Hazards, disasters and your community (2006 - 7th edition), Australian Government, Emergency Management Australia

1. **Overview of the current edition**
   - **Purpose:** This booklet was produced to provide information on a range of hazards and disasters in Australia and overseas, including ways to cope.
   - **Target audience:** Secondary school students, teachers and the public

   - **Content / Chapters**

     Chapter 1: While the chapter title is *How do we cope with hazards and disasters?,* the information covers:
     - the difference between hazards, disasters and accidents
     - the origin of natural hazards and disasters - meteorological, geological, biological or extra-terrestrial
     - the categorisation of non-natural hazards and disasters as human-caused or technological origin; and
     - the need for Australian to be aware of likely hazards and potential disasters, including how to cope with their effects. This last section states that at the end of each chapter there is information on survival and property protection, including details on what we can do before, during and after the impact of a particular hazard to reduce the risk of disaster.

     Chapters 2-11: Hazards and disasters

     Consecutive chapters describe the nature of the hazards listed in the below table as well as case studies (mainly Australian)-. Each chapter also contains project ideas for students to explore.

     - wildfire
     - flood
     - heatwave
     - severe storm
     - drought
     - cyclone
     - earthquake
     - tsunami
     - landslide
     - volcano

     Chapter 12: Other types of hazards and disasters

     Brief information is on the following:
     - Other natural hazards of biological origin (human epidemics and pandemics, exotic animal diseases, insect and vermin plagues), extreme cold (meteorological), effects of severe frosts, asteroids and comets (extraterrestrial)
     - Human-caused hazards and disasters – urban structure fires and terrorist bombings and shooting massacres
     - Technological hazards and disasters – transport accidents (rail, bridge), nuclear power accidents, hazardous materials (toxic emissions)

     Chapter 13: Australian emergency and disaster management arrangements

     This chapter informs that while the States and Territories have prime responsibilities to protect life, property and environment; the Australian Government, through Emergency Management Australia (EMA), supports the States and Territories; and diverse professional and volunteer organisations help when disaster strikes. There is further information on the history of the EMA, its mission and leadership role, and detailed plans in readiness to respond to emergencies in a coordinated way.

     ANNEX A Selected disasters in Australia 1945 to Feb 2005
     ANNEX B Suggested activities for students

2. Alignment to Australian Curriculum v9

The resource has the potential to align to the following learning areas for Years 7 to 10:

- Health and Physical Education (see Appendix 1)
- Geography (see Appendix 2)
- Technologies – Design and technologies (see Appendix 3)
- Science (see Appendix 4)

3. Actions to align

1. It is recommended that consideration be given to the following actions:
   - Decide which learning areas are best supported by the desired content
   - Engage with the year 7 to 10 achievement standards in the selected learning area/s and aligned content descriptions to determine those that can embrace desired hazards and disaster-related content
   - Aim to develop both the knowledge and skills relevant to the selected AC learning areas, including the general capabilities, particularly Personal and social capability, Ethical understanding, Literacy and Numeracy
   - Articulate the educative purpose – that is, how the learning is aligned to each learning area (e.g. state the learning area, year or band, aspect/s of achievement standard, content description/s and code)
   - Take a strengths-based approach (an AC: HPE proposition)
     - provide activities (discussion questions, scenarios) that support students to critique and/or find solutions and plans of action that might work for them as individuals (rather than promoting a "one-size-fits-all" approach to being safe);
     - task students to investigate how disaster management community resources and organizations contribute to the health, safety and wellbeing of families and communities, including how to access them.
   - Develop (health) literacy
     - provide opportunities to access, critique and use relevant and meaningful (health) information and support networks
     - encourage students to apply their health / geographic/ science knowledge and skills in a variety of complex and meaningful contexts – (for example, scenarios).
   - Develop numeracy
     - Provide data for students to interpret
   - Take a critical inquiry approach (a HPE learning area proposition)
     - provide opportunities for students to challenge, question and interrogate knowledge and assumptions in the health, geographic, scientific and or technology fields
     - encourage students to use a critical lens when interrogating information and ideas commonly expressed in society (Why is it unsafe to cross a flooded causeway?)
     - challenge students to recognise that being and staying healthy, safe and well in a disaster are shaped by a range of contextual factors, some of which are out of an individual's control.

4. School use of a revised resource

- Schools may choose to use the resource as a student and or teacher reference to support a specific learning area unit or integrated unit:
  - scenarios to support safety education in HPE
  - technical information to support geography, science or technology learning
  - data interpretation

5. Other actions

- Update: technical information, case studies and Annex A (selected disasters in Australia 1945 to Feb 2005)
- Annex B – Suggested activities for students: Consider developing learning area specific activities (as per Actions to align on previous page)
- Review and revise 'Further information' section (ie expand State and Territory organizations)
- Consider developing a hub / website rather than a booklet

Appendix 1: Australian Curriculum: Health and Physical Education – Version 9 (Extracts)

Rationale (extract): …..Health and Physical Education (HPE) addresses factors that influence the health, safety, relationships, wellbeing and physical activity patterns of individuals, groups and communities.

Aims (extract only)

HPE aims to enable students to:

- access, evaluate and synthesise information to make informed choices and act to enhance and advocate for their own and others' health, wellbeing, safety and physical activity participation
- develop and use personal, social and cognitive skills and strategies to promote self-identity and wellbeing, and to build and manage respectful relationships

Focus areas of relevance

- **Mental health and wellbeing**

This focus area addresses how mental health and wellbeing can be enhanced and strengthened at an individual and community level. The content teaches students to maintain and enhance their own mental health and wellbeing, and to support that of others.

It is expected that students …. will learn about:

- resilience and skills that support resilient behaviour
- coping skills, help-seeking strategies and community support resources

- **Safety**

This focus area addresses safety issues that students may encounter in their daily lives. The content supports students to make safe decisions and behave in ways that protect their own safety and that of others.

