

Course advice

Background

The development of the Australian Curriculum is guided by *The Shape of the Australian Curriculum*. This document has been approved by education ministers to guide the development of the Australian Curriculum by the Australian Curriculum, Assessment and Reporting Authority (ACARA).

The Shape of the Australian Curriculum: Version 3.0, ACARA states:

For some learning areas, the Australian Curriculum will be written with the expectation that they will be taught in each year of schooling from Foundation to Year 10. For other areas, the Australian Curriculum will describe an entitlement that students will have the opportunity to learn across Foundation to Year 8, as well as additional learning they may choose and/or schools may choose to provide in Years 9–10.

In this way, ACARA has set an “entitlement” for all students, but acknowledges that the Australian Curriculum does not make assumptions about how the curriculum will be delivered in schools. This is ultimately the responsibility of schools acting within jurisdictional requirements.

Agricultural Education

In Queensland, the Australian Curriculum: Science is to be taught to all students as part of the entitlement curriculum. The various school subjects that draw upon Agricultural Education subject matter have some links to the Australian Curriculum: Science.

To enable schools to use the expertise and resources in this area, examples of Australian Curriculum: Science elaborations relating directly to an Agricultural Education context have been provided below. The Agricultural Education elaborations provided are not exhaustive and have been provided only for relevant Australian Curriculum: Science content descriptions.

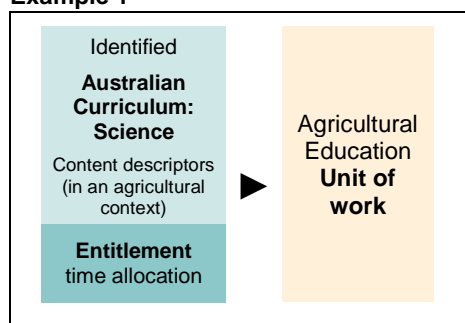
It is at the school’s discretion how courses are developed using Agricultural Education elaborations.

Schools may consider:

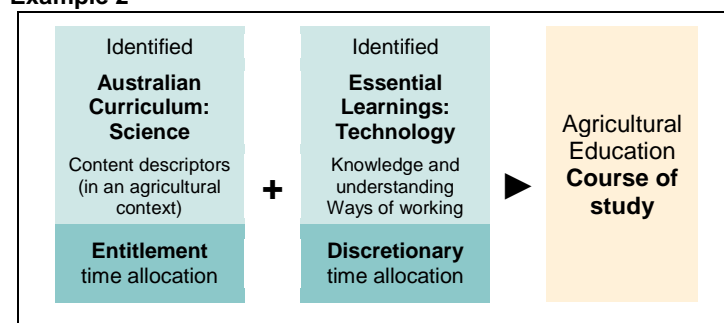
- Agricultural Education as a context in which to deliver some of the content descriptions of the Australian Curriculum: Science
- Agricultural Education as a separate course of study that offers the opportunity to integrate some of the content descriptions of the Australian Curriculum: Science and the Essential Learnings: Technology
- the use of both entitlement and discretionary time allocation.

The examples below illustrate some ways the *Australian Curriculum: Science, Agricultural Education Elaborations* may be used by schools to build a unit/s of work or a course of study.

Example 1



Example 2



Year 7 Australian Curriculum: Science

Agricultural Education Elaborations

Science Understanding

Year 7 Australian Curriculum: Science	Biological sciences	Elaborations: Agricultural Education context
	There are differences within and between groups of organisms; classification helps organise this diversity (ACSSU111)	<ul style="list-style-type: none"> considering the reasons for classifying agricultural organisms such as identification and communication grouping agricultural organisms on the basis of similarities and differences in particular features classifying local agricultural organisms using hierarchical systems such as kingdom, phylum, class, order, family, genus and species using scientific conventions for naming agricultural organisms using a range of identification keys to identify agricultural plants and animals
	Interactions between organisms can be described in terms of food chains and food webs; human activity can affect these interactions (ACSSU112)	<ul style="list-style-type: none"> using food chains to show the relationships between plants and organisms in agricultural contexts constructing and interpreting agricultural food webs to show the relationship between plants, animals and the agricultural environment recognising the role of organisms within agricultural food chains and food webs according to their position in the food chain investigating the effect of human activity on local habitats in relation to food production, e.g. land clearing, biodiversity, sustainable agriculture exploring how living things can cause changes to both the natural and farm environment and their impact on other living things, e.g. rabbits, cane toads, exotic diseases, plant competition researching the impact of human activity in the development of your local agricultural community researching the impact on local Indigenous populations when food and fibre production is changed in the local environment
	Chemical sciences	Elaborations: Agricultural Education context
Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques (ACSSU113)	<ul style="list-style-type: none"> recognising differences between pure substances and mixtures used in agriculture and giving examples of each identifying the solvent and solute in solutions, e.g. fertilisers, water quality and testing investigating and using a range of physical separation techniques such as filtration, decantation, evaporation, crystallisation, chromatography and distillation, e.g. wine industry, sugar industry, fruit processing, dairy industry exploring and comparing separation methods used in agriculture using soil and fertiliser solutions 	

