# Knowledge and understanding

## SCIENCE

### By the end of Year 3

**Science as a human endeavour**
- Science is a part of everyday activities and experiences.
  - Knowledge and understanding
  - By the end of
  - Year 3
  - Science is a part of everyday activities and experiences.
    - It has applications in daily life, including at home, at school, at work, and during leisure time.
    - Examples include: medicines to treat illness in people and animals; lighting for living spaces.
  - Science can impact on people and their environments.
    - Knowledge of the effects of the sun’s rays influences sun safety precautions.
  - Stewardship of the environment involves conserving natural resources.
    - Strategies to conserve water and preserve wilderness environments.
  - Australian Indigenous knowledge of natural phenomena has been developed over time as a result of people observing, investigating and testing in everyday life.
    - Observing changes in the environment to help determine seasons.

### By the end of Year 5

**Science as a human endeavour**
- Science relates to students’ own experiences and activities in the community.
  - It has applications in daily life, including at home, at school, at work, and during leisure time.
  - Examples include: medicines to treat illness in people and animals; lighting for living spaces.
  - Science can impact on people and their environments.
    - Knowledge of the effects of the sun’s rays influences sun safety precautions.
  - Stewardship of the environment involves conserving natural resources.
    - Strategies to conserve water and preserve wilderness environments.
  - Australian Indigenous knowledge of natural phenomena has been developed over time as a result of people observing, investigating and testing in everyday life.
    - Observing changes in the environment to help determine seasons.

### By the end of Year 7

**Science as a human endeavour**
- Science impacts on people, their environment, and their communities.
  - Scientific knowledge has been accumulated and refined over time, and can be used to change the way people live.
    - Examples include: use of and changes to technology, including mobile phones and computers; improved medical procedures.
  - Ethical considerations are involved in decisions made about applications of science.
    - Examples include: preservation of wilderness environments to help protect endangered species.
  - Scientific knowledge can help to make natural, social, and built environments sustainable, at a scale ranging from local to global.
    - Examples include: recycling to reduce resource use.
  - Different cultures, including those of Aboriginal people and Torres Strait Islander people, have contributed to science and scientific practice.
    - Examples include: Indigenous knowledge of flora and fauna makes contributions to scientific knowledge and the development of pharmaceutical products; traditional Chinese medicine recognises relationships between the human body and the environment.

### By the end of Year 9

**Science as a human endeavour**
- Responsible and informed decisions about real-world issues are influenced by the application of scientific knowledge.
  - Immediate and long-term consequences of human activity can be predicted by considering past and present events.
    - Examples include: consequences of unsustainable use of fossil fuels can be seen in environmental impacts.
  - Responsible, ethical and informed decisions about social priorities often require the application of scientific understanding.
    - Examples include: use of alternative forms of energy; development of influenza vaccines.
  - People from different cultures contribute to and shape the development of science.
    - Examples include: Australian Indigenous knowledge can be applied to land and water management, food production and waste management.

### Earth and beyond

**Changes in the observable environment influence life.**
- Earth and space experience recurring patterns and natural cycles of events, including seasons, weather and moon phases, and these can affect living things.
  - Examples include: tides, temperature changes due to the sun's rays, and changes in the phases of the moon.
  - Materials of the earth can be used in various ways.
  - Examples include: water for drinking; soil for growing crops.

**Interactions and changes in physical systems and environments can be explained and predicted.**
- Scientific ideas can be used to explain the development and workings of everyday items.
  - Examples include: scientific notions of energy can help explain how a bicycle moves.
  - Ethics is a significant part of scientific endeavour.
    - An ethical consideration is whether or not it is appropriate to test products on animals.
  - Science can help to make natural, social and built environments sustainable and may influence personal human activities.
    - Implementing "green" strategies may help to minimise a person’s ecological footprint.
  - Science can contribute to people’s work and leisure.
    - The development of new technologies has contributed to increased efficiency in the workplace; people can have a healthier lifestyle if they understand how their physical development benefits from physical activity and healthy food choices.
  - Cultures from around the world, including those of Aboriginal people and Torres Strait Islander people, have contributed to scientific understanding.
    - Examples include: Aboriginal people extract dyes from natural materials; Galileo, an Italian scientist, described motion of objects in the solar system.