It is expected that students ……will learn about:

- safe practices at school and home, in road or transport environments, in the outdoors, near water
- strategies for dealing with unsafe or uncomfortable situations
- protective behaviours and help-seeking strategies (saying no assertively, leaving situations that are unsafe or uncomfortable, telling a trusted adult, accessing credible information, seeking advice from a trusted friend,)
- safe practices when using digital tools and online services, including dealing with cyberbullying
- managing personal safety
- first aid and emergency care
- safety when participating in physical activity, including sun safety

AC: HPE Curriculum elements - Years 7–8

Band level description
The Years 7–8 curriculum builds on each student's prior learning. **During this time, a major influence on students is the world around them, and their peers become a key source of motivation and support when managing their health and wellbeing.** **Students reflect on factors that influence** their perception of themselves and **their capacity to be resilient. Students explore behavioural expectations for different social situations. They develop the knowledge, understanding and skills to recognise instances of disrespect,** ~~discrimination, harassment and violence,~~ **and to act assertively to support their own rights and feelings and those of others.** Students investigate a range of health issues relevant to young people to understand the choices people make about their health and wellbeing. They examine the factors that can influence an individual's choices, and explore and evaluate options, consequences, and healthier and safer alternatives. Students continue to refine their health literacy skills as well as their understanding of the sources of support available, to seek early help when they or people around them need it. ..... Students have opportunities to practise using creative and collaborative processes to work in a group or team to communicate effectively, solve problems, resolve conflicts, and make decisions in ~~movement and~~ social contexts.

Achievement standard
By the end of Year 8, students analyse factors that influence identities, emotions and responses to change, and describe strategies to respond to these influences. They analyse how stereotypes, respect, empathy and valuing diversity influence relationships. Students analyse the effectiveness of assertive communication strategies, protective behaviours and help-seeking strategies applied online and offline. They analyse health information and messages to propose strategies that enhance their own and others' health, safety, relationships and wellbeing. Students apply and transfer movement skills and movement concepts across a range of situations. They implement and evaluate the effectiveness of movement strategies on movement outcomes. Students propose and evaluate strategies designed to achieve personal health, fitness and wellbeing outcomes. They select, use and refine strategies to support inclusion, fair play and collaboration across a range of movement contexts.

Strand: Personal, social and community health	Years 7–8
Sub-strand: Making healthy and safe choices	
Content descriptions *Students learn to:*	**Content elaborations** *This may involve students:*
refine protective behaviours and evaluate community resources to seek help for themselves and others AC9HP8P08	• exploring different strategies they can use, and resources or help sites they can access or refer others to, if they are experiencing symptoms of anxiety or depression • exploring help-seeking scenarios young people may encounter and sharing strategies for dealing with each situation, including situations linked to safety and risk-taking
investigate how media and influential people impact attitudes, beliefs, decisions and behaviours in relation to health, safety, ~~relationships~~ and wellbeing AC9HP8P09	• analysing the credibility, validity and relevance of health messages conveyed by different sources (including news sites, bloggers, influencers and social media advertising) and applying credible information to health-related decisions
plan and implement strategies, using health resources, to enhance their own and others' health, safety~~, relationships~~ and wellbeing AC9HP8P10	• proposing and implementing actions and behaviours that promote safe participation in physical activities, and evaluating the impact participation can have on their own and others' mood and mental wellbeing • investigating preventive health practices relevant to young people, and designing and implementing health promotion activities targeting these practices • investigating different approaches and developing personal plans for promoting their own positive mental health and wellbeing, such as mindfulness, relaxation techniques and healthy eating

AC: HPE Curriculum elements - Years 9–10

Band level description
The Years 9–10 curriculum builds on each student's prior learning. During this time, students refine their understanding of how they can contribute to individual and community health and wellbeing. Students have frequent opportunities to participate in physical activities, including in outdoor settings, to value the importance of active recreation as a way of enhancing their health and wellbeing throughout their lives. Students explore practical and creative actions that promote their own health and wellbeing and that of their wider community, such as designing spaces promoting physical activity, active transport options and sustainable strategies for selecting food sources. Practical learning experiences in these years support students to plan, implement, monitor and evaluate personal habits to enhance their wellbeing. Students explore how societal attitudes and values can reinforce stereotypes and role expectations. They investigate how these can impact young people's choices in relation to health behaviours, healthcare options, help-seeking strategies and physical activity participation. Students investigate a range of health issues relevant to young people, including mental health, sexual health, healthy eating, personal and relationship safety, body image and behaviours associated with substance use. As they do so, students further refine their help-seeking strategies, assertive behaviours, conflict resolution and negotiation. Students have opportunities to explore the nature and benefits of respectful relationships. They further develop skills to manage their relationships as they change over time. They have opportunities to explore empathy, ethical decision-making, respect and consent, and analyse the role they play in establishing and maintaining respectful relationships. Students practise and refine more specialised movement skills and complex movement strategies and concepts in different movement environments. They apply movement concepts and strategies to evaluate and refine their own and others' movement performances. Students further investigate techniques to assess the quality of movement performances. They adapt and improvise their movements to respond to different movement situations, stimuli and challenges. Students refine and consolidate their leadership, teamwork and collaborative skills through participation in a range of physical activities.
Achievement standard
By the end of Year 10, students propose and evaluate personal strategies to manage their identities, emotions and responses to change. They evaluate how attitudes and beliefs about equality, respect, diversity and inclusion influence the nature and quality of relationships. Students propose and justify strategies to manage ~~online and~~ offline situations where their own or others' health, safety, relationships or wellbeing may be at risk. They synthesise health information from credible sources to propose and justify strategies to enhance their own and others' health, safety, relationships and wellbeing. Students evaluate and refine their own and others' movement skills and performances, and apply movement concepts in challenging or unfamiliar situations. They adapt and transfer movement strategies to unfamiliar situations to achieve successful outcomes. Students propose and evaluate community-based physical activity interventions designed to improve the health, fitness and wellbeing of themselves and others. They apply and evaluate leadership approaches, collaboration strategies and ethical behaviours across a range of movement contexts.