Year 7 Australian Curriculum: Science	Earth and space sciences	Elaborations: Agricultural Education context
	Predictable phenomena on Earth, including seasons and eclipses, are caused by the relative positions of the sun, Earth and the moon (ACSSU115)	<ul style="list-style-type: none"> explaining how the seasons, sun and phases of the moon impact on decisions in agricultural contexts, e.g. alternative farming systems, biodynamics, permaculture exploring how Indigenous Australians used the seasons and positions of the sun and moon to harvest plants and locate animals as they travelled, e.g. fire-stick farming explaining why different regions of the Earth experience different seasonal conditions and the impact this has on the worldwide supply of food and fibre
	Some of Earth's resources are renewable, but others are non-renewable (ACSSU116)	<ul style="list-style-type: none"> considering what is meant by the term "renewable" in the context of agriculture exploring the renewable and non-renewable resources used in food production locally and globally comparing renewable and non-renewable energy sources and how they are used by agriculturalists
	Water is an important resource that cycles through the environment (ACSSU222)	<ul style="list-style-type: none"> exploring the water cycle in terms of changes to the state of water investigating the factors that influence the water cycle and how this relates to local food and fibre production exploring the human management of water for food production and the impact it has on the water cycle, e.g. dams, bores investigating sources of water in local catchments, e.g. surface water, ground water
	Physical sciences	Elaborations: Agricultural Education context
	Change to an object's motion is caused by unbalanced forces acting on the object (ACSSU117)	<ul style="list-style-type: none"> investigating the effects of applying different forces to familiar objects investigating common situations where forces are balanced, such as stationary objects, and unbalanced, such as falling objects, tractor rollover investigating a simple machine such as a lever or pulley system, e.g. crowbars, wheelbarrows, ratchets
Earth's gravity pulls objects towards the centre of the Earth (ACSSU118)	<p>General Science elaborations (not in a specific Agricultural Education context):</p> <ul style="list-style-type: none"> exploring how gravity affects objects on the surface of Earth considering how gravity keeps planets in orbit around the sun 	

Science as a Human Endeavour

Year 7 Australian Curriculum: Science	Nature and development of science	Elaborations: Agricultural Education context
	Scientific knowledge changes as new evidence becomes available, and some scientific discoveries have significantly changed people’s understanding of the world (ACSHE119)	<ul style="list-style-type: none"> investigating how advances in agricultural production methods have provided new evidence about fertilisers and plant growth researching “the green revolution” and understanding the impact it has had on agricultural production techniques
	Science knowledge can develop through collaboration and connecting ideas across the disciplines of science (ACSHE223)	<ul style="list-style-type: none"> considering how water use and management in agriculture rely on knowledge from different areas of science and the use of technology, e.g. remote irrigation operation identifying the contributions of Australian scientists to the study of food and fibre production methods, processing, breeding programs and technology investigating how land management practices of Aboriginal and Torres Strait Islander peoples can help inform sustainable management of the environment
	Use and influence of science	Elaborations: Agricultural Education context
	Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations (ACSHE120)	<ul style="list-style-type: none"> investigating ways to control introduced plants and animals that impact on food production, e.g. mimosa on grazing land, Asian honey bees, myrtle rust, feral pigs, rabbits and goats considering the issues relating to the distribution, use and management of water in a rural community for food production considering how human activity within a community can have both positive and challenging effects on the sustainability of agricultural systems, e.g. housing development, mining
	Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management (ACSHE121)	<ul style="list-style-type: none"> investigating farming applications of physical separation techniques in contexts such as vaccine production, reducing farm pollution, extracting products from plants, cleaning up chemical spills investigating how advances in science and technology have been applied to the treatment and application of water in agricultural systems, e.g. irrigation techniques researching the different scientific responses to the rabbit plagues in Australian agricultural areas
	People use understanding and skills from across the disciplines of science in their occupations (ACSHE224)	<ul style="list-style-type: none"> identifying the role played by water and land management in food and fibre production, and leisure activities such as gardening considering how agricultural scientists apply knowledge of plants to improve yields investigating how separation techniques are used in the food, fibre and wine industries to produce food products, e.g. cheesemaking considering how seasonal changes in weather affect farming communities in relation to food production, e.g. drought, floods and cyclones

Science Inquiry Skills

Year 7 Australian Curriculum: Science	Questioning and predicting	Elaborations
	Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSIS124)	<ul style="list-style-type: none"> working collaboratively to identify a problem to investigate recognising that the solution to some questions and problems requires consideration of social, cultural, economic or moral aspects rather than, or as well as, scientific investigation using information and knowledge from previous investigations to predict the expected results from an investigation
	Planning and conducting	Elaborations
	Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (ACSIS125)	<ul style="list-style-type: none"> working collaboratively to decide how to approach an investigation learning and applying specific skills and rules relating to the safe use of scientific and agricultural equipment identifying whether the use of their own observations and experiments or the use of other research materials is appropriate for their investigation developing strategies and techniques for effective research using secondary sources, including use of the internet
	In fair tests, measure and control variables, and select equipment to collect data with accuracy appropriate to the task (ACSIS126)	<ul style="list-style-type: none"> recognising the differences between controlled, dependent and independent variables using a digital camera to record observations and comparing images using information technologies using specialised scientific and agricultural equipment to increase the accuracy of measurement within an investigation
	Processing and analysing data and information	Elaborations
Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships, including using digital technologies as appropriate (ACSIS129)	<ul style="list-style-type: none"> understanding different types of graphical and physical representation and considering their advantages and disadvantages using spreadsheets to aid the presentation and simple analysis of data describing the trends shown in collected data 	
Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions (ACSIS130)	<ul style="list-style-type: none"> using diagrammatic representations to convey abstract scientific ideas and to simplify complex situations comparing and contrasting data from a number of sources to create a summary of collected data identifying data that provides evidence to support or negate the hypothesis under investigation referring to relevant evidence when presenting conclusions drawn from an investigation 	