**Events on earth and in space are explained using scientific theories and ideas, including the geological and environmental history of the earth and the universe.**
- Scientific ideas and theories offer explanations about the earth that extend to the origins of the universe.
  - Examples include: ideas about the expanding universe.
  - Global patterns of change on earth and in its atmosphere can be predicted and modelled.
  - Examples include: the effects of rising temperatures on natural environments.
  - Geological evidence can be interpreted to provide information about past and present events.
    - Examples include: the earth’s surface is shaped by volcanoes and earthquakes, which can be understood in terms of the theory of plate tectonics.
### Knowledge and understanding

#### SCIENCE

**By the end of Year 3**

**Energy and change**
- Energy can be used for different purposes.
  - Pushes and pulls affect the shape and motion of objects
    - e.g. squeezing clay; stretching a spring; throwing a ball.
  - Forces of energy, including electricity, light, heat, movement and sound, have different applications
    - e.g. electricity can light the classroom; most animals use light to see; the sun can warm us; kicking a ball makes it move; blowing musical instruments makes sound.

**Life and living**
- Needs, features and functions of living things are related and change over time.
  - Animals, plants and non-living things have different features/characteristics
    - e.g. some animals have fur; unlike plants and animals, rocks do not grow.
  - Offspring have similar characteristics to their parents
    - e.g. dogs have puppies; cats have kittens; birds have chicks.
  - Change occurs during the life cycle of living things
    - e.g. a seed grows into a plant; a joey in the pouch develops into an adult kangaroo.
  - Living things depend on the environment and each other
    - e.g. plants need light to make food; adult birds feed their young.

**By the end of Year 5**

**Energy and change**
- Actions of forces, and forms and uses of energy, are evident in the everyday world.
  - The greater the force on an object, the greater the change in shape or motion
    - e.g. pressing harder on a plasticine ball makes it flatter; the harder a ball is thrown the further it travels.
  - Forces may act at a distance or may need to be in contact with an object to affect it
    - e.g. magnetic and gravitational forces attract objects from a distance; hitting a ball requires contact with a bat.
  - Energy can be transferred from one object to another
    - e.g. a heater transfers warmth to a nearby human body.
  - Different forms of energy used within a community have different sources
    - e.g. electricity can be generated from a range of sources, including coal and solar energy.

**Life and living**
- Living things have features that determine their interactions with the environment.
  - Living things can be grouped according to their observable characteristics
    - e.g. insects have six legs; mammals have pouches; fish have fins and fins.
  - Structures of living things have particular functions
    - e.g. roots bring water and minerals to plants; skeletons give bodies shape and protect vital organs.
  - Reproductive processes and life cycles vary in different types of living things
    - e.g. plants reproduce by seeds, bulbs and cuttings; animals may lay eggs or produce live young.
  - Living things have relations with other living things and their environment
    - e.g. the relationship between clown fish and an anemone on a coral reef is mutually beneficial.

**By the end of Year 7**

**Energy and change**
- Forces and energy can be identified and analysed to provide explanations that benefit community lifestyles and decision making.
  - The motion of an object changes as a result of the application of opposing or supporting forces
    - e.g. a surfer makes use of a number of forces, including gravity, buoyancy and the motion of the water, to ride a wave.
  - Renewable and non-renewable energy sources can be identified and used for different purposes
    - e.g. wind or coal is used to generate electricity; wind can also be used to pump water.
  - Energy can be transferred and transformed
    - e.g. recharging a car battery transforms electrical energy into chemical energy that is stored in the battery; plants transform light energy from the sun into chemical energy that is stored.

**Life and living**
- Living things have structures that enable them to survive and reproduce.
  - Cells are the basic unit of all living things and perform functions that are needed to sustain and reproduce life
    - e.g. some organisms are single-celled; complex organisms such as humans are collections of specialised cells.
  - Systems of scientific classification can be applied to living things
    - e.g. dichotomous keys can be designed for groups of organisms.
  - Survival of organisms is dependent on their adaptation to their environment
    - e.g. animals use camouflage to protect themselves; plants in very dry areas may store water in modified structures.
  - Different feeding relationships exist within an ecosystem
    - e.g. producer, consumer, herbivore, carnivore relationships form a food web.