Strand: Personal, social and community health	Years 9–10
Sub-strand: Making healthy and safe choices	
Content descriptions *Students learn to:*	**Content elaborations** *This may involve students:*
plan, rehearse and evaluate strategies for managing situations where their own or others' health, safety or wellbeing may be at risk AC9HP10P08	• critiquing the appropriateness and effectiveness of help and support services available for young people in the local community • proposing and practising a range of realistic responses to scenarios where peers are encouraging them to take unnecessary risks, such as *[playing in flood waters]* • planning and practising responses to emergencies where they may be required to administer first aid to a friend or stranger, including CPR
critique health information, services and media messaging about ~~relationships,~~ lifestyle choices, health decisions and behaviours to evaluate their influence on individual attitudes and actions AC9HP10P09	• critiquing health information and services that provide advice and support on issues targeted at specific groups of young people, including support with……personal safety • evaluating strategies and actions to increase personal safety and planning to promote these in the school and community
plan, justify and critique strategies to enhance their own and others' health, safety, relationships and wellbeing AC9HP10P10	• investigating community-action initiatives young people have started that have a positive influence on the health and wellbeing of their communities

Appendix 2: Australian Curriculum: Geography – Version 9

Aims

Geography aims to ensure that students develop:

- a sense of wonder and curiosity about, and respect for, places, people, cultures and environments throughout the world
- a deep geographical knowledge of their own locality, Australia, the countries of Asia and the world
- the ability to inquire and think geographically, using the geographical concepts of place, space, environment, scale, change, interconnections and sustainability
- the capacity to be competent, critical and creative users of geographical methods and skills, including questioning and researching, interpreting and analysing, concluding and decision-making, and communicating effectively
- an appreciation for the nature of geographical phenomena and challenges, and their impact on people's lives, places and environments
- capabilities to engage in everyday life, including critical and creative thinking, ethical understanding and intercultural understanding.

AC: Geography Curriculum elements

Year 7

Year level description
The Year 7 curriculum involves the study of 2 topics. **Water in the world** – focuses on the many uses of water, the ways it is perceived and valued, and the hazards associated with environmental processes. Students examine the distribution of its different forms as a resource, its varying availability in time and across space, and its scarcity. They also explore the ways water connects and changes places as it moves through the environment, and the impact of water-related hazards on human–environment relationships. It is suggested that the study of this topic draws on studies from Australia and countries in Asia. **Place and liveability** – focuses on the factors that influence liveability, how it is perceived, and the idea that places provide us with the services and facilities needed to support and enhance our lives. Students examine the distribution of these spaces, and how they are planned and managed by people. They also consider the ways that the liveability of a place is enhanced and how sustainability is managed. It is suggested that the study of this topic draws on studies from Australia and countries in Europe. Inquiry questions provide a framework for developing students' knowledge, understanding and skills. The following inquiry questions are examples only and may be used or adapted to suit local contexts. • What approaches can be used to improve the availability of resources and access to services? • How does people's reliance on places and environments influence their perception of them? • What effect does the uneven distribution of resources and services have on the lives of people?
Achievement standard
By the end of Year 7, students describe how the characteristics of places are perceived and valued differently by people. They describe the importance of environments to people. They describe the features of a distribution. They explain the interconnections between people and places and environments, and describe how these interconnections change places or environments. Students describe a response or strategy to address a geographical phenomenon or challenge. Students develop questions about a geographical phenomenon or challenge. They collect, organise and represent relevant data and information, using primary research methods and secondary research materials. They identify similarities and differences, and describe patterns in data and information. They draw conclusions about the impact of the geographical phenomenon or challenge on people, places and environments. They develop a strategy for action. Students use geographical knowledge, concepts, terms and relevant findings from sources to create descriptions, explanations and responses.

Strand: Knowledge and understanding	Year 7
Sub-strand: Water in the world	
Content descriptions *Students learn about:*	**Content elaborations** *This may involve students:*
classification of environmental resources and the way that water connects and changes places as it moves through environments AC9HG7K01	• explaining how moving water changes places; for example, moving water causes soil and rock erosion or cuts valleys into mountains
the location and distribution of water resources in Australia, their implications, and strategies to manage the sustainability of water AC9HG7K02	• representing the location of Australia's water resources, such as surface water and groundwater • describing the distribution of Australia's water resources and its implications for people; for example, limited access to water for people in rural and remote places and its implications • identifying the causes of variability in water resources or water scarcity; for example, an absolute shortage of water (physical cause), inadequate development of water resources (economic cause), or the ways water is used (such as farming, industry, drinking, washing or watering) • explaining the factors that contribute to variability in water resources or water scarcity; for example, location, climate, topography, seasonality or evaporation • examining why water is a difficult resource for communities to manage and sustain; for example, because of its shared and competing uses, and variability of supply over time • examining how a strategy may manage the sustainability of water resources; for example, recycling ("grey water"), stormwater harvesting and re-use, desalination, inter-regional transfer of water and trade in virtual water, and reducing water consumption
the causes and impacts of an atmospheric or hydrological hazard, and responses from communities and governments AC9HG7K04	• explaining the environmental processes that cause a hazard, such as drought, storms, tropical cyclones or floods • explaining how the impacts of a hazard on people and the environment are influenced by environmental, social or economic factors • identifying examples of responses to a hazard from the community and the government at the local scale, and identifying practices that increased effectiveness • reflecting on the principles of prevention, mitigation and preparedness in responses from the community and the government to explain how the impact of a hazard can be reduced

Sub-strand: Place and liveability	
factors that influence the decisions people make about where to live, including perceptions of the liveability of places and the influence of environmental quality AC9HG7K05	• examining the influence of environmental quality on decisions people make about where to live; for example, clean land, air and water, views, recreation facilities and favourable climate
strategies used to enhance the liveability of a place, including for young people, the aged or those with disability, drawing on studies such as those from Australia or Europe AC9HG7K08	• identifying strategies implemented in Australia or a country in Europe to improve the liveability of a place (for example, improving public spaces, walkability, transport connections or waste disposal and recycling) and consider applicability to their own locality • developing a strategy to improve an aspect of liveability at the local scale, taking into account the needs of diverse groups in the community, including young people (for example, through fieldwork in the local recreation area) or Traditional Owners (for example, developing bilingual signage or garden projects in the local area with First Nations Australians) • evaluating a strategy to improve the liveability of a place using criteria, and deciding on its applicability to their own locality