Year 7 Australian Curriculum: Science	Evaluating	Elaborations
	Reflect on the method used to investigate a question or solve a problem, including evaluating the quality of the data collected, and identify improvements to the method (AC SIS131)	<ul style="list-style-type: none"> • discussing investigation methods with others to share ideas about the quality of the inquiry process • identifying and considering indicators of the quality of the data when analysing results • suggesting improvements to agricultural scientific inquiry methods based on experience
	Use scientific knowledge and findings from investigations to evaluate claims (AC SIS132)	<ul style="list-style-type: none"> • using the evidence provided by scientific investigations to evaluate the claims or conclusions of their peers in agricultural situations
	Communicating	Elaborations
Communicate ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate (AC SIS133)	<ul style="list-style-type: none"> • presenting the outcomes of agricultural research using effective forms of representation of data or ideas and scientific language that is appropriate for the target audience • using digital technologies to access information and to communicate and collaborate with others on and off site 	

Year 8 Australian Curriculum: Science

Agricultural Education Elaborations

Science Understanding

Year 8 Australian Curriculum: Science	Biological sciences	Elaborations: Agricultural Education context
	Cells are the basic units of living things and have specialised structure and functions (ACSSU149)	<ul style="list-style-type: none"> distinguishing plant cells from animal or fungal cells identifying structures within cells and describing their function examining a variety of cells using a light microscope, digital technology or simulation recognising how plant and animal cells reproduce by division describing mitosis as cell division
	Multi-cellular organisms contain systems of organs that carry out specialised functions that enable them to survive and reproduce (ACSSU150)	<ul style="list-style-type: none"> identifying the organs and functions of a system of multicellular farm animals in supporting the life processes describing the structure of each organ in a system and relating its function to the overall function of the system comparing similar systems in different organisms, e.g. digestion in herbivores and carnivores distinguishing between sexual and asexual reproduction and the importance of each to food production examining the specialised cells and tissues involved in structure and function of specialised organisms, e.g. nodulation in legumes comparing reproductive systems of farm animals such as chickens, cattle, horses, pigs and sheep
	Chemical sciences	Elaborations: Agricultural Education context
The properties of the different states of matter can be explained in terms of the motion and arrangement of particles (ACSSU151)	<ul style="list-style-type: none"> explaining why a model for the structure of matter is needed identifying and modelling the arrangement of particles in solids, liquids and gases, e.g. at different stages in food production and animal digestion using the particle model to explain observed phenomena linking the energy of particles to temperature changes, e.g. storage of foods at different temperatures 	

Year 8 Australian Curriculum: Science	Chemical sciences <i>continued</i>	Elaborations: Agricultural Education context
	Differences between elements, compounds and mixtures can be described at a particle level (ACSSU152)	<ul style="list-style-type: none"> • modelling the arrangement of particles in elements and compounds, e.g. fertilisers, chemicals, milk products • recognising that elements and simple compounds can be represented by symbols and formulas • locating elements on the periodic table • investigating common compounds and mixtures found in food production and processing, e.g. yeast
	Chemical change involves substances reacting to form new substances (ACSSU225)	<ul style="list-style-type: none"> • identifying the differences between chemical and physical changes • identifying evidence that a chemical change has taken place, e.g. fermentation • investigating reactions that produce food products, e.g. grain stored to form silage, milk to yoghurt
	Earth and space sciences	Elaborations: Agricultural Education context
	Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales (ACSSU153)	<ul style="list-style-type: none"> • representing the stages in the formation of igneous, metamorphic and sedimentary rocks, including indications of timescales involved • recognising that rocks are a collection of different minerals and investigating how these minerals are important to soils and plant nutrition • identifying a range of rock types found in the local area using a key based on observable physical and chemical properties and the soil types that come from their breakdown • recognising that rock types influence soil formation and investigating the impact of soil types on food production in the local area
	Physical sciences	Elaborations: Agricultural Education context
Energy appears in different forms including movement (kinetic energy), heat and potential energy, and causes change within systems (ACSSU155)	<ul style="list-style-type: none"> • recognising that kinetic energy is the energy possessed by moving bodies, e.g. farming equipment such as tractors, harvesters, travelling irrigators • recognising that potential energy is stored energy, such as gravitational, chemical and elastic energy, e.g. stored grain and fertilisers • investigating different forms of energy in terms of the effects they cause, such as gravitational potential causing objects to fall and heat energy transferred between materials that have a different temperature • recognising that heat energy is often produced as a by-product of energy transfer, reducing the energy efficiency, e.g. heat energy lost by animals, silage • using flow diagrams to illustrate changes between energy forms in farm animals and farm equipment/machinery • recognising that potential energy found in food products is stored chemical energy ready for conversion to other forms of energy when consumed and digested 	

