures** features of the weather (eg wind-speed, rainfall and temperature), using instruments commercially available and of their own design. **R5** • **Researches** the exploration for and uses of minerals (eg iron, uranium, gold). • **Investigates** the ocean as a resource (eg habitat, methods of salt extraction and desalination, impact of commercial fishing). • **Investigates** the cause and effect of natural disasters (eg drought, flood, bushfires). **R3**	• **Debates** the issues associated with mining and considers alternative futures (eg loss of habitat, waste management, more efficient use of resources). **R10** • **Investigates** the properties of soils (eg designs and carries out tests for water retention and compaction). • **Describes** features of the earth's internal structure and relates this to changes in the crust (eg volcanoes, earthquakes). **R7** • **Explains** how the interaction of the air and the ocean influence the weather (eg sea breezes). • **Describes** the ocean as a system (eg tides, currents, nutrient cycles). • **Interprets** diagrams of the structure of the atmosphere (eg troposphere, ionosphere). **R1 R13** • **Identifies** uses of science and technology in managing natural environments (eg satellite imagery, seismography).	• **Researches** the environmental impact of historical and/or indigenous land use practices (eg fire used by Australian Aboriginal people, hunting practices of North American Indians, intensive farming in Europe in the Middle Ages). • **Creates scenarios** of sudden geological events which impact on the daily lives of humans (eg earthquakes, volcanoes, tsunamis) and presents them via electronic modelling or creative writing. • **Debates** the links between the ozone layer, human use of gaseous products and the incidence of skin cancer in Australia (eg oral debate, media release). • **Investigates** the advantages and disadvantages of a proposed conservation park in a local area (eg creates information poster or brochure). • **Describes** the impact of variations in weather patterns that determine the rainfall of an area (eg computer simulation, *PowerPoint* presentation, role-play to younger audience).	**3.1** Describes the characteristics that sustain life on the earth and changes to these characteristics and their impact over time. **F In T** KC2 **4.1** Identifies and investigates changes, both natural and human-induced, on the earth and suggests ideas which encourage the preservation of the natural environment for all living things. **F In T** KC1 KC6

Students investigate, through fieldwork and research, the central importance of the earth's role in sustaining life and how changes impact on life; and understand the interaction of the atmosphere, the oceans and the earth's surface. **F In T** KC1 KC3 **relating to outcomes 3.1, 4.1**	ASSESSMENT EXAMPLE Prepares and presents a report on the process of soil erosion.	ASSESSMENT EXAMPLE Draws and annotates a diagram of the water cycle.	ASSESSMENT EXAMPLE **Working scientifically**—Identifies the links between natural phenomena and human activities, through research and discussion. **Knowledge—**Identifies aspects of atmosphere, earth and sun which impact on human activities	**3.1** Describes the characteristics that sustain life on the earth and changes to these characteristics and their impact over time. **F In T** KC2 **4.1** Identifies and investigates changes, both natural and human-induced, on the earth and suggests ideas which encourage the preservation of the natural environment for all living things. **F In T** KC1 KC6

An example of how **Futures** can be developed is to view the earth as a continually changing system and consider possible futures resulting from naturally occurring and human influences.

Learning Area: Science

Strand: Earth and space **Band: Middle Years** **Standards: 3 & 4**

KEY IDEAS	(*refer p 23 for Primary Years)*		*(refer p 60 for Middle–Senior Years)*	OUTCOMES
	Year 6 **Standard 3**	**Year 7** **Towards Standard 4**	**Year 8** **Standard 4**	
Students select and use observational instruments and digital and electronic technologies to develop understandings about structures and events in the universe. They appraise, and share opinions about, the ethics of space exploration. **F In C** KC2 KC7 **relating to outcomes 3.2, 4.2**	• **Observes** and **distinguishes** between stars, planets and constellations of the night sky. **R2 R12** • **Models** the relative movement of the earth and sun and explains associated phenomena (eg day and night results from rotation, the year results from revolution around the sun). **R12** • Participates in the construction of a scale map of the solar system (eg walk scale distances between planets, construct scale models of the planets). **R2** • **Analyses** the history, benefits and costs of space exploration (eg development of rockets, human space flight). **R12** ASSESSMENT EXAMPLE **Selects** suitably sized spheres to **model** the movement of the earth around the sun.	• **Compares** conditions on earth with those on another planet (eg temperature, gravity). • **Models** the relative movement of the earth, sun and moon and explains associated phenomena (eg phases of the moon, eclipses, tides). **R12** • **Compares** the appearance of stars, planets and nebulae as seen with different technologies (eg Mars viewed through naked eye, telescope, landing craft). • **Debates** the moral and ethical issues of space travel and considers future directions (eg human versus robot exploration). • **Describes** how views of the universe have differed over time and cultures (eg indigenous stories, historical models having the earth at the centre). ASSESSMENT EXAMPLE **Describes** the obstacles associated with human habitation of a planet or the moon.	• Develops an understanding of the events and structure of the solar system (eg sun, planets, asteroids, comets, natural satellites, solar storms) **using** optical instruments or recordings from optical instruments). • **Uses** visual recordings or prints from radio telescopes and the Hubble Telescope to explore the universe (eg **describes** and **compares** various galaxies). • **Communicates** an understanding of the possibilities of space exploration (eg communicates, through a scale diagram, the vastness of space, the plausibility of its exploration, and associated ethics). ASSESSMENT EXAMPLE **Working scientifically—**Identifies various components of our universe from photos etc. **Knowledge**—Demonstrates an understanding of the size and distances of the solar system and its parts by the use of scale diagrams.	**3.2** Describes various components of the solar system and the effects of these on our everyday lives. **F In C** KC2 **4.2** Investigates and analyses astronomical features and changes as seen from the earth and debates the ways scientists examine and explain these. **F In C** KC2

An example of how **Communication** can be developed is to use a variety of ICTs to gather information about the universe, and to report understandings using electronic or other means.

Learning Area: Science

Strand: Energy systems **Band: Middle Years** **Standards: 3 & 4**

KEY IDEAS	(*refer p 25 for Primary Years)*		*(refer p 61 for Middle–Senior Years)*	OUTCOMES
	Year 6 **Standard 3**	**Year 7** **Towards Standard 4**	**Year 8** **Standard 4**	
Students collect data about, and critique, their own patterns of energy use in terms of its environmental impact. **F Id C** KC1 KC5 **relating to outcomes 3.3, 4.3**	• **Analyses** data and compares energy use by various sites such as homes, workplaces, schools (eg using online data). **W1 R3** • **Suggests** ways to use energy more efficiently in the future. • **Constructs** energy chains to demonstrate the importance of the sun as a source of energy. • **Researches** the environmental impact of obtaining, transporting and using energy from different sources. • **Examines** the energy content of different foods and presents findings to compare different patterns of consumption (eg traditional and western diets). ASSESSMENT EXAMPLE **Analyses data** on energy use in the home and prepares a report recommending changed practices.	• **Analyses** energy use patterns for different cultures (eg online data sorted by country or industry) and makes suggestions for the future. • **Classifies** fuels as renewable or non-renewable, examines past and present patterns of use and discusses the implications for the future. • **Evaluates** their personal impact on the environment (eg their energy use). **W1** • **Compares** energy requirements of different activities with energy contents of foods, and the relationship with obesity, exercise and diabetes. ASSESSMENT EXAMPLE **Presents a report** on the source and use (including personal use) of a fuel in everyday life.	• **Identifies** the by-products of fossil fuel based energy generation (eg delivers a presentation about greenhouse gases, smog, acid rain or carbon monoxide). • **Identifies** a potential waste of energy at home or school (eg **develops an action plan** to raise the awareness of the offenders using multimedia techniques such as posters, strategic stickers and advertising campaigns). ASSESSMENT EXAMPLE **Working scientifically—**Collects data in a useable form that identifies a waste of energy at home or school. **Knowledge—**Presents evidence-showing understanding of the detrimental effect on life of a by-product of fossil fuel combustion.	**3.3** Investigates and reports on patterns of energy use in the home, school and other places. **F Id C** KC1 KC2 KC5 **4.3** Investigates ways of obtaining, transferring and using energy (including from sustainable energy sources and from fossil fuels) for particular purposes. **F C** KC6

An example of how **Identity** can be developed is for students to examine themselves as energy users and consider their role in possible futures.