AC: Geography Curriculum elements

Year 8

Year level description
The Year 8 curriculum involves the study of 2 topics. **Landforms and landscapes** – focuses on the processes that shape individual landforms, the values and meanings placed on landforms and landscapes by diverse cultures, and hazards associated with landscapes. Students explore the distribution of Australia's distinctive landscapes and significant landforms. They also consider the ways that the sustainability of significant landscapes and the impacts of hazards are managed. It is suggested that the study of this topic draws on studies from Australia and countries in Asia. **Changing nations** – focuses on the changing human geography of countries with the process of urbanisation, the reasons for the high level of urban concentration in Australia, and the influences of internal and international migration. Students can examine the distribution of population in Australia compared to other countries and shifts in population distribution over time. They also focus on the ways that sustainability of Australia's urban areas is managed. It is suggested that the study of this topic draws on studies from Australia, the United States of America and a country in Asia. Inquiry questions provide a framework for developing students' knowledge, understanding and skills. The following inquiry questions are examples only and may be used or adapted to suit local contexts. • How do environmental and human processes affect the characteristics of places and environments? • How do the interconnections between places, people and environments affect the lives of people? • What are the consequences of changes to places and environments, and how can these changes be managed?
Achievement standard
By the end of Year 8, students explain how the interactions of people and environmental processes impact on the characteristics of places. They explain how the characteristics of places are perceived and valued differently by people. **They describe the effects of human activity or hazards on environments**. They explain the features of a distribution and identify implications. **They explain the interconnections between people and places and environments. They explain how these interconnections change places or environments. Students explain responses or strategies to address a geographical phenomenon or challenge, referring to environmental, economic or social factors.** Students develop relevant questions about a geographical phenomenon or challenge. They collect, organise and represent relevant and reliable data and information, using primary research methods and secondary research materials. They interpret and analyse data and information to explain patterns and trends and infer relationships. They draw reasoned conclusions about the impact of the geographical phenomenon or challenge. They decide on appropriate strategies for action and explain potential impacts. Students use geographical knowledge, methods, concepts, terms and reference findings from sources to create descriptions, explanations and responses.

Strand: Knowledge and understanding	Year 8
Sub-strand: Landscapes and landforms	
Content descriptions *Students learn about:*	**Content elaborations** *This may involve students:*
geomorphological processes that produce different landscapes and significant landforms AC9HG8K01	• explaining how tectonics, volcanism, folding, faulting, chemical weathering and physical weathering such as erosion, transportation and deposition shape places; for example, folding – MacDonnell Ranges, Northern Territory, Australia; faulting – Great Sumatran Fault (Semangko Fault), Indonesia; volcanism – Krakatoa, Indonesia • explaining the effects of erosion, transportation and deposition of water and wind on a selected landform at the local scale; for example, Fraser Island, Queensland, formed by wind, waves and ocean currents; the Twelve Apostles, Victoria, formed by erosion, tides and ocean currents
the interconnections between human activity and geomorphological processes, and ways of managing distinctive landscapes AC9HG8K04	• identifying the interconnections and effects of erosion and sedimentation produced by human activities on the quality of the environment; for example, the effects of overuse of tourist tracks in bushland or the effects of land-clearing for the production of palm oil in Indonesia and Malaysia • explaining the interconnections and effects of mining, quarrying and urban development on the quality of the environment; for example, the interconnections of the quality of the environment and uranium mining in Kakadu, urban development in Singapore or the extension of land area in Tokyo Bay • explaining the effects of river regulation, including dams, locks, channel straightening and drains, on the quality of riverine and wetland environments; for example, the Three Gorges Dam on the Yangtze River in China, or dams and weirs on the Murray–Darling river system
the causes and impacts of a geomorphological hazard on people, places and environments, and the effects of responses AC9HG8K05	• identifying the causes of a geomorphological hazard such as a volcanic eruption, earthquake, tsunami, landslide or avalanche • examining the environmental, economic or social impacts of a hazard at the local scale; for example, where people choose to live; the negative consequences for human wellbeing including loss of industry and unemployment; and lack of infrastructure and resources to prepare and respond to hazards • reflecting on observations of a location where the environment has been altered by human activities to explain how the change has heightened the impact of a hazard • reflecting on the principles of prevention, mitigation and preparedness to explain how the harmful effects of a hazard can be reduced by the implementation of a management strategy

AC: Geography Curriculum elements

Year 9

Year level description
The Year 9 curriculum involves the study of 2 topics. **Biomes and food security** – focuses on the biomes of the world, their characteristics and significance as a source of food and fibre. Students examine the distribution of biomes as regions, and their contribution to food production and food security. They consider the effects of the alteration of biomes, and the environmental challenges and constraints of expanding sustainable food production in the future. It is suggested that the study of this topic draws on studies from Australia and countries in Asia. ~~**Geographies of interconnections** – focuses on how people, through their choices and actions, are connected to places throughout the world in a wide variety of ways, and how these connections help to make and change places and their environments. Students examine the nature of these connections between people and places through the products people buy and the effects of their production on the places that make them. Students consider the management of the impacts of tourism and trade on places.~~ ~~It is suggested that the study of this topic draws on studies from Australia and other countries.~~ Inquiry questions provide a framework for developing students' knowledge, understanding and skills. The following inquiry questions are examples only and may be used or adapted to suit local contexts. • What are the causes and consequences of change in places and environments, and how can this change be managed? • What are the future implications of changes to places and environments? • Why are interconnections and interdependencies important for the future of places and environments?
Achievement standard
By the end of Year 9, students explain how peoples' activities or environmental processes change the characteristics of places. They explain the effects of human activity on environments, and the effects of environments on human activity. They explain the features of biomes' distribution and identify implications for environments. They analyse the interconnections between people and places and environments. They identify and explain how these interconnections influence people, and change places and environments. **Students analyse strategies to address a geographical phenomenon or challenge using environmental**, social or economic criteria. Students develop a range of questions about a geographical phenomenon or challenge. They collect, represent and compare relevant and reliable geographical data and information by using a range of primary research methods and secondary research materials in a range of formats. They interpret and analyse data and information to explain patterns and trends and infer relationships. They draw evidence-based conclusions about the impact of the geographical phenomenon or challenge. They develop and evaluate strategies, predict impacts and make a recommendation. Students use geographical knowledge, concepts, terms and digital tools as appropriate to develop descriptions, explanations and responses that acknowledge research findings.