**By the end of Year 9**

**Energy and change**
- Forces and energy are identified and analysed to help understand and develop technologies, and to make predictions about events in the world.
  - An unbalanced force acting on a body results in a change in motion
    - e.g. a car is slowed by friction from braking.
  - Objects remain stationary or in constant motion under the influence of balanced forces
    - e.g. a book resting on a table; a vehicle travelling at constant speed.
  - Energy can be transferred from one medium to another
    - e.g. the stove transfers heat to the pot of water.
  - Transfer of energy can vary according to the medium in which it travels
    - e.g. some materials are good conductors of heat; light is refracted when it moves from air to water — the pencil appears to bend in a glass of water.
  - Energy is conserved when it is transferred or transformed
    - e.g. a light bulb converts electrical energy into light energy and also produces heat.

**Life and living**
- Organisms interact with their environment in order to survive and reproduce.
  - The diversity of plants and animals can be explained using the theory of evolution through natural selection
    - e.g. Australian marsupials would have had a common pouched ancestor.
  - In ecosystems, organisms interact with each other and their surroundings
    - e.g. the scavenger role of the crab in the mangroves means that it has a plentiful supply of food and it contributes by cleaning its surroundings.
  - Complex organisms depend on interacting body systems to meet their needs internally and with respect to their environment
    - e.g. the digestive system processes food and the circulatory system distributes it throughout the body.
  - All the information required for life is a result of genetic information being passed from parent to offspring
    - e.g. hereditary information is contained in the genes located on chromosomes.
  - Changes in ecosystems have causes and consequences that may be predicted
    - e.g. bushfires destroy natural bushland, which temporarily changes the ecosystem; birds return to dried-up waterholes after rain.
<table>
<thead>
<tr>
<th>Natural and processed materials</th>
<th>Natural and processed materials</th>
<th>Natural and processed materials</th>
<th>Natural and processed materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials have different properties and undergo different changes.</td>
<td>Properties, changes and uses of materials are related.</td>
<td>Properties, changes and uses of substances and mixtures are related to their particular composition.</td>
<td>The properties of materials are determined by their structure and their interaction with other materials.</td>
</tr>
<tr>
<td>• Materials are categorised according to their observable properties e.g. texture, colour and solubility can be used to group materials.</td>
<td>• Materials are composed of smaller parts, some of which may be visible to the naked eye, while others are too small to be seen e.g. cloth can be made up of interwoven fibres; rocks may be composed of visible crystals.</td>
<td>• Properties of a material will vary according to the type and quantity of components that make up its structure e.g. the colour of a paint depends on the proportion of different colours in the mixture; durability of Aboriginal arts works is dependent on paint ingredients; different alloys of iron produce different amounts of rust.</td>
<td>• Changes in physical properties of substances can be explained using the particle model e.g. use of the particle model to describe states of matter.</td>
</tr>
<tr>
<td>• Properties of familiar materials may be changed e.g. water is usually liquid but is solid when frozen.</td>
<td>• Materials are used for a particular purpose because of their specific properties e.g. lunch boxes and water bottles are made of plastic, because plastic is durable and water resistant.</td>
<td>• Chemical change produces new substances that have properties different from those of the original substances e.g. burning paper produces ash.</td>
<td>• Matter can be classified according to its structure e.g. elements and compounds, or molecules and atoms.</td>
</tr>
<tr>
<td>Natural and processed materials</td>
<td>• The properties of an object can differ from the properties of its component parts e.g. concrete differs from the cement, water and sand from which it is made.</td>
<td>• Physical change produces no new substances e.g. changing a solid to a liquid and back to a solid.</td>
<td>Chemical reactions can be described using word and balanced equations e.g. hydrogen plus oxygen gives water or (2H_2 + O_2 = 2H_2O).</td>
</tr>
<tr>
<td>Properties, changes and uses of materials are related.</td>
<td>• Properties of materials are affected by processes of change e.g. sugar dissolves in water; ingredients interact when a cake is baked.</td>
<td>Natural and processed materials</td>
<td>Reaction rate is affected by various factors, including temperature, concentration and surface area e.g. milk goes sour more quickly when left at room temperature; a soluble tablet will dissolve faster when it is crushed.</td>
</tr>
</tbody>
</table>