Learning Area: Science

Strand: Energy systems **Band: Middle Years** **Standards: 3 & 4**

KEY IDEAS	(*refer p 26 for Primary Years)*		*(refer p 62 for Middle–Senior Years)*	OUTCOMES
	Year 6 **Standard 3**	**Year 7** **Towards Standard 4**	**Year 8** **Standard 4**	
Students use the concepts of force, energy and transfer of energy to investigate and explain phenomena and changing patterns of events in the natural world. **In T** KC1 KC2 **relating to outcomes 3.4, 4.4**	• **Explains** energy as the ability to bring about change and identifies different forms of energy (eg light, heat, kinetic, potential, chemical, nuclear, sound, electrical). **R1** • **Investigates** and measures how the flow of energy can be enabled or impeded (eg uses a thermometer to measure the effectiveness of insulation in keeping a container of liquid hot/cold, selects materials to complete electric circuits, tests conductivity using a multimeter, designs and tests a model sound-proof room). **R12** • **Describes** simple machines in terms of ways of doing work differently (eg crowbar, jack, ramp, jar wrench, pulley). **R2 R8 R13** • **Measures** performance with consideration of **variables** resulting from energy transfer (eg temperature as a result of heating, performance life of different batteries). ASSESSMENT EXAMPLE **Explains** the action of a familiar machine in terms of energy transfer.	• **Examines** a common appliance (eg electric screwdriver, hair drier, wind-up car), describes the energy changes involved and suggests alternative uses for it (eg light bulb to heat a lizard's cage). • **Investigates** and **explains** a system in terms of inputs and outputs (eg simple hydraulics using syringes and plastic tubes, bicycle gears). • **Measures** and **compares variables** relating to the efficiency of various energy transfer systems (eg compares performance of balls bouncing on different surfaces, results of collisions between toy cars of different weights). • **Uses terms** such as force, energy and work when describing situations in which energy is utilised (eg deforming of shapes when they are dropped, shifting a load of bricks). **R1** ASSESSMENT EXAMPLE **Identifies** and **controls variables** in a **fair test** to compare the performance of various materials in affecting the flow of energy (eg grows seedlings under different coloured filters, rolls ball down slopes covered with different materials).	• **Uses** the concept of force to explain motion in daily phenomena (eg **uses** forces of attraction and repulsion in permanent magnets and electromagnets to explain motion). • **Communicates** an understanding of various changes and transfers of energy in a system (eg draws a flow chart showing the changes and transfers of energy from fossil fuel to use of electricity in the home). • **Investigates** the loss of energy from a system due to efficiency (eg **measures** the various heights a ball bounces and explains the loss of energy and hence its efficiency). ASSESSMENT EXAMPLE **Working scientifically—**Makes accurate measurements, which lead to a plausible efficiency statement. **Knowledge—**Relates the difference between potential and kinetic energy, and energy transformation and translation.	**3.4** Uses the idea of force to describe and explain different ways of transferring energy. **In T** KC2 **4.4** Plans and evaluates investigations that focus on the transfer and transformation of energy. **In T** KC3

An example of how **Thinking** can be developed is to evaluate situations in which energy is transferred and generalise findings to other situations.

Learning Area: Science

Strand: Life systems **Band: Middle Years** **Standards: 3 & 4**

KEY IDEAS	(*refer p 27 for Primary Years)*		*(refer p 64 for Middle–Senior Years)*	OUTCOMES
	Year 6 **Standard 3**	**Year 7** **Towards Standard 4**	**Year 8** **Standard 4**	
Students develop a shared understanding of the characteristics and behaviour of living things and how they are interrelated and interdependent. They appreciate and report on the place of humans in the earth's ecology, and develop their understanding of, explore future possibilities for, and act to contribute to, sustainable environments. **F In** KC1 KC2 KC3 **relating to outcomes 3.5, 4.5**	• **Investigates** the major body systems of animals (eg skeletal, circulatory, respiratory, nervous). • **Describes** the parts of plants and relates them to their functions (eg flowers—seed production, fruits—seed dispersal, leaves—photosynthesis, roots—support and absorption). **R13** • Experiments to investigate the factors necessary for seed germination (eg seed type, temperature, water, soil). • Visits and **examines** a local ecosystem and describes it in terms of food chains. **R3** • **Describes** respiration and photosynthesis as life sustaining processes. • **Documents**, after online or other research, the environmental impact of humans in different cultures (eg habitat destruction, pollution).	• **Compares** the body systems of vertebrates and invertebrates (eg endo/exoskeletons, lungs/gills, compound eyes/simple eyes). **R12** • **Examines** and compares the structure of plants and/or animals in terms of adaptation to environment. **R8** • **Designs** and **carries out** an experiment to investigate the factors necessary for optimum plant growth (eg plant type, temperature, water, soil, light). • **Uses an understanding** of photosynthesis and respiration to **explain** the optimum conditions for life (eg light and temperature for photosynthesis, temperature and oxygen for respiration). • Visits and **examines** a local ecosystem and describes it in terms of cycles (eg water, oxygen, carbon). • **Suggests** possible futures resulting from various environmental practices (eg forest versus plantation timber, density of housing, agricultural practices).	• **Demonstrates** that cells are the smallest living units and that they are constructed of organelles that perform specific life functions (eg **identifies and labels** the key organelles of plant and animal cells and their functions from diagrams or slides). • **Develops microscope skills** to appreciate the levels of organisation of living things (eg examination of plant and animal cells as a vehicle for setting up and using a microscope).	**3.5** Explains the interrelationships between systems within living things, and between living things in ecological systems. They relate these ideas to the health of individuals and to threats to the sustainability of ecological systems. **F Id In** KC1 KC2 **4.5** Investigates and explains the functioning of living systems from the microscopic to the macroscopic. **F In** KC1 KC2

Students develop a shared understanding of the characteristics and behaviour of living things and how they are interrelated and interdependent. They appreciate and report on the place of humans in the earth's ecology, and develop their understanding of, explore future possibilities for, and act to contribute to, sustainable environments. **F In** KC1 KC2 KC3 **relating to outcomes 3.5, 4.5**	ASSESSMENT EXAMPLE **Draws a diagram** of a food chain that might be found in a familiar ecosystem.	• **Designs** a no watering garden with shade for summer and sun for winter and which attracts indigenous birds all year round. ASSESSMENT EXAMPLE **Describes** how particular plants or animals are adapted to their environment.	ASSESSMENT EXAMPLE **Working scientifically—**Checklist of microscope care and usage (eg safe transport and setting up, label microscope parts, focusing, not touching glass surfaces. **Knowledge—**Draws plant and animal cells and labels 3 major organelles.	**3.5** Explains the interrelationships between systems within living things, and between living things in ecological systems. They relate these ideas to the health of individuals and to threats to the sustainability of ecological systems. **F Id In** KC1 KC2 **4.5** Investigates and explains the functioning of living systems from the microscopic to the macroscopic. **F In** KC1 KC2

An example of how **Thinking** can be developed is to appreciate the complex interrelationships between the components of living systems, at an organism or ecosystem level.

Learning Area: Science

Strand: Life systems **Band: Middle Years** **Standards: 3 & 4**

KEY IDEAS	(*refer p 28 for Primary Years)*		*(refer p 65 for Middle–Senior Years)*	OUTCOMES
	Year 6 **Standard 3**	**Year 7** **Towards Standard 4**	**Year 8** **Standard 4**	
Students examine the ways organisms reproduce, grow and change over generations. They engage with, and appreciate different positions on, ethical issues such as those associated with ecological sustainability and gene technologies. **F In T C** KC1 **relating to outcomes 3.6, 4.6**	• **Hypothesises** possible reasons for natural variation in the growth of a species (eg different rates of growth of seeds under the same conditions). • **Describes** the biodiversity of various habitats (eg mangroves, wetlands, mature forests). • **Describes** and models the way in which fossils are formed (eg impressions, casts, mineralisation). • **Researches** the notion of extinction in terms of an inability to adapt to change. **R3** • **Researches** and reports on the way domesticated animals and plants have changed for human purposes through selective breeding (eg different breeds of sheep, cattle, chickens, apples and cherries). ASSESSMENT EXAMPLE **Researches** and **reports** on an extinct Australian animal and **considers** the factors leading to extinction.	• **Compares** the similarities and differences in the reproduction of plants and animals (eg conifers versus flowering plants, egg laying versus live birth, plant versus animal). • **Reports** on the effects of human activity on species diversity (eg plantation versus natural forest, urban growth introduction of exotic species such as the cat and cane toad). **R9** • **Examines** fossils and appreciates that living things may change over time. • **Predicts** the likely effects on species if hypothesised changes to the environment occur (eg specialised feeders such as anteaters will be affected more critically). • **Researches** and reports on their understanding of the use of biotechnology to modify living things for human purposes (eg genetically modified canola, use of gene technology in medicine). ASSESSMENT EXAMPLE **Compares** and **contrasts** the reproductive cycles of two organisms.	• **Creates** visual representations of communities in various geological eras (eg accesses and uses various electronic and other sources of information). • **Plans** and **reports** on an investigation of the changes of an organism during its life cycle and the potential disruptions to that life cycle by human activities (eg insects and pesticides, weeds and herbicides). • **Appraises** the sustainability of identified endangered species (eg platypus, native cat, black cockatoo) and presents their views to a wide audience. • **Critiques** articles on arguments for and against human alteration of a given environment (eg accesses magazines, documentaries, internet). ASSESSMENT EXAMPLE **Working scientifically—**Accesses various resources to research the effect of human activities on plant and animal species, and reports on their findings through a variety of presentation modes. **Knowledge—**Identifies the human activities that impact on the survival of other species.	**3.6** Identifies, analyses and communicates confidently the similarities and differences in the ways living things reproduce, and considers the ethics of related issues. **F T C** KC1 KC2 **4.6** Explores how living things have changed over geological time and debates the value of species diversity and the ethics of human intervention. **F T C** KC2 KC6

An example of how **Futures** can be developed is to examine how life has changed in the past, may change in the future, and the impact of human technologies.