Strand: Knowledge and understanding	Year 9
Sub-strand: Biomes and food security	
Content descriptions *Students learn about:*	**Content elaborations** *This may involve students:*
the distribution and characteristics of biomes as regions with distinctive climates, soils, vegetation and productivity AC9HG9K01	• identifying and describing the major aquatic and terrestrial biomes of Australia and other areas of the world, and mapping their distribution • interpreting and explaining patterns and trends in the productivity of the major aquatic and terrestrial biomes in Australia compared with a country in Asia • explaining the effects of interconnections between environmental processes (atmosphere, hydrosphere, lithosphere and biosphere) and human activities such as deforestation, mining and agriculture on the characteristics of biomes
the effects on environments of human alteration of biomes to produce food, industrial materials and fibres AC9HG9K02	• identifying the biomes in Australia and a country in Asia that produce some of the foods and plant material people consume • explaining the differences between natural and agricultural ecosystems in flows of nutrients and water, and in biodiversity; for example, the tropical rainforest biome in Indonesia produces food such as fruit, grains, nuts, vegetables and spices, and non-food products such as wood, rubber, coffee, chocolate and palm oil • explaining how human alteration of biomes (for example, drip irrigation, fertilisers, pesticides, genetically modified seeds, agrobiotics, terracing, and controlling erosion and overgrazing) has increased agricultural productivity in Australia and a country in Asia
the environmental, economic and technological factors that impact agricultural productivity, in Australia and a country in Asia AC9HG9K03	• examining how environmental factors, such as climate, soil, landform, water and hazards, support higher agricultural production, such as wheat, rice and maize, in Australia and a country in Asia • examining how agricultural innovations have reduced environmental limitations on food production in Australia and a country in Asia; for example, increased food production due to research into and development of high-yielding and genetically engineered pest resistant varieties, construction of drip irrigation systems, and the use of stubble mulching, intercropping, agroforestry and crop rotation • explaining the impact of the interconnections between environmental, economic and technological factors on the yield of a particular crop, such as wheat, rice or maize, in Australia

challenges to sustainable food production and food security in Australia and appropriate management strategies AC9HG9K04	• examining environmental impacts of changes to food production causing a decline in the capacity of the land to provide agricultural products; for example, land and water degradation such as soil erosion, salinity and desertification, shortage of fresh water, competing land uses, climate change and pollution contribute to a decrease in food production • examining economic and social impacts of changes to food production; for example, competing land uses such as urban and industrial uses, and recreation activities • examining the impacts of modifications to biomes on the productivity and availability of staple resources for First Nations Australians; for example, reduced access to bush food such as myrrnong (yam daisy) in Victoria or cycads, bunya nuts and wongi plums in northern Australia • examining management strategies that improve food security; for example, efforts to reduce food wastage, government policies or trade barriers • explaining management strategies that restore the quality or diversity of agriculture in Australia; for example, improving the function of natural biomes and anthropogenic biomes, monitoring land management practices, improving the condition of the soil or building the capability of farmers • generating ideas for a strategy to expand agricultural production in Australia; for example, market bush food such as herbs and wattle seed, invest in research, support farm innovations or develop the expertise of farmers
Sub-strand: Geographies of interconnections	
the impacts of the production and consumption of goods on places throughout the world, and strategies to manage sustainability in these places AC9HG9K08	• examining the effects on people, places or environments of mining, farming, forestry or the production of manufactured goods • explaining the environmental effects of the production and distribution of consumer products and services on the places that produce the raw materials, the people who make the products, and the environments that receive the waste at the end of the products' life; for example, the environmental effects of an e-waste supply chain from mining, production and sales to waste disposal • evaluating the environmental, economic and social impacts of the global oil supply chain, from where the resource is extracted, processed and sold, and how impacts could be sustainably managed in Australia and in West Asia • examining a strategy used by local, state or national governments to manage waste in one of Australia's cities or regional urban centres, and identifying implications for sustainability (environmental, economic and social factors)

AC: Geography Curriculum elements

Year 10

Year level description
The Year 10 curriculum involves the study of 2 topics. **Environmental change and management** – focuses on the environmental functions that support all life, the major challenges to their sustainability, and the environmental world views that influence how people perceive and respond to these challenges. Students have the opportunity to examine the causes and consequences of a change within the context of a specific environment and the strategies to manage the change. It is suggested that the study of this topic draws on studies from within Australia, and other countries. **Geographies of human wellbeing** – focuses on global, national and local differences in human wellbeing between places, the different measures of human wellbeing, and the causes of global differences in measurements between countries. Students consider the spatial differences in wellbeing within and between countries, and programs designed to reduce the gap between differences in wellbeing. It is suggested that the study of this topic draws on studies from within Australia, India and another country in Asia or the Pacific. Inquiry questions provide a framework for developing students' knowledge, understanding and skills. The following inquiry questions are examples only and may be used or adapted to suit local contexts. • How can the spatial variation between places and changes in environments be explained? • What management options exist for sustaining human and natural systems into the future? • How do world views influence decisions on how to manage environmental and social change?
Achievement standard
By the end of Year 10, students explain how the interactions of people and environmental processes at different scales change the characteristics of places. They explain the effects of human activity on environments, and the effect of environments on human activity, over time. They evaluate the implications of a distribution. They evaluate the extent of interconnections occurring between people and places and environments. They analyse changes that result from these interconnections and their consequences. Students evaluate strategies to address a geographical phenomenon or challenge, using environmental, social and economic criteria. Students develop a range of relevant questions about a geographical phenomenon or challenge. They collect, represent and compare relevant and reliable geographical data and information by using a range of primary research methods and secondary research materials, using appropriate formats. They interpret and analyse data and information to make generalisations and predictions, explain significant patterns and trends, and infer relationships. They draw evidence-based conclusions, based on relevant data and information, about the impact of the geographical phenomenon or challenge. They develop and evaluate strategies using criteria, recommend a strategy and explain the predicted impacts. Students use geographical knowledge, concepts, terms and digital tools as appropriate to develop descriptions, explanations and responses that synthesise research findings.