Science as a Human Endeavour

Year 8 Australian Curriculum: Science	Nature and development of science	Elaborations: Agricultural Education context
	Scientific knowledge changes as new evidence becomes available, and some scientific discoveries have significantly changed people's understanding of the world (ACSHE119)	<ul style="list-style-type: none"> investigating developments that have led to our understanding of cells and how this knowledge has impacted on health and medicine for animals in terms of vaccines, gene technology and antibiotics
	Science knowledge can develop through collaboration and connecting ideas across the disciplines of science (ACSHE223)	<ul style="list-style-type: none"> researching the use of reproductive technologies such as embryo transfer, artificial insemination in food production and how knowledge in this area comes from different areas of science
	Use and influence of science	Elaborations: Agricultural Education context
	Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations (ACSHE135)	<ul style="list-style-type: none"> investigating design requirements of systems for collecting and recycling animal wastes, e.g. piggeries investigating strategies to maintain a balance between farmed and natural environments discussing ethical issues that arise from food production, e.g. live animal transport, organic vs. inorganic methods, intensive animals housing investigating the development of farm machinery over time including its application to soil sustainability
	Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management (ACSHE136)	<ul style="list-style-type: none"> describing how technologies have been applied to modern farming techniques to improve yields and production sustainability, e.g. water monitoring and application in crops, irrigation, laser levelling investigating the role of agricultural science in the development of food production and food security for the world describing the impact of plant cloning techniques within agriculture, animal production, horticulture and viticulture investigating how Aboriginal people recognise relationships in ecosystems
People use understanding and skills from across the disciplines of science in their occupations (ACSHE224)	<ul style="list-style-type: none"> recognising the role of knowledge of the environment and ecosystems in a number of agricultural occupations considering how engineers improve the energy efficiency of a range of agricultural processes and machinery investigating how scientists have created new materials such as synthetic fibres and pharmaceuticals used in agricultural practices, e.g. vaccines 	

Year 8 Australian Curriculum: Science	Use and influence of science	Elaborations: Agricultural Education context
	<p>Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations (ACSHE135)</p>	<ul style="list-style-type: none"> investigating design requirements of systems for collecting and recycling animal wastes, e.g. piggeries investigating strategies to maintain a balance between farmed and natural environments discussing ethical issues that arise from food production, e.g. live animal transport, organic vs. inorganic methods, intensive animals housing investigating the development of farm machinery over time including its application to soil sustainability
	<p>Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management (ACSHE136)</p>	<ul style="list-style-type: none"> describing how technologies have been applied to modern farming techniques to improve yields and production sustainability, e.g. water monitoring and application in crops, irrigation, laser levelling investigating the role of agricultural science in the development of food production and food security for the world describing the impact of plant cloning techniques within agriculture, animal production, horticulture and viticulture investigating how Aboriginal people recognise relationships in ecosystems
	<p>People use understanding and skills from across the disciplines of science in their occupations (ACSHE224)</p>	<ul style="list-style-type: none"> recognising the role of knowledge of the environment and ecosystems in a number of agricultural occupations considering how engineers improve the energy efficiency of a range of agricultural processes and machinery investigating how scientists have created new materials such as synthetic fibres and pharmaceuticals used in agricultural practices, e.g. vaccines

Science Inquiry Skills

Year 8 Australian Curriculum: Science	Questioning and predicting	Elaborations
	Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSIS124)	<ul style="list-style-type: none"> considering whether investigation using available resources is possible when identifying questions or problems to investigate recognising that the solution to some questions and problems requires consideration of social, cultural, economic or moral aspects rather than, or as well as, scientific investigation using information and knowledge from their own investigations and secondary sources to predict the expected results from an investigation
	Planning and conducting	Elaborations
	Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (ACSIS125)	<ul style="list-style-type: none"> working collaboratively to decide how to best approach an investigation identifying any ethical considerations that may apply to the investigation taking into consideration all aspects of fair testing, available equipment and safety when planning investigations
	In fair tests, measure and control variables, and select equipment to collect data with accuracy appropriate to the task (ACSIS126)	<ul style="list-style-type: none"> using specialised equipment to increase the accuracy of measurement within an investigation identifying and explaining the differences between controlled, dependent and independent variables
	Processing and analysing data and information	Elaborations
Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships, including using digital technologies as appropriate (ACSIS129)	<ul style="list-style-type: none"> describing measures of central tendency and identifying outliers for quantitative data explaining the strengths and limitations of representations such as physical models, diagrams and simulations in terms of the attributes of systems included or not included 	
Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions (ACSIS130)	<ul style="list-style-type: none"> constructing tables, graphs, keys and models to represent relationships and trends in collected data drawing conclusions based on a range of evidence including primary and secondary sources 	

Year 8 Australian Curriculum: Science	Evaluating	Elaborations
	Reflect on the method used to investigate a question or solve a problem, including evaluating the quality of the data collected, and identify improvements to the method (ACSIS131)	<ul style="list-style-type: none"> • suggesting improvements to investigation methods that would increase the accuracy of the data recorded • discussing investigation methods with others to share ideas about the quality of the inquiry process
	Use scientific knowledge and findings from investigations to evaluate claims (ACSIS132)	<ul style="list-style-type: none"> • identifying the scientific evidence available to evaluate claims • deciding whether or not to accept claims based on scientific evidence • identifying where science has been used to make claims relating to products and practices
	Communicating	Elaborations
Communicate ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate (ACSIS133)	<ul style="list-style-type: none"> • using digital technologies to construct a range of text types to present science ideas • selecting and using appropriate language and representations to communicate science ideas within a specified text type and for a specified audience 	