Learning Area: Science

Strand : Matter **Band: Middle Years** **Standards: 3 & 4**

KEY IDEAS	(*refer p 29 for Primary Years)*		*(refer p 67 for Middle–Senior Years)*	OUTCOMES
	Year 6 **Standard 3**	**Year 7** **Towards Standard 4**	**Year 8** **Standard 4**	
Students communicate understandings about the properties and personal uses of materials. They research future availability of earth materials for human use, and explore possible sustainable alternatives to current patterns of use. **F In T C** KC1 KC2 KC6 **relating to outcomes 3.7, 4.7**	• **Researches** and **classifies** the raw materials for the component parts of everyday objects (eg parts of a car having mineral, vegetable and animal origin). • **Investigates** the structure of common materials (eg different types of paper, string and cloth) using magnifiers or light scopes, and relates it to macroscopic properties (eg strength, stretch, smoothness). • **Uses a fair test** to compare the relative strength of materials joined in different ways (eg plaited versus spun yarns, corrugated versus flat paper). • **Researches** and constructs a report on the environmental impact of a substance or material used in packaging (eg plastics). • **Discusses** the ethical positions of using and disposing of materials, considers alternatives and the implications for their personal use.	• **Devises a fair test** to compare the relative properties of materials (eg solubility, texture, flexibility, elasticity, hardness, buoyancy, corrosion resistance). • **Researches** and constructs a report on the life of a material from 'dust to dump' (eg iron for a steel can from mining to recycling, plastic for a bottle from oil to landfill or recycling). • **Researches** and reports on the distribution of a raw material (eg gold, coal) and **describes** the role of science in the mining and processing (eg role of geologist, chemist). • **Investigates** the way cultural groups have used fibres to support their lifestyle (eg animal skins as protection from the cold). • **Compares** patterns of use and disposal of different materials by other cultures and **suggests** alternatives to current practices towards a sustainable future (eg waste management, selection of specific materials for a purpose). **R14**	• **Compares properties** of materials, before and after physical or chemical change (eg hardness, strength, elasticity; texture and appearance before and after physical and chemical change; solid wood converted to chipboard and craft wood). • **Negotiates an investigation** on common materials with possible alternatives for the future (eg **varies** the ratios of sand, cement, gravel and water and **compares** the resulting strength in the concrete produced).	**3.7** Describes the structure of some common materials, explains how materials are used for different purposes, and understands their impact on the environment. **F In T C** KC1 KC2 **4.7** Compares properties of materials before and after physical or chemical change by planning, conducting, evaluating and communicating an investigation. **In T C** KC1 KC2 KC3

Students communicate understandings about the properties and personal uses of materials. They research future availability of earth materials for human use, and explore possible sustainable alternatives to current patterns of use. **F In T C** KC1 KC2 KC6 **relating to outcomes 3.7, 4.7**	ASSESSMENT EXAMPLE **Uses a fair test** to **compare** the strength of corrugated cardboard in different directions and **links the results** to the direction of corrugations.	ASSESSMENT EXAMPLE Writes and presents a drama depicting the life history of a material from raw material, through manufacture and use to disposal.	ASSESSMENT EXAMPLE **Working scientifically—Designs** a practical that compares materials fairly, uses a control, and keeps a log of their progress. **Knowledge—Writes** a report suggesting plausible alternatives to the materials they investigated.	**3.7** Describes the structure of some common materials, explains how materials are used for different purposes, and understands their impact on the environment. **F In T C** KC1 KC2 **4.7** Compares properties of materials before and after physical or chemical change by planning, conducting, evaluating and communicating an investigation. **In T C** KC1 KC2 KC3

An example of how **Futures** can be developed is to consider implications for a sustainable future, while reflecting on the availability, use and disposal of materials.

Learning Area: Science

Strand: Matter **Band: Middle Years** **Standards: 3 & 4**

KEY IDEAS	(*refer p 31 for Primary Years)*		*(refer p 68 for Middle–Senior Years)*	OUTCOMES
	Year 6 **Standard 3**	**Year 7** **Towards Standard 4**	**Year 8** **Standard 4**	
Students pose questions to investigate ways in which physical and chemical processes can be altered in order to achieve desirable outcomes, such as food preservation. **T C** KC1 **relating to outcomes 3.8, 4.8**	• **Uses understanding** of the properties of solids, liquids and gases to **explain** the behaviour of solids, liquids and gases (eg participates in a dramatic representation of the behaviour of particles in different states of matter). • **Uses a fair test** to compare corrosion of different metals (eg iron, brass, copper). • Develops and publishes a set of rules for storage, safe handling and disposal of common household materials and makes recommendations for changing practices. • **Uses common processes** (eg filtration, evaporation) to separate mixtures and relates the method to the properties of the individual substances. **R12** • **Uses a fair test** to investigate the effect of varying the proportion of ingredients in common processes (eg making plaster, glue, play dough, biscuits). • **Investigates** the factors affecting rates of processes (eg temperature on dissolving, dehydration on food spoiling).	• **Uses understanding** of the properties of solids, liquids and gases to explain the behaviour of substances when they are mixed (eg solutions and suspension in mixing salt and water, mixing chalk dust and water). **R7** • **Devises a fair test** to compare conditions affecting corrosion of metals (eg effect of water and oxygen on iron, household cleaners on aluminium cans). • **Gathers data** on storage, safe handling and disposal of materials used in the workplace and presents it to an audience (eg visits a local workplace, gathers data from online sources). • **Explains** the processes of filtration, evaporation, chromatography, decanting, distillation, crystallisation and magnetism, and i**nvestigates** their **application** in separating mixtures in the home and industry. **R7 R12** • **Designs a fair test** to investigate the effect of varying the ingredients in common processes (eg adding salt to plaster, fresh pineapple in jelly, baking powder in scones).	• **Hypothesises**, **plans** and **reports** on an investigation to determine the effects of storage conditions on food (eg refrigeration, dehydration, food additives, cooking). • **Researches**, **describes** and **makes decisions** about choice of materials for a variety of conditions (eg building materials including metals). • **Investigates** the properties and uses of a range of household products (eg drain cleaner, detergent, sodium hydrogen carbonate). • **Predicts** and **tests** the reaction rates for materials in particulate and bulky form (eg dissolving tablets, cooking cakes).	**3.8** Uses the changes in properties and uses of materials in product life cycles. **T C** KC1 **4.8** Recognises and describes conditions that influence reactions or change in materials. **T C** KC1 KC2

Students pose questions to investigate ways in which physical and chemical processes can be altered in order to achieve desirable outcomes, such as food preservation. **T C** KC1 **relating to outcomes 3.8, 4.8**	ASSESSMENT EXAMPLE **Designs** and **carries out an experiment** to **investigate** the effects of changing the proportion of water in a plaster of Paris mixture.	• **Researches information** to explain common preservation processes such as freezing, drying, vacuum sealing, salting and pasteurisation. ASSESSMENT EXAMPLE **Separates** the components of a mixture of sand and salt, using safe work practices.	ASSESSMENT EXAMPLE **Working scientifically—Designs** and **conducts** an experiment testing the dissolving rates of a number of products using one variable as a control. **Knowledge—Matches** a variety of materials to a specified purpose, explaining the choices made in terms of properties of these materials.	**3.8** Uses the changes in properties and uses of materials in product life cycles. **T C** KC1 **4.8** Recognises and describes conditions that influence reactions or change in materials. **T C** KC1 KC2

An example of how **Futures** can be developed is to observe changes in materials and make predictions.

GLOSSARY

WORKING SCIENTIFICALLY

Acts responsibly: Acts to achieve a positive outcome for environments and the global community

Analyses: Studies something critically to identify the elements or relationships between the elements

Applies: Uses ideas, processes or skills in new situations

Cares: Provides what a living thing needs to keep it healthy, and ensures it does not come to any harm

Classifies: Analyses properties to group objects or events, including using graphic organisers such as Venn Diagrams

Classification: The way in which scientists make sense of the world by grouping things that look behave or reproduce etc in similar ways

Classification tree: A model used for classification when the response to a classifying question (eg What colour is it?) can have a number of variables, and where each of these groups can then be sub-grouped (eg by size)

Collects, records, interprets data: The collection and analysis of information, using skills such as comparing, helps children to make accurate assessments about their investigations and to hypothesise or make predictions about particular phenomena

Communicates: Indicates understanding by giving and/or receiving information orally, pictorially and/or in writing

Compares: Examines objects for similarities and differences

Concludes: Uses data, evidence or observations from an investigation to explain the results

Considers: Thinks about carefully, taking all facts into account

Conducts: Directs, manages and undertakes a scientific process

Constructs: Applies knowledge to build

Creates: Reorganises elements into a new structure, makes

Data: Factual information used as a basis for reasoning, discussion and calculation

Debates: Justifies personal opinions, and listens to alternative points of view

Demonstrates: Explains with the use of examples, experiments

Describes: Tells or writes about, shows an understanding of

Designs: Creates a picture (mentally or by drawing) from which a model can be built

Devises: Applies knowledge to innovate or create

Differentiates: Considers differences between objects to distinguish between them, distinguishes relevant from irrelevant

Discovers: Finds out through study or investigation

Discusses: Considers something from different points of view, by talking or writing about it

Distinguishes: Considers differences between objects to tell them apart, sees or shows the difference in

Draws: Communicates ideas through pictures, patterns or diagrams

Examines: Looks at closely and carefully using tools of inquiry and/or apparatus

Explains: Interprets; gives reason for; makes meaning plain or clear (eg '**explain** how' usually asks for the sequence, '**explain why'** usually asks for the cause)

Explanation: The skill of communication in which an interpretation of information is given

Experiments: Performs a scientific test to prove a theory or make a discovery

Fair test: An experiment whose results can be reasonably trusted for basing conclusions because it has been performed in an identical way for each item

Findings: Information gained or conclusions drawn as a result of investigations

Hypothesises: Speculates, generates a 'best guess' based on a synthesis of their current knowledge or information

Identifies: Recognises patterns, facts, or details

Infers: Draws a conclusion about a specific event based on observations and data, may include cause and effect relationships

Illustrates: Makes clear by examples or drawings, compares, designs

Investigation: To observe or study by using a systematic inquiry approach

Investigates: Uses scientific methodology that systematically employs many inquiry skills (eg performs experiments and communicates results, analyses and/or summarises information)

Locates: Finds where something is, applies knowledge to find examples

Makes: Applies knowledge to build, create, construct or produce

Measures: Compares objects to arbitrary units that may or may not be standardised

Modifies: Alters a design based on understanding of factors influencing performance

Monitors: Regularly checks how something is changing or progressing over a period of time

Observes/Observation: Gathers information by direct evidence of the properties of an object or event by using senses and/or scientific instruments

Orders: Applies knowledge to sort in a particular sequence (eg large to small)

Organises: Analyses information to determine how parts fit together within a structure

Plans: Decides in detail what they are going to do and how they are going to do it

Poses questions: Asks questions to guide investigations and research and to encourage inquiry

Predicts: Tells about an event or an outcome before it occurs

Recognises: Applies knowledge from memory to identify patterns and understanding

Records: Puts information into a permanent form for reference

Reports/Presents: Communicates accurate or relevant information in a variety of formats (eg role-play, written, oral, visual)

Reflects: Considers ideas, thoughts and opinions

Relates: Connects or associates in thought or meaning

Researches: Collects and analyses facts and information to gain new knowledge and understanding

Science: An activity which uses observation, inference and experimentation to develop knowledge and understanding of how the world works

Scientific literacy: The knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity.