Strand: Knowledge and understanding	Year 10
Sub-strand: Environmental change and management	
Content descriptions *Students learn about:*	**Content elaborations** *This may involve students:*
the human-induced changes that challenge the sustainability of places and environments AC9HG10K01	• identifying tensions between the conflicting perspectives of individuals, communities and governments on the use of sustainable practices • explaining the nature of human-induced environmental changes (for example, water and atmospheric pollution; loss of biodiversity; degradation of land and aquatic environments) and the challenges they pose for sustainability • discussing the concept of sustainability in relation to environmental functions and identifying tensions between the conflicting perspectives of communities, businesses and government
the environmental world views of people and their implications for environmental management AC9HG10K02	• discussing the influence of people's environmental world views (human-centred and earth-centred) regarding environmental management • comparing differences in people's views about the causes of an environmental issue of personal, national and global importance • discussing whether environmental change is necessarily a problem that should be managed and explaining people's choices of methods for managing or responding to environmental changes
First Nations Australians' approaches to custodial responsibility and environmental management in different regions of Australia AC9HG10K03	• identifying the influence of cultural values on how First Nations Australians manage environments (for example, continuity of cultural practices, management or development of Country/Place, and land tenure systems) and explaining custodial responsibilities for a Country/Place • discussing the role of First Nations Australian Park Rangers and their cultural knowledge and practices in the management of their Country/Place and environments • explaining First Nations Australians' models of sustainability, which contribute to broader conservation practices; for example, obligations to Country/Place, land management and care practices such as cleaning up the land and fire management, removal of weeds and rubbish, protection of threatened species, and capacity building within their communities

causes and effects of a change in an identified environment at a local, national or global scale, and strategies to manage sustainability AC9HG10K04	• identifying a context to be studied, describing the causes of the environmental change and impacts for the sustainability of its functions (resource, service or spiritual) • recognising and discussing the influence of people's world views on how management strategies are developed and implemented • proposing strategies to manage the effects of environmental change; for example, environmental strategies – establishing marine reserves, national parks, World Heritage sites or ecosystem-based management; spatial strategies – corridors to preserve flora and fauna or urban planning to reduce energy consumption; holistic thinking – addressing past and present causes of environmental change • comparing management strategies in Australia with strategies in another country for human-induced environmental change, using criteria; for example, managing waste in Australia compared with India's rubbish pickers or managing floods in Australia compared to floods in China • explaining how Traditional Owners, communities, developers, governments and non-government organisations use environmental, economic and social criteria, and consider trade-offs when making decisions
Sub-strand: Geographies of human wellbeing	
reasons for, and consequences of, spatial variations in human wellbeing in Australia, including for First Nations Australians AC9HG10K07	• explaining how a person's wellbeing is influenced by where they live, with reference to interconnections of environmental, economic, social and technological factors in at least 2 different places in Australia, such as urban and remote places

Appendix 3: Australian Curriculum: Science – Version 9

Aims

Science aims to ensure that students develop:

- an interest in science as a way of expanding their curiosity and willingness to explore, ask questions about and speculate on the changing world they live in
- a solid foundation of knowledge of the biological, Earth and space, physical and chemical sciences, including being able to select and integrate scientific knowledge and practices to explain and predict phenomena and to apply understanding to new situations and events
- an understanding of scientific inquiry and the ability to use a range of scientific inquiry practices, including questioning; planning and conducting experiments and investigations based on ethical and interculturally aware principles; generating and analysing data; evaluating results; and drawing critical, evidence-based conclusions
- an ability to communicate scientific understanding and findings to a range of audiences, to justify claims with evidence, and to evaluate and debate scientific explanations and arguments
- an ability to solve problems and make informed decisions about current and future uses of science while taking into account ethical, environmental, social and economic implications of decisions
- an understanding of the dynamic nature of science knowledge including historical and global contributions, and an understanding of the relationship between science and society including the diversity of science careers.

AC: Science - Curriculum elements

Year 7

Year level description
In Year 7 students explore the diversity of life on Earth and continue to develop their understanding of the role of classification in ordering and organising information. They use and develop models to represent and analyse the flow of energy and matter through ecosystems and explore the impact of changing components within these systems. They investigate relationships in the Earth-sun-moon system and use models to predict and explain events. They extend their understanding of the particulate nature of matter and explore how interactions of matter and energy at the sub-microscopic scale determine macroscopic properties. They consider the effects of multiple forces when explaining changes in an object's motion. Students make accurate measurements and analyse relationships between system components. They construct and use models to test hypotheses about phenomena at scales that are difficult to study directly and use these observations and other evidence to draw conclusions. They begin to understand the relationship between science and society and appreciate the need for ethical and cultural considerations when acquiring data. Inquiry questions can help excite students' curiosity and challenge their thinking. Following are examples of inquiry questions that could be used to prompt discussion and exploration: • Mosquitoes are so annoying! What would the impact be if we got rid of them? • What would Australian ecosystems look like without fire? • How do simple machines make our lives easier? • Why is being able to separate mixtures important? • How have systems of classification changed over time? How do they differ across cultures?
Achievement standard
By the end of Year 7 students explain how biological diversity is ordered and organised. They represent flows of matter and energy in ecosystems and predict the effects of environmental changes. They model cycles in the Earth-sun-moon system and explain the effects of these cycles on Earth phenomena. They represent and explain the effects of forces acting on objects. They use particle theory to explain the physical properties of substances and develop processes that separate mixtures. Students identify the factors that can influence development of and lead to changes in scientific knowledge. They explain how scientific responses are developed and can impact society. They explain the role of science communication in shaping viewpoints, policies and regulations. Students plan and conduct safe, reproducible investigations to test relationships and aspects of scientific models. They identify potential ethical issues and intercultural considerations required for field locations or use of secondary data. They use equipment to generate and record data with precision. They select and construct appropriate representations to organise data and information. They process data and information and analyse it to describe patterns, trends and relationships. They identify possible sources of error in methods and identify unanswered questions in conclusions and claims. They identify evidence to support their conclusions and construct arguments to support or dispute claims. They select and use language and text features appropriately for their purpose and audience when communicating their ideas and findings.