Year 9 Australian Curriculum: Science

Agricultural Education Elaborations

Science Understanding

Year 9 Australian Curriculum: Science	Biological sciences	Elaborations: Agricultural Education context
	<p>Multi-cellular organisms rely on coordinated and interdependent internal systems to respond to changes to their environment (ACSSU175)</p>	<ul style="list-style-type: none"> describing how the requirements for life (for example oxygen, nutrients, water and removal of waste) are provided through the coordinated function of animal body systems such as the respiratory, circulatory, digestive, nervous and excretory systems explaining, using models, flow diagrams or simulations, how animal body systems work together to maintain a functioning body identifying animal responses that use the nervous and endocrine systems exploring the effects on animals of exposure to ultraviolet radiation, e.g. lighting in poultry, sunburn in pigs or cattle investigating the effects of light and temperature on plants, e.g. tropisms and flowering response investigating the response of an animal's body as a result of parasites or other disease-causing organisms
	<p>Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems (ACSSU176)</p>	<ul style="list-style-type: none"> exploring interactions between farm organisms such as predator/prey, parasites, competition, pollinators and disease organisms examining factors that affect population sizes or stocking rates, such as pasture coverage, pests and disease, animal welfare regulations, introduced species, climate and weather events considering how energy flows into and out of an agricultural ecosystem via the pathways of food webs, and how it must be replaced to maintain the sustainability of the system investigating how agricultural ecosystems change as a result of events such as bushfires, drought and flooding and severe weather events

Year 9 Australian Curriculum: Science	Chemical sciences	Elaborations: Agricultural Education context
	<p>All matter is made of atoms which are composed of protons, neutrons and electrons; natural radioactivity arises from the decay of nuclei in atoms (ACSSU177)</p>	<ul style="list-style-type: none"> • modelling the structure of atoms in terms of nucleus, protons, neutrons and electrons • identifying the elements in a range of substances, e.g. agricultural fertilisers, water, insecticides, hormones • describing soil cation exchange and nutrient uptake in plants in relation to protons, neutrons and electrons • comparing the mass and charge of protons, electrons and neutrons • describing in simple terms how alpha and beta particles and gamma radiation are released from unstable atoms
	<p>Chemical reactions involve rearranging atoms to form new substances; during a chemical reaction mass is not created or destroyed (ACSSU178)</p>	<ul style="list-style-type: none"> • identifying reactants and products in the chemical process of silage making • identifying reactants and products when mixing chemicals in agricultural contexts, e.g. fertilisers, food manufacturing • modelling chemical reactions in terms of rearrangement of atoms • describing observed reactions using word equations, e.g. fermentation, anaerobic respiration • investigating the chemical reaction of photosynthesis, e.g. planting density, CO₂ concentration, light • recognising that the conservation of mass in a chemical reaction can be demonstrated by simple chemical equations
	<p>Chemical reactions, including combustion and the reactions of acids, are important in both non-living and living systems and involve energy transfer (ACSSU179)</p>	<ul style="list-style-type: none"> • investigating the reactions of acids with metals, bases and carbonates and the impact this has on the storage of farm chemicals, fertilisers and fuels • investigating the role that oxygen plays in food processing, e.g. grain fermentation in silage, beer and wine making, milk products such as yoghurts and sour cream • investigating a range of different reactions that occur in food processing and classifying them as exothermic or endothermic, e.g. silage • investigating pH and the impact this has on the growth of different crops, e.g. aquaculture, hydroponics

Earth and space sciences	Elaborations: Agricultural Education context
The theory of plate tectonics explains global patterns of geological activity and continental movement (ACSSU180)	<ul style="list-style-type: none"> • relating the occurrence of earthquakes and volcanic activity to plate boundaries and the effect of this on soil nutrients and location of agricultural activities globally <p>General Science elaborations (not in a specific Agricultural Education context)</p> <ul style="list-style-type: none"> • recognising the major plates on a world map • modelling sea-floor spreading • considering the role of heat energy and convection currents in the movement of tectonic plates • relating the extreme age and stability of a large part of the Australian continent to its plate tectonic history
Physical sciences	Elaborations: Agricultural Education context
Energy transfer through different mediums can be explained using wave and particle models (ACSSU182)	<ul style="list-style-type: none"> • investigating factors that affect the transfer of energy through an electrical circuit such as in electric fencing, insulators, conductors • exploring how and why energy and heat transfer varies in a greenhouse used for plant production <p>General Science elaborations (not in a specific Agricultural Education context)</p> <ul style="list-style-type: none"> • exploring how and why the movement of energy varies according to the medium through which it is transferred • discussing the wave and particle models and how they are useful for understanding aspects of phenomena • investigating the transfer of heat in terms of convection, conduction and radiation, and identifying situations in which each occurs • understanding the processes underlying convection and conduction in terms of the particle model • investigating factors that affect the transfer of energy through an electric circuit • exploring the properties of waves, and situations where energy is transferred in the form of waves, such as sound and light