Selects: Chooses between options based on certain criteria

Shows: Illustrates or demonstrates ideas or knowledge

Sequences: Applies understanding to place things in correct order

Sorts: Separates into different groups, orders, organises

Suggests: Makes proposals based on understanding

Surveys: Collects sample opinions, facts or figures in order to estimate the overall situation

Technology: The scientific application of knowledge to solve practical problems and to make new inventions

Tests: Finds out what something is like by using and observing it over time or under different conditions

Understands: Constructs meaning from instructional messages, including oral, written and graphic communication

Uses: Applies understanding or a procedure to a task, utilises

Variables, identifies and controls: Identifies the variables in a situation and selects those variables that are to be manipulated and those which are to remain constant

GLOSSARY

SCIENTIFIC CONCEPTS

Strand: Earth and space

Atmosphere: The layer of gas surrounding the earth or other planets. The *upper* atmosphere is the region of earth's atmosphere above the troposphere (which extends to about 20km). Regions of the upper atmosphere are the stratosphere, mesosphere and thermosphere
Climate: The atmospheric conditions for a long period of time, and generally refers to the normal or mean course of the weather
Greenhouse gases: Greenhouse gases are present in relatively small quantities in the atmosphere and strongly absorb infrared radiation or 'heat' emitted by the earth. The primary greenhouse gases are water vapour, carbon dioxide, methane, nitrous oxide, ozone, and some of the chlorofluorocarbons. Concentrations of several greenhouse gases are increasing, primarily as a result of human activities
Ionosphere: The region of earth's atmosphere that extends from about 50 to 600kms above the surface of the planet
Ozone depletion: Ozone is continually being formed and destroyed by chemical reactions occurring in the stratosphere. There are large natural changes in ozone concentration in the stratosphere; for example, between summer and winter there is a change of about 25% at mid-latitudes. Ozone depletion occurs if the rate of ozone destruction is increased due to human activities
Revolution: When an object moves in orbit around another object
Rock type: **Igneous:** Rocks formed by the solidification from a molten or liquid state (eg quartz crystals, pumice)
Metamorphic: Rock that has been changed by pressure (eg slate)
Sedimentary: Rock produced by mechanical or chemical weathering processes (sandstone, fossils)
Troposphere: The first layer of the atmosphere, lying below 10km altitude
Weather: Day-to-day variation in atmospheric conditions

Strand: Energy systems

Conductor: A thing that transmits heat, electricity, light, sound or other form of energy
Energy: The ability to cause matter to move or change, the ability of an object to do work
Energy forms: Forms of energy include sound, light, heat, electrical, kinetic (the energy of motion), mechanical (the total amount of kinetic and potential energy in a system) and stored or potential energy (the object currently isn't doing any work, but could)
Energy receiver: The object that receives the energy (eg a light globe receives electrical energy)
Energy source: Where the energy comes from (eg the sun)
Energy patterns of use: Use of energy varies over a day (eg need for lighting in evening) and over the year (air conditioning in summer)
Energy Renewable: An energy resource replenished continuously or that is replaced after use through natural means. Includes solar energy, wind energy, geothermal power and hydropower
Energy: Non-renewable: Non-renewable resources have been built up or evolved over a geological time-span and cannot be used without depleting the stock and raising questions of ultimate exhaustibility, since their rate of formation is so slow as to be meaningless in terms of the human life-span
Force: A push or pull between two objects
Friction: The resistive force acting between bodies that tends to oppose and damp out motion
Hydraulics: The science of fluids in motion
Machine: **Simple** machines have few, if any, moving parts. Simple machines include the lever, the screw, the wheel and axle, the inclined plane, the pulley, and the wedge
Complex machines have two or more moving parts
Pendulum: Amplitude: The magnitude of an oscillation, or swing. The **bob** is the weight
Thrust: A reaction force described quantitatively by Newton's Second Law when a system expels or accelerates mass in one direction to propel an object in the opposite direction

Strand: Life systems

Biotechnology: Technique that uses living organisms (or parts of organisms) to make or modify products, to change plants and animals, or to develop microorganisms for specific use
Carbon cycle: Nutrient cycling that includes uptake of carbon dioxide by plants, ingestion by animals, and respiration and decay of the animal
Endoskeleton: The bony and cartilaginous structure that is inside the body
Exoskeleton: The hard structure developed on the outside of, and giving support to, a body, such as the chitinous covering of an insect
Gene technology: Branch of modern biotechnology. Range of techniques used by scientists in an attempt to control or modify genes or, most significantly, move them between two unrelated species (called recombinant DNA technology)
Genetic modification: The addition, deletion, substitution, rearrangement or recombination of heritable genetic material
Mineralisation: The conversion of an element through the action of microbes from an organic to an inorganic state
Oxygen cycle: Cyclic movement of oxygen in different chemical forms from the environment to organisms, and then back to the environment
Parasite: An organism that grows, feeds and is sheltered on or in a different organism while contributing nothing to the survival of its host
Salinity: Measure of the concentration of dissolved salts in seawater, normally expressed as parts per thousand (‰). Freshwater is regarded as < 0.5 ‰, seawater as > 30 ‰
Scavenger: Any animal that feeds on refuse and other decaying organic matter
Selective breeding: The selection of certain seeds or animals for reproduction in order to influence the traits inherited by the next generation.

Strand: Matter

Chromatography: A separation technique that separates small traces of substances using differences in solubility (eg can separate colours)
Decanting: The process of removing the sediment from a liquid
Filtration: A separation technique that uses a filter to separate objects of different sizes in a mixture
Irreversible change: Change that cannot be changed back to return the matter to its original state (eg cooked food), chemical change
Reversible change: Change that can be changed back to return the matter to its original state (eg ice to water), physical change
Solute: The dispersed (dissolved) phase of a solution
Solution: Homogeneous mixture of two or more substances. A saturated solution is a solution in which no more solute will dissolve.

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- Department of Education, Training and Employment (2002) *South Australian Curriculum, Standards and Accountability Framework—English as a Second Language (ESL), Scope and Scales*. Adelaide, DETE.
- Education Department of South Australia (1985) *Evaluating R–7 Science at the classroom level.* Adelaide: Education Department of South Australia.
- Department of Education, Training and Employment (1998) *Assessment and recording in R–10 Science*. Adelaide: DETE.
- Pohl M (2000) *Teaching complex thinking. Critical, creative, caring.* Hawker Brownlow Education Australia.

SUGGESTED RESOURCES

It is expected that most schools will have resources available to support aspects of Science content in the Middle Years Band. The following texts are cited as examples only of recently published materials and shall not be seen as restrictive in use to a particular learning descriptor.

R1 Clutterbuck P (2000) *Understanding science. Upper primary*. Blake Education.

R2 R I C Publications (2002) *Primary science. Book F*. R I C Publications.

R3 R I C Publications (2002) *Primary science. Book G*. R I C Publications.

R5 Ralphs F (1998) *Focus on science. Weather.* User Friendly Resource Enterprises Ltd.

R7 Petheram L & Jakob C (2002) *Rigby science files. File D.* Rigby.

R8 Nardelli D, Richards M & Paton R (2003) *Science worksheets for multiple intelligences.* John Wiley & Sons.

R9 Pryor K J (2003**)** *Threats to plants and animals – introduced species.* Macmillan.

R10 Pryor K J (2003) *Threats to plants and animals – habitat destruction.* Macmillan.

R11 Richards J (2003) *Smart structures: Skyscrapers and towers.* Macmillan.

R12 Nardelli D (2004) *Science alive 1. Jacaranda middle years project.* John Wiley & Sons.

R13 Bishop S (2000) *Science student workbook. CSF teaching and assessment resource. Grade 6. Level 4.* Hawker Brownlow.

R13 Bishop S (2000) *Science teacher resource. CSF teaching and assessment resource. Grade 6. Level 4*. Hawker Brownlow.

R14 Clare Primary School (1995) *A piece of string: Aboriginal perspectives across the curriculum* Adelaide: DECS.

OUTREACH AND DECS SERVICES

Technology Education Centre, 32a Dew Street, Thebarton SA 5031.
Phone (08) 8354 4000. Fax (08) 8354 4088. E-mail teched@adelaide.on.net
Catalogue available online http://www.teched
Technology resources for Australian classrooms. A comprehensive range of technology and science resources and advice for the classroom.

R–7 Science Materials Catalogue.
Phone (08) 8226 1603 Fax (08) 8226 1177 Courier R11/07 E-mail **Turnbull.Peter@saugov.sa.gov.au**
A wide range of science materials and equipment available year round at contract prices. For a catalogue, further information or advice contact Peter Turnbull

The Nature Education Centre. Norwood Primary School 39 Osmond Terrace Norwood SA 5067
Phone (08) 8363 0238 Fax (08) 8362 0102
Live animals and collections for hire to schools.

WEBSITES

W1 Origin energy efficiency calculator
http://www.originenergy.com.au/efficiency/wholesite.html

CREST CREativity in Science and Technology
http://www.csiro.au/crest/index.html
Students undertake science and technology research projects which involve three elements: Creativity, perseverance and application.