Strand: Science understanding	Year 7
Sub-strand: Biological sciences	
Content descriptions *Students learn to:*	**Content elaborations** *This may involve students:*
~~investigate the role of classification in ordering and organising the diversity of life on Earth and use and develop classification tools including dichotomous keys~~ ~~AC9S7U01~~	• ~~observing and identifying the similarities and differences of particular features within and between groups of organisms~~ • ~~creating and modifying a dichotomous key to classify organisms into groups and groups within groups~~ • ~~naming and classifying species using scientific conventions from the Linnaean hierarchical classification system, such as kingdom, phylum, class, order, family, genus, species~~ • ~~considering the reasons for classifying living things, such as identification and communication~~ • ~~examining how biological classification has changed over time through improvements in microscopy~~ • ~~using provided dichotomous keys to identify organisms surveyed on a field trip~~ • ~~investigating First Nations Australians' systems of classifying living things and how these systems differ from those used by contemporary science~~
use models, including food webs, to represent matter and energy flow in ecosystems and predict the impact of changing abiotic and biotic factors on populations AC9S7U02	• ~~analysing food webs to show feeding relationships between organisms in an ecosystem and the role of microorganisms~~ • ~~modelling how energy flows into and out of an ecosystem via the pathways of food webs~~ • predicting the effects on local ecosystems when living things such pollinators or predators are removed from or die out in an area • examining how events such as seasonal changes, destruction of habitat or introduction of a species impact abiotic and biotic factors and cause changes to populations • investigating First Nations Australians' responses to invasive species and their effect on food webs that many communities are a part of, and depend on, for produce and medicine • considering how First Nations Australians' fire management practices over tens of thousands of years have changed the distribution of flora and fauna in most regions of Australia
Sub-strand: Earth and space sciences	

~~model cyclic changes in the relative positions of the Earth, sun and moon and explain how these cycles cause eclipses and influence predictable phenomena on Earth, including seasons and tides~~ ~~AC9S7U03~~	• ~~using physical models or virtual simulations to explain how Earth's tilt and position relative to the sun causes differences in light intensity on Earth's surface, resulting in seasons~~ • ~~examining the effect of the gravitational attraction of the moon and the sun on Earth's oceans and describing how the relative positions of the moon and sun with respect to Earth result in tidal variations~~ • ~~using physical models or virtual simulations to explain the cyclic patterns of lunar phases and eclipses of the sun and moon~~ • ~~researching knowledges held by First Nations Australians regarding the phases of the moon and the connection between the lunar cycle and ocean tides~~ • ~~investigating First Nations Australians' calendars and how they are used to predict seasonal changes~~ • ~~researching First Nations Australians' oral traditions and cultural recordings of solar and lunar eclipses and investigating similarities and differences with contemporary understandings of such phenomena~~
Sub-strand: Physical sciences	
investigate and represent balanced and unbalanced forces, including gravitational force, acting on objects, and relate changes in an object's motion to its mass and the magnitude and direction of forces acting on it AC9S7U04	• investigating the effects of applying different forces to familiar objects of the same and different mass • analysing the effect of balanced and unbalanced forces on an object's motion, such as starting, stopping and changing direction • measuring the magnitude of a force using a force meter and representing the magnitude and direction of forces acting on an object using force arrow diagrams • ~~investigating how Earth's gravitational force is the attractive force which pulls objects to the centre of Earth and its magnitude is related to the mass of an object~~ • ~~investigating how simple machines such as levers and pulleys are used to change the magnitude of force needed to perform a task~~ • ~~examining how gravity affects objects in space, including moons, planets, stars, galaxies and black holes~~ • ~~analysing the forces acting on boomerangs and how early First Peoples of Australia designed an air foil profile which allowed for multiple variations and applications~~ • ~~investigating the effect of forces through the application of simple machines, such as the bow and~~ arrows used by Torres Strait Islander Peoples or the spearthrowers used by First Peoples of Australia

Sub-strand: Use and influence of science

examine how proposed scientific responses to contemporary issues may impact on society and explore ethical, environmental, social and economic considerations AC9S7H03	• investigating how scientific knowledge that larger reserves are better for maintaining ecosystem function might interact with competing viewpoints, values and interests for land use when planning ecological reserves • ~~examining how laboratory grown meat might reduce impact on ecosystems and considering any social, ethical and economic implications of developing laboratory grown meat for wide consumption~~ • examining how the use of desalination plants to produce fresh water has impacted marine ecosystems where the desalination plants are located • ~~investigating the contributions of First Nations Australians' knowledges in the identification of medicinal properties of endemic plants and the ethical, environmental, social and economic implications of others using these knowledges~~ • investigating the ethical, environmental, social and economic implications of proposed scientific responses that involve cross-cultural partnerships and build on First Nations Australians' land management techniques • discussing how scientific knowledge of the forces involved in flight has led to changes in aircraft design and any ethical, environmental, social and economic considerations of these changes • ~~researching how properties of gases were utilised in the gas warfare in World War I and the subsequent development of the Geneva Protocol and the later adoption of the Chemical Weapons Convention international arms control treaty~~
explore the role of science communication in informing individual viewpoints and community policies and regulations AC9S7H04	• ~~investigating how, through two way approaches, First Nations Australians are communicating their knowledge and viewpoints, such as Caring for Country and Place initiatives to influence related policies~~ • examining how science communication of endangered species has led to policies and regulations related to fishing catch and hunting limits • exploring how Dame Jane Goodall's communication of her research resulted in changed individual viewpoints and conservation policies • examining how global reporting on high-impact weather events such as cyclones, tidal surges and heatwaves has led to the development of warning systems and evacuation policies • ~~reflecting on the role of contemporary First Nations Australians astronomers and astrophysicists, such as Wiradjuri astrophysicist and science communicator Kirsten Banks, in promoting First Nations astronomy knowledges and understandings~~ • investigating how science communication of the impact of waste materials on the environment has led to the adoption of community policies for separating household waste and encouraged other recycling initiatives