Science as a Human Endeavour

Year 9 Australian Curriculum: Science	Nature and development of science	Elaborations: Agricultural Education context
	Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community (ACSHE157)	<ul style="list-style-type: none"> investigating how models can be used to predict changes in pest and agricultural populations due to environmental changes such as flooding, loss of habitat, fire or cyclones investigating integrated pest management and how it has been used by farmers to manage pest populations in plant and animal production systems investigating parasite numbers and how to control them in food-producing animals
	Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries (ACSHE158)	<ul style="list-style-type: none"> considering how advances in technology such as microscopes, scanning, radiation and telecommunication have assisted agricultural scientists and food producers in decision making and are linked to new discoveries of diseases and pests evolution of agricultural technologies and growth of Australian agriculture, e.g. stump jump plough
	Use and influence of science	Elaborations: Agricultural Education context
	People can use scientific knowledge to evaluate whether they should accept claims, explanations or predictions (ACSHE160)	<ul style="list-style-type: none"> using knowledge of agricultural science to test claims used in advertising or expressed in the media, e.g. hormones in meat, animal cruelty, mulesing in sheep, food security evaluating claims relating to such issues as climate change, genetically modified foods, hormone implants, cloning, pesticides, fruit bat infestations, flying fox colonies considering the impacts of human farming activity on an ecosystem from a range of different perspectives, e.g. irrigation, erosion, run-off, damming
	Advances in science and emerging sciences and technologies can significantly affect people's lives, including generating new career opportunities (ACSHE161)	<ul style="list-style-type: none"> investigating how technologies using DNA markers and gene identification are being used to assist in plant and animal breeding programs, e.g. artificial insemination, grafting considering the impact of agricultural technological advances in Australia such as harvesting and cultivating machinery, softer pesticides (using yeast and fungi), improved water measurement and application and development of industrial hemp recognising aspects of science, engineering and technology within careers such as agricultural engineering, agronomy, veterinary science, horticulture investigating the discovery of pasteurisation and the impact this has had on dairy production, the manufacturing sector and human health

Use and influence of science <i>continued</i>	Elaborations: Agricultural Education context
The values and needs of contemporary society can influence the focus of scientific research (ACSHE228)	<ul style="list-style-type: none"> • considering how technologies have been developed to assist scientists and food producers to meet increasing needs for mobile communication, e.g. GPS and satellite guidance, remote weather sensors, remote irrigation sensors • investigating how agricultural science and technological advances have been applied to the agricultural industries, such as feedlots, piggeries, poultry production (eggs and meat) and hydroponics, to minimise pollution and save energy and water • recognising how choices related to the use of ethanol impact on the associated industry and economics of a sector • investigating the work of Australian agricultural scientists in a range of sectors and how their discoveries have altered aspects of food production (using local, state, national and global examples) • investigating contemporary agricultural science issues related to living in other countries, in particular Asia and the Pacific, and the influences on agricultural production in Australia

Science Inquiry Skills

Year 9 Australian Curriculum: Science	Questioning and predicting	Elaborations
	Formulate questions or hypotheses that can be investigated scientifically (ACSIS164)	<ul style="list-style-type: none"> • using internet research to identify problems that can be investigated • evaluating information from secondary sources as part of the research process • revising and refining research questions to target specific information and data collection or finding a solution to the specific problem identified • developing ideas from students' own or others' investigations and experiences to investigate further
	Planning and conducting	Elaborations
	Plan, select and use appropriate investigation methods, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods (ACSIS165)	<ul style="list-style-type: none"> • explaining the choice of variables to be controlled, changed and measured in an investigation • identifying the potential hazards of chemicals or biological materials used in experimental investigations • ensuring that any investigation involving or impacting on animals is justified, humane and considerate of each animal's needs • using modelling and simulations, including using digital technology to investigate situations and events • combining research using primary and secondary sources with students' own experimental investigations • considering how investigation methods and equipment may influence the reliability of collected data

Year 9 Australian Curriculum: Science	Planning and conducting <i>continued</i>	Elaborations
	Select and use appropriate equipment, including digital technologies, to systematically and accurately collect and record data (AC SIS166)	<ul style="list-style-type: none"> • using probes and data loggers to record information • applying specific skills for the use of scientific instruments
	Processing and analysing data and information	Elaborations
	Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies (AC SIS169)	<ul style="list-style-type: none"> • using spreadsheets to present data in tables and graphical forms and to carry out mathematical analyses on data • describing sample properties (such as mean, median, range, large gaps visible on a graph) to predict characteristics of the larger population • designing and constructing appropriate graphs to represent data and analysing graphs for trends and patterns
	Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (AC SIS170)	<ul style="list-style-type: none"> • comparing conclusions with earlier predictions and reviewing scientific understanding where appropriate • suggesting more than one explanation of the data presented
	Evaluating	Elaborations
	Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data (AC SIS171)	<ul style="list-style-type: none"> • identifying gaps or weaknesses in conclusions (students' own or those of others) • identifying alternative explanations that are also consistent with the evidence
	Critically analyse the validity of information in secondary sources and evaluate the approaches used to solve problems (AC SIS172)	<ul style="list-style-type: none"> • discussing what is meant by "validity" and how we can evaluate the validity of information in secondary sources • researching the methods used by scientists in studies reported in the media • describing how scientific arguments are used to make decisions on personal and community issues
Communicating	Elaborations	
Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations (AC SIS174)	<ul style="list-style-type: none"> • presenting results and ideas using formal experimental reports, oral presentations, slide shows, poster presentations and contributing to group discussions • using secondary sources as well as students' own findings to help explain a scientific concept • using the internet to facilitate collaboration in joint projects and discussions 	