Globe Project
http://www.globe.gov/globe_flash.html
A global weather and hydrology project for primary and secondary students.

Learning Area: Science

Strand: Earth and space **Band: Middle–Senior Years** **Standards: 4 & 5**

KEY IDEAS	*(refer p 39 for Middle Years)*			OUTCOMES
	Year 8 ⟷ Year 9 ⟷ Year 10			
	Standard 4	**Towards Standard 5**	**Standard 5**	
Students investigate, through fieldwork and research, the central importance of the earth's role in sustaining life and how changes impact on life; and understand the interaction of the atmosphere, the oceans and the earth's surface. **F In T** KC1 KC3 **relating to outcome 4.1** Students learn that the earth is composed of materials that are altered by forces within it and on its surface, and that affects the way it sustains life. They report on this to various audiences. **F In T** KC2 **relating to outcome 5.1**	• **Researches** the environmental impact of historical and/or indigenous land use practices (eg fire used by Australian Aboriginal people, hunting practices of North American Indians, intensive farming in Europe in the Middle Ages). • **Creates scenarios** of sudden geological events which impact on the daily lives of humans (eg earthquakes, volcanoes, tsunamis) and presents them via electronic modelling or creative writing. • **Debates** the links between the ozone layer, human use of gaseous products and the incidence of skin cancer in Australia (eg oral debate, media release). • **Investigates** the advantages and disadvantages of a proposed conservation park in a local area (eg creates information poster or brochure). • **Describes** the impact of variations in weather patterns that determine the rainfall of an area (eg computer simulation, *PowerPoint* presentation, role-play to younger audience).	• **Explains** the difference in origins and potential uses of two or three commonly used rocks (eg granite, sandstone, basalt, limestone). • **Debates** the environmental and economic implications of exploration and exploitation of precious and semiprecious minerals (eg gold, diamonds, opals, emeralds, sapphires). • **Designs** and **conducts** field investigations of the impact of wind and/or water erosion in a local area, and suggests possible solutions to reduce or reverse such erosion. • **Researches** changing occupations within industries related to exploitation and management of earth's resources (eg fishing, forestry, open cut mining). • **Identifies** links between weather patterns and human activities in a number of diverse locations (eg coastal, desert, forests; uses electronic data sources).	• **Investigates** and **reports** the geological history of a specific area through analysis of geological features (eg fossils, igneous activity, sedimentation events; uses visual presentation modes). • **Researches** and **understands** the relationship between intercontinental location of mineral resources, fossil occurrences and orogenic events as explained by theories of plate tectonics. • **Presents** a **report** of future scenarios for a specific mining venture (eg uranium, coal, oil; presentation in oral or written format to a community audience). • **Investigates** farming processes including past land use practices and their effect on available arable land in a given region (eg use of fertilisers, cultivation, land clearing; develops a policy statement, media article or presentation). • **Researches**, **designs** and **devises** flow charts explaining the interrelationships between earth, oceans, land and life forms at a given point in time for an identified area (eg age of dinosaurs, early primates).	**4.1** Identifies and investigates changes, both natural and human-induced, on the earth and suggests ideas which encourage the preservation of the natural environment for all living things. **F In T** KC1 KC6 **5.1** Researches and analyses contemporary theories about geological features, such as plate tectonics, and investigates their effects on sustaining life on earth. **F In T** KC1 KC6

Students investigate, through fieldwork and research, the central importance of the earth's role in sustaining life and how changes impact on life; and understand the interaction of the atmosphere, the oceans and the earth's surface. **F In T** KC1 KC3 **relating to outcome 4.1** Students learn that the earth is composed of materials that are altered by forces within it and on its surface, and that affects the way it sustains life. They report on this to various audiences. **F In T** KC2 **relating to outcome 5.1**	ASSESSMENT EXAMPLE **Working scientifically**—Identifies the links between natural phenomena and human activities, through research and discussion. **Knowledge—**Identifies aspects of atmosphere, earth and sun which impact on human activities.	ASSESSMENT EXAMPLE **Working scientifically –** Designs and conducts investigations, through laboratory work, field work and research, which demonstrate the impact of human interference with the environment. **Knowledge—**Understands the composition of the earth in terms of rock formation and degradation.	ASSESSMENT EXAMPLE **Working scientifically –** Investigates and reports on relationships between the natural and human influenced environment and proposes actions to promote sustainability. **Knowledge—**Makes links between natural earth features and processes and resources that humans exploit.	**4.1** Identifies and investigates changes, both natural and human-induced, on the earth and suggests ideas which encourage the preservation of the natural environment for all living things. **F In T** KC1 KC6 **5.1** Researches and analyses contemporary theories about geological features, such as plate tectonics, and investigates their effects on sustaining life on earth. **F In T** KC1 KC6

An example of how **Interdependence** can be developed is to identify the relationships between all earth systems (eg earth's surface, oceans, atmosphere, biosphere).

Learning Area: Science

Strand: Earth and space **Band: Middle–Senior Years** **Standards: 4 & 5**

KEY IDEAS	*(refer p 41 for Middle Years)*			OUTCOMES
	Year 8 ⟷ Year 9 ⟷ Year 10 **Standard 4 — Towards Standard 5 — Standard 5**			
Students select and use observational instruments and digital and electronic technologies to develop understandings about structures and events in the universe. They appraise, and share options about, the ethics of space exploration. **F In C** KC2 KC7 **relating to outcome 4.2** Students explore and report on the structure and evolution of the universe, using a variety of resources including information and communication technologies. **In C** KC2 KC7 **relating to outcome 5.2**	• Develops an understanding of the events and structure of the solar system (eg sun, planets, asteroids, comets, natural satellites, solar storms) **using** optical instruments or recordings from optical instruments). • **Uses** visual recordings or prints from radio telescopes and the Hubble Telescope to explore the universe (eg **describes** and **compares** various galaxies). • **Communicates** an understanding of the possibilities of space exploration (eg communicates, through a scale diagram, the vastness of space, the plausibility of its exploration, and associated ethics). ASSESSMENT EXAMPLE **Working scientifically—**Identifies various components of our universe from photos etc. **Knowledge—**Demonstrates an understanding of the size and distances of the solar system and its parts by the use of scale diagrams**.**	• **Appraises** the ethics of space exploration (eg analyses the scientific and the political motivation behind space exploration development). • **Investigates** the various types and orbits of satellites and space probes (eg researches the various types, uses and orbits of satellites and space probes). • **Appraises** the value of space exploration (debates the value of space travel based on the impact on and quality of life due to satellites). • **Analyses** the needs required for colonising other planets (eg writes a realistic story about living on a futuristic space station, taking into account some of the technologies which would make this possible, such as miniaturisation, solar cells, ceramics, insulation, food preservation and life support). ASSESSMENT EXAMPLE **Working scientifically—**Debates or discusses orally the ethics of space exploration, comparing the advantages and disadvantages. **Knowledge—**Writes a realistic futuristic story of living on a space station.	• **Explores** alternative cultural viewpoints of the origin of the universe. • **Researches** and **reports** on astronomical features (eg nebulas, various stars, pulsars, supernovas and quasars relating them using Hertzsprung–Russell diagram). • **Uses** current technologies to investigate scientific views of the universe (eg **uses** spectral analysis and Doppler effect to support the theories of the life cycle of stars). • **Develops** personal theoretical preference based on a critical examination of the theories of the evolution of the universe (eg explores and reports on the theories of astronomy which contribute to their understanding of the universe). ASSESSMENT EXAMPLE **Working scientifically—**Uses spectral analysis to demonstrate an understanding of how scientists can determine the composition and age of stars. **Knowledge—**Writes a scientifically justified argument supporting their personal theory of the evolution of the universe.	**4.2** Investigates and analyses astronomical features and changes as seen from the earth and debates the ways scientists examine and explain these. **F In C** KC2 **5.2** Critically examines theories of astronomy and how they have contributed to our understandings about the universe, and articulates personal theoretical preferences. **In C** KC1

An example of how **Futures** can be developed is to examine how change is not only natural, but essential to sustain our biosphere and that space exploration and the ethics associated with this activity is a part of this change.

Learning Area: Science

Strand: Energy systems **Band: Middle–Senior Years** **Standards: 4 & 5**

KEY IDEAS	*(refer p 42 for Middle Years)*			OUTCOMES
	Year 8 **Standard 4**	**Year 9** **Towards Standard 5**	**Year 10** **Standard 5**	
Students collect data about, and critique, their own patterns of energy use in terms of its environmental impact. **F Id C** KC1 KC5 **relating to outcome 4.3** Students critique key methods of energy conversion and energy use, and compare the extent of currently known sources with projected needs. They identify changes necessary for sustainable energy transformation and use. **F In T** KC1 **relating to outcome 5.3**	• **Identifies** the by-products of fossil fuel based energy generation (eg delivers a presentation about greenhouse gases, smog, acid rain or carbon monoxide). • **Identifies** a potential waste of energy at home or school (eg **develops an action plan** to raise the awareness of the offenders using multimedia techniques such as posters, strategic stickers and advertising campaigns). ASSESSMENT EXAMPLE **Working scientifically—**Collects data in a useable form that identifies a waste of energy at home or school. **Knowledge—**Presents evidence showing understanding of the detrimental effect on life of a by-product of fossil fuel combustion.	• **Researches** past, present and future use patterns of renewable (eg wood, tide, wind, solar) and non-renewable (coal, oil, gas) fuel reserves, using a variety of data sources. • **Investigates** the behaviour of electrical circuits (eg **solves a problem** by **applying** the principles of electrical circuits to a model, or wires up a model with lights). ASSESSMENT EXAMPLE **Working scientifically—**Solves problems using circuit wiring expertise. **Knowledge—**Presents a report showing knowledge of energy generation fuels usage around the world.	• **Analyses** the merits of alternative energy sources to fossil fuels by investigating viable alternatives and presenting arguments via debate, submission or presentation. • **Examines** and **applies principles** of energy efficiency (eg **plans** an efficient building or home integrating aspects such as alternative energy sources, efficient use of energy, and novel alternative energy generation). • **Researches** the power consumption of light types (eg incandescent, high efficiency, fluoro, quartz halogen) and light arrays being used at home or school. • **Examines** energy conversion (eg plans and makes an energy converter using a renewable energy source such as a wind powered generator or hydroelectric pump to develop electricity on a small scale). ASSESSMENT EXAMPLE **Working scientifically—**Debates the scientific merit of fossil fuel alternatives. **Knowledge—**Applies concepts of energy conversion to build a converter that does not require fossil fuels.	**4.3** Investigates ways of obtaining, transferring and using energy (including from sustainable energy sources and from fossil fuels) for particular purposes. **F C** KC6 **5.3** Analyses aspects of energy sustainability, including energy resources, energy production and distribution, and challenges for future 'worldwide' uses of energy. **F In** KC1

An example of how **Futures** can be developed is to investigate the alternatives for current energy sources and their sustainability.

Learning Area: Science

Strand: Energy systems **Band: Middle–Senior Years** **Standards: 4 & 5**

KEY IDEAS	*(refer p 43 for Middle Years)*			OUTCOMES
	Year 8 **Standard 4**	**Year 9** **Towards Standard 5**	**Year 10** **Standard 5**	
Students use the concepts of force, energy and transfer of energy to investigate and explain phenomena and changing patterns of events in the natural world. **In T** KC1 KC2 **relating to outcome 4.4** Students apply quantitative relationships between forces, energy and energy transfer in order to explore the properties of the physical world. **In T** KC5 KC6 **relating to outcome 5.4**	• **Uses** the concept of force to explain motion in daily phenomena (eg **uses** forces of attraction and repulsion in permanent magnets and electromagnets to explain motion). • **Communicates** an understanding of various changes and transfers of energy in a system (eg draws a flow chart showing the changes and transfers of energy from fossil fuel to use of electricity in the home). • **Investigates** the loss of energy from a system due to efficiency (eg **measures** the various heights a ball bounces and explains the loss of energy and hence its efficiency).	• **Demonstrates an understanding** of force and energy by explaining the transfer and transformation of energy in various events (eg **uses** ticker times with trolleys and Newton's laws to explain force and energy, describes forces involved in riding a bike, weight and the apparent weightlessness in space). • **Uses** the concept of force to **investigate** and explain various phenomena (eg **uses** water rockets and Newton's second law to explain how rockets work in space). • **Plans** an investigation on the force of friction and its control (eg tyre tread design, racing tyre versus domestic, conventional brakes versus anti-lock systems).	• Communicates an understanding of force, energy and work derived from basic laws and definitions, relating it to everyday examples (eg uses formulae to solve simple problems). • Shows an understanding of the conservation of energy in the transfer and transformation of potential and kinetic energy (eg discusses the transfer and transformation of energy in systems like trampolines, tennis or roller-coasters, equating the potential and kinetic energy forms in harmonic motion using formulae). • **Investigates** the concepts of work, energy and power in various systems (eg **relates** the quantitative energy content in food to work done walking up stairs or running through the use of energy formula and then **relates** the rate at which the work is done to power). • **Relates** an understanding that in the real world inefficiency causes a loss of energy from a desired outcome (eg uses efficiency formula to calculate the output of objects such as lights, springs and cars).	**4.4** Plans and evaluates investigations that focus on the transfer and transformation of energy. **In T** KC3 **5.4** Explains energy input/output devices using concepts of work, force and power, and explores, through investigations, various systems for the transfer and transformation of energy. **In T** KC2

Students use the concepts of force, energy and transfer of energy to investigate and explain phenomena and changing patterns of events in the natural world. **In T** KC1 KC2 **relating to outcome 4.4** Students apply quantitative relationships between forces, energy and energy transfer in order to explore the properties of the physical world. **In T** KC5 KC6 **relating to outcome 5.4**	ASSESSMENT EXAMPLE **Working scientifically—**Makes accurate measurements, which lead to a plausible efficiency statement. **Knowledge—**Relates the difference between potential and kinetic energy, and energy transformation and translation.	ASSESSMENT EXAMPLE **Working scientifically—**Uses trolleys and ticker timer accurately to calculate potential and kinetic energy and writes a plan that includes a controlled experiment and considers the variables involved. **Knowledge—**Explains Newton's laws and uses appropriate examples.	ASSESSMENT EXAMPLE **Working scientifically—**Demonstrates understanding of energy systems through formulae related to real-life situations. **Knowledge—**Manipulates formulae to calculate work, energy, power and efficiency when given appropriate information.	**4.4** Plans and evaluates investigations that focus on the transfer and transformation of energy. **In T** KC3 **5.4** Explains energy input/output devices using concepts of work, force and power, and explores, through investigations, various systems for the transfer and transformation of energy. **In T** KC2

An example of how **Futures** can be developed is to assess and solve problems, consider conflicting outcomes and develop notions of energy efficiency and transfer.

Learning Area: Science

Strand: Life systems **Band: Middle–Senior Years** **Standards: 4 & 5**

KEY IDEAS	*(refer p 44 for Middle Years)*			OUTCOMES
	Year 8 Standard 4 ⟷	**Year 9 Towards Standard 5** ⟷	**Year 10 Standard 5**	
Students develop a shared understanding of the characteristics and behaviour of living things and how they are interrelated and interdependent. They appreciate and report on the place of humans in the earth's ecology, and develop their understanding of, explore future possibilities for, and act to contribute to, sustainable environments. **F In** KC1 KC2 KC3 **relating to outcome 4.5** Students use explanatory models to research the interrelationships within and between individual cells and whole organisms, and the environments that sustain and influence them. **In T** KC1 **relating to outcome 5.5**	• **Demonstrates** that cells are the smallest living units and that they are constructed of organelles that perform specific life functions (eg **identifies and labels** the key organelles of plant and animal cells and their functions from diagrams or slides). • **Develops microscope skills** to appreciate the levels of organisation of living things (eg examination of plant and animal cells as a vehicle for setting up and using a microscope). ASSESSMENT EXAMPLE **Working scientifically—**Checklist of microscope care and usage (eg safe transport and setting up, label microscope parts, focusing, not touching glass surfaces. **Knowledge—**Draws plant and animal cells and labels 3 major organelles.	• **Researches** the interdependence of plants and animals (eg **devises** a food chain based on prevalent species and environmental conditions in a region, clearly identifying producers, consumers and decomposers, such as SeagrassŸ MinnowŸ TunaŸ Shark). • **Identifies** niche-sharing lifestyles of organisms such as the symbiosis of mould and fungus in lichen and parasitism of mistletoe on eucalypts (ie outlines roles of participating species in a relationship and the impact of either species disappearing). • **Assesses** the impact of introduced factors such as human settlement, pollution and introduced plants and animals on native habitats (eg **identifies** trends in native species' numbers in a habitat affected by the introduction of an exotic). ASSESSMENT EXAMPLE **Working scientifically—**Presents scientific evidence on the effect of an exotic on a native population. **Knowledge—**Produces a window display of a food chain they have researched.	• **Critically analyses** human ecosystem intervention and **proposes** ecologically sustainable alternatives (eg River Murray, Ord River, outback cattle farming). • **Researches** crop and animal alternatives for a sensitive area, based on the sustainable use of the land by traditional inhabitants (eg Australian native species farming, sustainable fishing practices in American bays, rotated land use in farmland around the Aral Sea). • **Identifies** the cells that make up body tissues, the tissues that make up organs, and the roles they play in systems (eg **draws** and **labels** body systems, or **researches** and **presents** an investigation about health problems resulting in breakdown of a system component, as in asthma, diabetes or cystic fibrosis). ASSESSMENT EXAMPLE **Working scientifically—**Presents alternatives to current practices based on the scientific evidence of detriment caused by the current methodology. **Knowledge—**Writes an essay explaining how the impaired function of a component of a body system affects the whole organism.	**4.5** Investigates and explains the functioning of living systems from the microscopic to the macroscopic. **F In** KC1 KC2 **5.5** Interprets and uses information about the structure and function of living systems and their relationship to survival of ecosystems. **In T** KC1

An example of how **Interdependence** can be developed is to deepen understanding that all life is linked at levels from cells to populations.