Year 10 Australian Curriculum: Science

Agricultural Education Elaborations

Science Understanding

Year 10 Australian Curriculum: Science	Biological sciences	Elaborations: Agricultural Education context
	<p>The transmission of heritable characteristics from one generation to the next involves DNA and genes (ACSSU184)</p>	<ul style="list-style-type: none"> describing the role of DNA as the blueprint for controlling the characteristics of organisms used in food and fibre production using models and diagrams to represent the relationship between DNA, genes and chromosomes recognising that genetic information passed on to offspring is from both parents by meiosis and fertilisation, e.g. milk quality in dairy cows, crop yields representing patterns of inheritance of a simple dominant/recessive characteristic through generations of an animal or plant family predicting simple ratios of offspring genotypes and phenotypes in crosses involving dominant/recessive gene pairs or in genes that are sex-linked describing mutations as changes in DNA or chromosomes outlining the factors that contribute to mutations and the impact they can have in farm animals and plants, e.g. genetically modified foods
<p>The theory of evolution by natural selection explains the diversity of living things and is supported by a range of scientific evidence (ACSSU185)</p>	<ul style="list-style-type: none"> outlining processes involved in natural selection including variation and selection describing biodiversity as a function of evolution and the value of this to agricultural breeding programs investigating changes caused by natural selection in a particular population, e.g. geographic isolation investigating changes caused by artificial selection in breeding animals for desired characteristics, e.g. pollness in cattle, egg laying in chickens, meat production relating genetic characteristics to survival and reproduction rates evaluating and interpreting breeding programs using Estimated Breeding Values (EBVs) 	

Year 10 Australian Curriculum: Science	Chemical sciences	Elaborations: Agricultural Education context
	The atomic structure and properties of elements are used to organise them in the Periodic Table (ACSSU186)	<p>General Science elaborations (not in a specific Agricultural Education context):</p> <ul style="list-style-type: none"> recognising that elements in the same group of the periodic table have similar properties describing the structure of atoms in terms of electron shells explaining how the electronic structure of an atom determines its position in the periodic table and its properties investigating the chemical activity of metals
	Different types of chemical reactions are used to produce a range of products and can occur at different rates (ACSSU187)	<ul style="list-style-type: none"> investigating how chemistry can be used to produce a range of useful agricultural products such as ethanol, fertiliser, chemicals, wine, preserved food items (e.g. dried fruits, meat) using word or symbol equations to represent agricultural chemical reactions investigating the effect of a range of factors, such as temperature and catalysts, on the rate of chemical reactions necessary in agricultural production, e.g. slow-release fertilisers, cheese and yoghurt production, wine making
	Earth and space sciences	Elaborations: Agricultural Education context
The universe contains features including galaxies, stars and solar systems and the Big Bang theory can be used to explain the origin the universe (ACSSU188)	<p>General Science elaborations (not in a specific Agricultural Education context):</p> <ul style="list-style-type: none"> identifying the evidence supporting the Big Bang theory, such as Edwin Hubble's observations and the detection of microwave radiation recognising that the age of the universe can be derived using knowledge of the Big Bang theory describing how the evolution of the universe, including the formation of galaxies and stars, has continued since the Big Bang 	
Global systems , including the carbon cycle, rely on interactions involving the biosphere, lithosphere, hydrosphere and atmosphere (ACSSU189)	<ul style="list-style-type: none"> investigating how human activity in the food and fibre production sector affects global systems modelling and recognising the importance of cycles such as water, carbon, nitrogen or phosphorus within the biospheres to agricultural production explaining the cause of the greenhouse effect and its impact on food production and how it can be used advantageously investigating the effect of climate change on food production considering the long-term effects of loss of biodiversity through monoculture examining the factors that drive deep ocean currents, the role currents play in regulating global climate (e.g. El Niño) and the subsequent effects on food production 	

Year 10 Australian Curriculum: Science	Earth and space sciences <i>continued</i>	Elaborations: Agricultural Education context
	Energy conservation in a system can be explained by describing energy transfers and transformations (ACSSU190)	<ul style="list-style-type: none"> recognising that the Law of Conservation of Energy explains that total energy is maintained in energy transfer and transformation recognising that in energy transfer and transformation, a variety of processes can occur, so that the usable energy is reduced and the system is not 100% efficient, e.g. machinery, animal food consumption comparing energy changes in interactions, e.g. agricultural processing and harvesting machinery using models to describe how energy is transferred and transformed within systems, e.g. biofuels, alternative energy sources such as wind and solar
	The motion of objects can be described and predicted using the laws of physics (ACSSU229)	<p>General Science elaborations (not in a specific Agricultural Education context):</p> <ul style="list-style-type: none"> gathering data to analyse everyday motions produced by forces, such as measurements of distance and time, speed, force, mass and acceleration recognising that a stationary object, or a moving object with constant motion, has balanced forces acting on it using Newton's Second Law to predict how a force affects the movement of an object recognising and applying Newton's Third Law to describe the effect of interactions between two objects