Learning Area: Science

Strand: Life systems **Band: Middle–Senior Years** **Standards: 4 & 5**

KEY IDEAS	*(refer p 46 Middle Years)*			OUTCOMES
	Year 8 **Standard 4**	**Year 9** **Towards Standard 5**	**Year 10** **Standard 5**	
Students examine the ways organisms reproduce, grow and change over the generations. They engage with, and appreciate different positions on, ethical issues such as those associated with ecological sustainability and gene technologies. **F In T C** KC1 **relating to outcome 4.6** Students critically explore the function of genetic and environmental influences on life processes. They consider the ethics and impacts of human intervention in manipulating these influences, and of taking responsible action. **Id In T** KC1 **relating to outcome 5.6**	• **Creates** visual representations of communities in various geological eras (eg accesses and uses various electronic and other sources of information). • **Plans** and **reports** on an investigation of the changes of an organism during its life cycle and the potential disruptions to that life cycle by human activities (eg insects and pesticides, weeds and herbicides). • **Appraises** the sustainability of identified endangered species (eg platypus, native cat, black cockatoo) and presents their views to a wide audience. • **Critiques** articles on arguments for and against human alteration of a given environment (eg accesses magazines, documentaries, internet).	• **Describes** patterns of inheritance using observations of human families or groups of organisms and **identifies** inheritable characteristics (eg in plants, fruit flies). • **Investigates** and **reports** on the potentials of development of new strains of plants and animals through artificial selection or genetic modification (eg dogs, cattle, flowers, food crops). • **Designs** a visual presentation of the transfer and transformation of material and energy through a food web (eg schoolyard, pond). • **Uses** graphical representations to **demonstrate** different reproductive strategies for a range of organisms (eg plants, fungi, marsupials, placental mammals). • **Develops** possible scenarios for endangered organisms given a variety of ecological and sociological conditions (eg blue whales, bald eagles, tigers, orang-utans).	• **Applies** theories of genetics and monohybrid crosses to understand patterns of inheritance (eg interpreting pedigrees, growing ‘fast plants’, using simulation software). • **Researches** and **debates** the ethics of applications of gene technology to develop organisms with desired characteristics (eg designer babies, pigs for human organs). • **Develops** a presentation on the interactions of living and non-living components of the biosphere in the cycling of carbon, oxygen and water (eg electronic, poster, speech). • **Applies** information from a food web to a variety of scenarios determined by interruption of aspects of that food web (eg habitat destruction, hunting, feral animals).	**4.6** Explores how living things have changed over geological time and debates the value of species diversity and the ethics of human intervention. **F T C** KC2 KC6 **5.6** Applies theories and conceptual frameworks associated with evolution, biodiversity, genetics, and the cycling of energy and matter in biological and physiological systems. **In T** KC1

Students examine the ways organisms reproduce, grow and change over the generations. They engage with, and appreciate different positions on, ethical issues such as those associated with ecological sustainability and gene technologies. **F In T C** KC1 **relating to outcome 4.6** Students critically explore the function of genetic and environmental influences on life processes. They consider the ethics and impacts of human intervention in manipulating these influences, and of taking responsible action. **Id In T** KC1 **relating to outcome 5.6**	ASSESSMENT EXAMPLE **Working scientifically—**Accesses various resources to research the effect of human activities on plant and animal species, and reports on their findings through a variety of presentation modes. **Knowledge—**Identifies the human activities that impact on the survival of other species.	ASSESSMENT EXAMPLE **Working scientifically—**Uses graphical representations to describe reproduction and patterns of inheritance. **Knowledge—**Understands reproductive strategies and human manipulation of these strategies through artificial selection.	ASSESSMENT EXAMPLE **Working scientifically—**Researches and debates the ethics of the application of gene technologies to manipulate species for human benefit. **Knowledge—**Understands how characteristics can be inherited and that manipulation of DNA can result in altered species.	**4.6** Explores how living things have changed over geological time and debates the value of species diversity and the ethics of human intervention. **F T C** KC2 KC6 **5.6** Applies theories and conceptual frameworks associated with evolution, biodiversity, genetics, and the cycling of energy and matter in biological and physiological systems. **In T** KC1

An example of how **Interdependence** can be developed is to examine the interrelationships between living and non-living components of given habitats.

Learning Area: Science

Strand: Matter **Band: Middle–Senior Years** **Standards: 4 & 5**

KEY IDEAS	*(refer p 47 for Middle Years)*			OUTCOMES
	Year 8 Standard 4 ⟷	**Year 9 Towards Standard 5** ⟷	**Year 10 Standard 5**	
Students communicate understandings about the properties and personal uses of materials. They research the future availability of earth materials for human use, and explore possible sustainable alternatives to current practice. **F In T C KC1 KC2 KC6 relating to outcome 4.7** Students use appropriate theories to explain the properties of similar and dissimilar materials and how these properties determine uses. **In T** KC2 **relating to outcome 5.7**	• **Compares properties** of materials, before and after physical or chemical change (eg hardness, strength, elasticity; texture and appearance before and after physical and chemical change; solid wood converted to chipboard and craft wood). • **Negotiates an investigation** on common materials with possible alternatives for the future (eg **varies** the ratios of sand, cement, gravel and water and **compares** the resulting strength in the concrete produced). ASSESSMENT EXAMPLE **Working scientifically—Designs** a practical that compares materials fairly, uses a control, and keeps a log of their progress. **Knowledge—Writes** a report suggesting plausible alternatives to the materials they investigated.	• **Uses** the particle model to compare the physical properties of matter (eg draws atomic structure of the three states of water). • **Investigates** properties of chemicals, before and after chemical reactions (eg **investigates** properties before and after acid base reactions, and metal and non-metal reactions). • **Communicates** an understanding of chemical change of matter using the particle model (**uses symbols** and the periodic table to write balanced equations, and describes physical and chemical change). • **Researches** sustainable alternatives to current patterns (eg electroplating versus painting). ASSESSMENT EXAMPLE **Working scientifically—**Works safely **recording observations** and relating them to chemical formulae. **Knowledge—**Writes balanced equations using symbols from the periodic table.	• **Uses** the particle model to explain the physical and chemical change in chemical reactions (eg uses constructions of various compounds made from chemical model kits to help explain chemical and physical properties). • **Predicts** chemical and property changes using formulae and equations (eg **investigates** acid with hydrocarbon chains in the production of rubber, plastics and polymers). • **Explains** the properties of similar and dissimilar materials and how this determines their use (eg **compares** different hydrocarbon chains). • **Researches** future availability of the raw materials and **explores** viable alternatives (eg alternative fuels save oils to produce plastics). ASSESSMENT EXAMPLE **Working scientifically—**Makes and draws various hydrocarbon molecules using model kits and works safely with acid in the production of rubber, **explaining** the physical change in the material. **Knowledge—**Writes a report of plausible alternative fuels to create a sustainable future.	**4.7** Compares the properties of materials before and after physical and chemical change by planning, conducting, evaluating and communicating an investigation. **In T C** KC1 KC2 KC3 **5.7** Uses the particle model to explain physical and chemical properties and change of matter. **In T** KC2

An example of how **Interdependence** can be developed is to investigate the properties of materials and plausible alternatives to create a sustainable future.

Learning Area: Science

Strand: Matter **Band: Middle–Senior Years** **Standards: 4 & 5**

KEY IDEAS	*(refer p 49 for Middle Years)*			OUTCOMES
	Year 8 Standard 4 ⟷	**Year 9 Towards Standard 5** ⟷	**Year 10 Standard 5**	
Students pose questions to investigate ways in which physical and chemical processes can be altered in order to achieve desirable outcomes, such as food preservation. **T C** KC1 **relating to outcome 4.8** Students investigate and critique new materials technologies and appraise and report on their likely impact on themselves and future generations. **F T** KC1 KC2 KC6 **relating to outcome 5.8**	• **Hypothesises**, **plans** and **reports** on an investigation to determine the effects of storage conditions on food (eg refrigeration, dehydration, food additives, cooking). • **Researches**, **describes** and **makes decisions** about choice of materials for a variety of conditions (eg building materials including metals). • **Investigates** the properties and uses of a range of household products (eg drain cleaner, detergent, sodium hydrogen carbonate). • **Predicts** and **tests** the reaction rates for materials in particulate and bulky form (eg dissolving tablets, cooking cakes). ASSESSMENT EXAMPLE **Working scientifically—Designs** and **conducts** an experiment testing the dissolving rates of a number of products using one variable as a control. **Knowledge—Matches** a variety of materials to a specified purpose, explaining the choices made in terms of properties of these materials.	• **Devises** written or visual safety procedures for the handling, storage and disposal of materials (eg acids, alkalis, plastics) • **Classifies** substances as determined by their reactions with water, acids and alkalis (eg reactivity series of metals). • **Reports** on applications of chemical reactions in industry (eg galvanising, making plastic, dyeing fabric; uses electronic and community sources of information). • **Collaborates** with others to **construct** future scenarios of chemical industries (eg for a specific community, country or globally). ASSESSMENT EXAMPLE **Working scientifically—Collects**, **organises** and **presents data** from a variety of sources that demonstrate the hazardous nature of some substances. **Knowledge—Draws** a **chart** or **designs** a poster that reflects the classification of metals as they react to water, acids and alkalis.	• **Collaboratively plans** and **reports** on investigations to classify chemical reactions (eg oxidation, reduction, neutralisation). • **Investigates** and **considers** issues, including environmental, personal and community safety, associated with mining and metal extraction (eg uranium mining, lead smelting). • **Prepares** and **presents** collected data and uses this to report on the composition and related cost effectiveness of products using recycled materials (eg paper, glass, plastic; presentations for small group, industry representatives). • **Explores** the potential, through **research** and community opinion, of naturally occurring and purpose designed materials. ASSESSMENT EXAMPLE **Working scientifically—Debates** the relative positive and negative effects that mining may have on the broader community. **Knowledge—Identifies** examples of oxidation through the provision of specific examples that occur in the local community, and explains in scientific terms the processes that are occurring.	**4.8** Recognises and describes conditions that influence reactions or change in materials. **T C** KC1 KC2 **5.8** Classifies chemical reactions and identifies their importance in providing materials for present and future generations. **F T** KC1

An example of how **Thinking** can be developed is to use scientific method to predict, plan experiments, and investigate properties and reactions of common substances.

GLOSSARY

WORKING SCIENTIFICALLY

Acts responsibly: Acts to achieve a positive outcome for environments and the global community

Analyses: Studies something critically to identify the elements or relationships between the elements

Applies: Uses ideas, processes or skills in new situations

Cares: Provides what a living thing needs to keep it healthy, and ensures it does not come to any harm

Classifies: Analyses properties to group objects or events, including using graphic organisers such as Venn Diagrams

Classification: The way in which scientists make sense of the world by grouping things that look behave or reproduce etc in similar ways

Classification tree: A model used for classification when the response to a classifying question (eg What colour is it?) can have a number of variables, and where each of these groups can then be sub-grouped (eg by size)

Collects, records, interprets data: The collection and analysis of information, using skills such as comparing, helps children to make accurate assessments about their investigations and to hypothesise or make predictions about particular phenomena

Communicates: Indicates understanding by giving and/or receiving information orally, pictorially and/or in writing

Compares: Examines objects for similarities and differences

Concludes: Uses data, evidence or observations from an investigation to explain the results

Considers: Thinks about carefully, taking all facts into account

Conducts: Directs, manages and undertakes a scientific process

Constructs: Applies knowledge to build

Creates: Reorganises elements into a new structure, makes

Data: Factual information used as a basis for reasoning, discussion and calculation

Debates: Justifies personal opinions, and listens to alternative points of view

Demonstrates: Explains with the use of examples, experiments

Describes: Tells or writes about, shows an understanding of

Designs: Creates a picture (mentally or by drawing) from which a model can be built

Devises: Applies knowledge to innovate or create

Differentiates: Considers differences between objects to distinguish between them, distinguishes relevant from irrelevant

Discovers: Finds out through study or investigation

Discusses: Considers something from different points of view, by talking or writing about it

Distinguishes: Considers differences between objects to tell them apart, sees or shows the difference in

Draws: Communicates ideas through pictures, patterns or diagrams

Examines: Looks at closely and carefully using tools of inquiry and/or apparatus

Explains: Interprets; gives reason for; makes meaning plain or clear (eg '**explain** how' usually asks for the sequence, '**explain why'** usually asks for the cause)

Explanation: The skill of communication in which an interpretation of information is given

Experiments: Performs a scientific test to prove a theory or make a discovery

Fair test: An experiment whose results can be reasonably trusted for basing conclusions because it has been performed in an identical way for each item

Findings: Information gained or conclusions drawn as a result of investigations

Hypothesises: Speculates, generates a 'best guess' based on a synthesis of their current knowledge or information

Identifies: Recognises patterns, facts, or details

Infers: Draws a conclusion about a specific event based on observations and data, may include cause and effect relationships

Illustrates: Makes clear by examples or drawings, compares, designs

Investigation: To observe or study by using a systematic inquiry approach

Investigates: Uses scientific methodology that systematically employs many inquiry skills (eg performs experiments and communicates results, analyses and/or summarises information)

Locates: Finds where something is, applies knowledge to find examples

Makes: Applies knowledge to build, create, construct or produce

Measures: Compares objects to arbitrary units that may or may not be standardised

Modifies: Alters a design based on understanding of factors influencing performance

Monitors: Regularly checks how something is changing or progressing over a period of time

Observes/Observation: Gathers information by direct evidence of the properties of an object or event by using senses and/or scientific instruments

Orders: Applies knowledge to sort in a particular sequence (eg large to small)

Organises: Analyses information to determine how parts fit together within a structure

Plans: Decides in detail what they are going to do and how they are going to do it

Poses questions: Asks questions to guide investigations and research and to encourage inquiry

Predicts: Tells about an event or an outcome before it occurs

Recognises: Applies knowledge from memory to identify patterns and understanding

Records: Puts information into a permanent form for reference

Reports/Presents: Communicates accurate or relevant information in a variety of formats (eg role-play, written, oral, visual)

Reflects: Considers ideas, thoughts and opinions

Relates: Connects or associates in thought or meaning

Researches: Collects and analyses facts and information to gain new knowledge and understanding

Science: An activity which uses observation, inference and experimentation to develop knowledge and understanding of how the world works

Scientific literacy: The knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity.

Selects: Chooses between options based on certain criteria

Shows: Illustrates or demonstrates ideas or knowledge

Sequences: Applies understanding to place things in correct order

Sorts: Separates into different groups, orders, organises

Suggests: Makes proposals based on understanding

Surveys: Collects sample opinions, facts or figures in order to estimate the overall situation

Technology: The scientific application of knowledge to solve practical problems and to make new inventions

Tests: Finds out what something is like by using and observing it over time or under different conditions

Understands: Constructs meaning from instructional messages, including oral, written and graphic communication

Uses: Applies understanding or a procedure to a task, utilises

Variables, identifies and controls: Identifies the variables in a situation and selects those variables that are to be manipulated and those which are to remain constant

GLOSSARY

SCIENTIFIC CONCEPTS

Strand: Earth and space

Atmosphere: The layer of gas surrounding the earth or other planets. The *upper* atmosphere is the region of earth's atmosphere above the troposphere (which extends to about 20km). Regions of the upper atmosphere are the stratosphere, mesosphere and thermosphere
Climate: The atmospheric conditions for a long period of time, and generally refers to the normal or mean course of the weather
Greenhouse gases: Greenhouse gases are present in relatively small quantities in the atmosphere and strongly absorb infrared radiation or 'heat' emitted by the earth. The primary greenhouse gases are water vapour, carbon dioxide, methane, nitrous oxide, ozone, and some of the chlorofluorocarbons. Concentrations of several greenhouse gases are increasing, primarily as a result of human activities
Ionosphere: The region of earth's atmosphere that extends from about 50 to 600kms above the surface of the planet
Ozone depletion: Ozone is continually being formed and destroyed by chemical reactions occurring in the stratosphere. There are large natural changes in ozone concentration in the stratosphere; for example, between summer and winter there is a change of about 25% at mid-latitudes. Ozone depletion occurs if the rate of ozone destruction is increased due to human activities
Revolution: When an object moves in orbit around another object
Rock type: **Igneous:** Rocks formed by the solidification from a molten or liquid state (eg quartz crystals, pumice)
Metamorphic: Rock that has been changed by pressure (eg slate)
Sedimentary: Rock produced by mechanical or chemical weathering processes (sandstone, fossils)
Troposphere: The first layer of the atmosphere, lying below 10km altitude
Weather: Day-to-day variation in atmospheric conditions

Strand: Energy systems

Conductor: A thing that transmits heat, electricity, light, sound or other form of energy
Energy: The ability to cause matter to move or change, the ability of an object to do work
Energy forms: Forms of energy include sound, light, heat, electrical, kinetic (the energy of motion), mechanical (the total amount of kinetic and potential energy in a system) and stored or potential energy (the object currently isn't doing any work, but could)
Energy receiver: The object that receives the energy (eg a light globe receives electrical energy)
Energy source: Where the energy comes from (eg the sun)
Energy patterns of use: Use of energy varies over a day (eg need for lighting in evening) and over the year (air conditioning in summer)
Energy Renewable: An energy resource replenished continuously or that is replaced after use through natural means. Includes solar energy, wind energy, geothermal power and hydropower
Energy: Non-renewable: Non-renewable resources have been built up or evolved over a geological time-span and cannot be used without depleting the stock and raising questions of ultimate exhaustibility, since their rate of formation is so slow as to be meaningless in terms of the human life-span
Force: A push or pull between two objects
Friction: The resistive force acting between bodies that tends to oppose and damp out motion
Hydraulics: The science of fluids in motion
Machine: **Simple** machines have few, if any, moving parts. Simple machines include the lever, the screw, the wheel and axle, the inclined plane, the pulley, and the wedge
Complex machines have two or more moving parts
Pendulum: Amplitude: The magnitude of an oscillation, or swing. The **bob** is the weight
Thrust: A reaction force described quantitatively by Newton's Second Law when a system expels or accelerates mass in one direction to propel an object in the opposite direction

Strand: Life systems

Biotechnology: Technique that uses living organisms (or parts of organisms) to make or modify products, to change plants and animals, or to develop microorganisms for specific use
Carbon cycle: Nutrient cycling that includes uptake of carbon dioxide by plants, ingestion by animals, and respiration and decay of the animal
Endoskeleton: The bony and cartilaginous structure that is inside the body
Exoskeleton: The hard structure developed on the outside of, and giving support to, a body, such as the chitinous covering of an insect
Gene technology: Branch of modern biotechnology. Range of techniques used by scientists in an attempt to control or modify genes or, most significantly, move them between two unrelated species (called recombinant DNA technology)
Genetic modification: The addition, deletion, substitution, rearrangement or recombination of heritable genetic material
Mineralisation: The conversion of an element through the action of microbes from an organic to an inorganic state
Oxygen cycle: Cyclic movement of oxygen in different chemical forms from the environment to organisms, and then back to the environment
Parasite: An organism that grows, feeds and is sheltered on or in a different organism while contributing nothing to the survival of its host
Salinity: Measure of the concentration of dissolved salts in seawater, normally expressed as parts per thousand (‰). Freshwater is regarded as < 0.5 ‰, seawater as > 30 ‰
Scavenger: Any animal that feeds on refuse and other decaying organic matter
Selective breeding: The selection of certain seeds or animals for reproduction in order to influence the traits inherited by the next generation.

Strand: Matter

Chromatography: A separation technique that separates small traces of substances using differences in solubility (eg can separate colours)
Decanting: The process of removing the sediment from a liquid
Filtration: A separation technique that uses a filter to separate objects of different sizes in a mixture
Irreversible change: Change that cannot be changed back to return the matter to its original state (eg cooked food), chemical change
Reversible change: Change that can be changed back to return the matter to its original state (eg ice to water), physical change
Solute: The dispersed (dissolved) phase of a solution
Solution: Homogeneous mixture of two or more substances. A saturated solution is a solution in which no more solute will dissolve.

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WEBSITES

W1 Origin energy efficiency calculator
http://www.originenergy.com.au/efficiency/wholesite.html

CREST CREativity in Science and Technology (students undertake science and technology research projects which involve three elements.
Creativity, perseverance and application
http://www.csiro.au/crest/index.html

Globe project. A global weather and hydrology project for primary and secondary students
http://www.globe.gov/globe_flash.html