Science as a Human Endeavour

	Nature and development of science	Elaborations: Agricultural Education context
	Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community (ACSHE157)	<ul style="list-style-type: none"> considering the role of different sources of evidence including biochemical, anatomical and fossil evidence for evolution by natural selection investigating the history and impact of development in genetic knowledge, e.g. assisted reproductive technologies, genetic modification considering the role of science in identifying and explaining the causes of climate change and the impact on agricultural systems
	Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries (ACSHE158)	<ul style="list-style-type: none"> recognising that the development of fast computers has had an impact on reproductive and communication technologies, e.g. DNA sequencing, GPS considering how computer modelling has improved knowledge of climate change and sustainable agricultural production and can be used to predict future phenomena researching examples of major international scientific projects, e.g. genetically modified crops, C₄ plants

Year 10 Australian Curriculum: Science	Use and influence of science	Elaborations: Agricultural Education context
	People can use scientific knowledge to evaluate whether they should accept claims, explanations or predictions (ACSHE160)	<ul style="list-style-type: none"> describing how science is used in the media to explain a natural event or justify people's actions around agriculture using knowledge of agricultural science to test claims made in advertising considering the scientific knowledge used in discussions relating to climate change and the impact on food production evaluating claims of environmental footprints in relation to agricultural production
	Advances in science and emerging sciences and technologies can significantly affect people's lives, including generating new career opportunities (ACSHE161)	<ul style="list-style-type: none"> predicting future applications of aspects of vaccines and nanotechnology on agricultural systems investigating the applications of gene technologies and influences on food production into the future recognising that scientific developments in the agricultural science field requires people working in a range of fields such as science, technology, engineering
	The values and needs of contemporary society can influence the focus of scientific research (ACSHE230)	<ul style="list-style-type: none"> investigating technologies associated with climate and weather forecasting and its relevance to agricultural production as well as the general community investigating technologies associated with the reduction of carbon such as carbon capture and how this is implemented within agricultural systems recognising that animal welfare is an important consideration for many consumers and how animal producers must adapt to consumer demands

Science Inquiry Skills

Year 10 Australian Curriculum: Science	Questioning and predicting	Elaborations
	Formulate questions or hypotheses that can be investigated scientifically (AC SIS164)	<ul style="list-style-type: none"> developing hypotheses based on well-developed models and theories using internet research to identify problems that can be investigated formulating questions that can be investigated within the scope of the classroom or field with available resources developing ideas from students' own or others' investigations and experiences to investigate further evaluating information from secondary sources as part of the research process
	Planning and conducting	Elaborations
	Plan, select and use appropriate investigation methods, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods (AC SIS165)	<ul style="list-style-type: none"> combining research using primary and secondary sources with a student's own experimental investigation using modelling and simulations, including using digital technology, to investigate situations and events deciding how much data are needed to produce reliable measurements considering possible confounding variables or effects and ensuring these are controlled identifying the potential hazards of chemicals or biological materials used in experimental investigations identifying safety risks and impacts on animal welfare and ensuring these are effectively managed within the investigation
	Select and use appropriate equipment, including digital technologies, to systematically and accurately collect and record data (AC SIS166)	<ul style="list-style-type: none"> selecting and using probes and data loggers to record information applying specific skills for the use of scientific instruments identifying where human error can influence the reliability or unreliability of data
	Processing and analysing data and information	Elaborations
Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies (AC SIS169)	<ul style="list-style-type: none"> using spreadsheets to present data in tables and graphical forms and to carry out mathematical analyses on data describing sample properties (such as mean, median, range, large gaps visible on a graph) to predict characteristics of the larger population, acknowledging uncertainties and the effects of outliers exploring relationships between variables using spreadsheets, databases, tables, charts, graphs and statistics 	
Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (AC SIS170)	<ul style="list-style-type: none"> using primary or secondary scientific evidence to support or refute a conclusion constructing a scientific argument showing how evidence supports a claim 	

Year 10 Australian Curriculum: Science	Evaluating	Elaborations
	Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data (AC SIS171)	<ul style="list-style-type: none"> evaluating the strength of a conclusion that can be inferred from a particular dataset distinguishing between random and systematic errors and how these can affect investigation results identifying alternative explanations that are also consistent with the evidence
	Critically analyse the validity of information in secondary sources and evaluate the approaches used to solve problems (AC SIS172)	<ul style="list-style-type: none"> researching the methods used by scientists in studies reported in the media judging the validity of science-related media reports and how these reports might be interpreted by the public describing how scientific arguments, as well as ethical, economic and social arguments, are used to make decisions regarding personal and community issues
	Communicating	Elaborations
Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations (AC SIS174)	<ul style="list-style-type: none"> using the internet to facilitate collaboration in joint projects and discussions constructing evidence-based arguments and engaging in debate about scientific ideas presenting results and ideas using formal experimental reports, oral presentations, slide shows, poster presentations and contributing to group discussions using a range of representations, including mathematical and symbolic forms, to communicate science ideas 	