AC: Science - Curriculum elements

Year 8

Year level description
In Year 8 students are introduced to cells as microscopic structures that explain macroscopic features of living systems. They connect form and function at an organ level and explore the organisation of a body system in terms of flows of matter between interdependent organs. They continue to develop a view of Earth as a dynamic system, in which change occurs across a range of timescales. They classify different types of energy and describe the role of energy in causing change in systems, including the role of energy and forces in the geosphere. They learn to classify matter at the atomic level and distinguish between chemical and physical change. They understand that chemical reactions also involve energy. Students use experimentation to isolate relationships between components in systems and explain these relationships through increasingly complex representations. They consider the magnitude of properties and events and use appropriate units to describe proportional relationships. Inquiry questions can help excite students' curiosity and challenge their thinking. Following are examples of inquiry questions that could be used to prompt discussion and exploration: • Can we predict changes to the shape and position of continents? • Are facts enough? How much does science communication matter? • How can we tell if a substance has changed? • How can we best measure what we cannot directly see? • How is a leaf like a lung?
Achievement standard
By the end of Year 8 students explain the role of specialised cell structures and organelles in cellular function and analyse the relationship between structure and function at organ and body system levels. They apply an understanding of the theory of plate tectonics to explain patterns of change in the geosphere. They explain how the properties of rocks relate to their formation and influence their use. They compare different forms of energy and represent transfer and transformation of energy in simple systems. They classify and represent different types of matter and distinguish between physical and chemical change. Students analyse how different factors influence development of and lead to changes in scientific knowledge. They analyse the key considerations that inform scientific responses and how these responses impact society. They analyse the importance of science communication in shaping viewpoints, policies and regulations. Students plan and conduct safe, reproducible investigations to test relationships and explore models. They describe potential ethical issues and intercultural considerations needed for specific field locations or use of secondary data. They select and use equipment to generate and record data with precision. They select and construct appropriate representations to organise and process data and information. They analyse data and information to describe patterns, trends and relationships and identify anomalies. They identify assumptions and sources of error in methods and analyse conclusions and claims with reference to conflicting evidence and unanswered questions. They construct evidence-based arguments to support conclusions and evaluate claims. They select and use language and text features appropriately for their purpose when communicating their ideas, findings and arguments to specific audiences.

Sub-strand: Earth and space sciences	
investigate tectonic activity including the formation of geological features at divergent, convergent and transform plate boundaries and describe the scientific evidence for the theory of plate tectonics AC9S8U03	• examining patterns of earthquake and volcanic activity over time and proposing explanations • evaluating the impact of tectonic events on human populations and examining engineering solutions designed to reduce the impact • modelling interactions at plate boundaries • investigating the relative significance of different forces involved in tectonic plate movement including slab pull, ridge push and convection • relating the extreme age and stability of a large part of the Australian continent to its plate tectonic history • constructing a timeline of evidence to show the development of the theory of plate tectonics • exploring how geologist and oceanographic cartographer Marie Tharp's topographic maps of the Atlantic Ocean floor provided support for the acceptance of the theory of plate tectonics • researching First Nations Australians' cultural accounts that provide evidence of earthquakes and volcanoes
describe the key processes of the rock cycle, including the timescales over which they occur, and examine how the properties of sedimentary, igneous and metamorphic rocks reflect their formation and influence their use AC9S8U04	• ~~comparing the observable properties of different types of rocks and identifying them using a provided dichotomous key~~ • exploring the major processes of the rock cycle including weathering, erosion, deposition, melting, crystallisation, uplift, heat and pressure in the formation of different types of rocks • analysing the role of forces and heat energy in the formation of different types of rocks and comparing how quickly or slowly different processes can occur • ~~examining fossil evidence, such as body, trace or opalised fossils, to predict how and when a rock was formed~~ • ~~explaining the uses of different types of rocks with reference to their properties and formation~~ • ~~exploring the traditional geological knowledges of First Nations Australians that are used in the selection of different rock types for different purposes~~ • ~~investigating how First Nations Australians have used quarrying to access rocks for use as or production of everyday objects such as grindstones, hammerstones, anvils and cutting tools~~ • exploring how the mining of ores and minerals impacts on local environments and examining environmental rehabilitation initiatives

Sub-strand: Physical sciences	
classify different types of energy as kinetic or potential and investigate energy transfer and transformations in simple systems AC9S8U05	• investigating relationships between kinetic and potential energy in a simple system such as a roller-coaster or Newton's cradle • classifying types of energy as either kinetic energy such as movement, heat and electricity or potential energy such as chemical, elastic and gravitational • critiquing and using representations such as flow diagrams to illustrate changes between different forms of energy in a system • identifying where heat energy is produced as a by-product of energy transfer, such as filament light globes, exercise, and battery charging and use • using electrical circuits and components to demonstrate electrical energy transfer and its transformation into heat, light and sound • observing a Rube Goldberg machine and identifying the energy transfers and transformations involved • investigating traditional fire-starting methods used by First Nations Australians and their understandings of the transformation of energy
Sub-strand: Chemical sciences	
~~classify matter as elements, compounds or mixtures and compare different representations of these, including 2-dimensional and 3-dimensional models, symbols for elements and formulas for molecules and compounds~~ ~~AC9S8U06~~	• ~~using virtual and physical models to distinguish between elements and compounds in terms of types of atoms~~ • ~~examining how Dmitri Mendeleev arranged the elements in the first version of the periodic table and comparing his arrangement with the current version~~ • ~~explaining why elements are represented by symbols, compounds and molecules by formulas and mixtures by percentages~~ • ~~using representations to show the classification of matter as elements, compounds and different types of mixtures such as solutions, suspensions and colloids~~ • ~~examining the information conveyed by different types of representations of elements and compounds and identifying where and why these different representations are used~~ • ~~creating a timeline or models to show how the concept of an element has changed over time from Democritus to John Dalton~~

compare physical and chemical changes and identify indicators of energy change in chemical reactions AC9S8U07	• performing simple chemical reactions to identify the indicators of chemical change such as gas production, solid production, colour change and temperature change • analysing and interpreting data on the properties of substances before and after the substances interact to determine if a chemical or physical change has occurred • investigating and identifying energy changes in different chemical reactions such as differences in temperature • examining how the physical and chemical properties of a substance will affect its production or use • discussing where indicators of chemical change are used for identifying the presence of particular substances, such as in soil, water and medical testing kits

Strand: Science as a human endeavour	**Year 8**
Sub-strand: Nature and development of science	
Content descriptions *Students learn to:*	**Content elaborations** *This may involve students:*
explain how new evidence or different perspectives can lead to changes in scientific knowledge AC9S8H01	• ~~identifying how technological developments, such as those related to microscopes and medical imaging, have led to improved understanding of cells and organs~~ • ~~considering how advances in technologies have enabled the repair and replacement of organs using synthetic materials~~ • analysing how sustainability priorities such as efficiency and limiting environmental impact have led to innovative practices in mining and mine site regeneration • examining the evidence that led to the acceptance of the theory of plate tectonics over the idea of continental drift • ~~investigating how advances in deep Earth imaging techniques have enabled identification of mineral, energy and water resources beneath surface sedimentary rock~~ • ~~discussing the story of Sir Isaac Newton's discovery of gravity or the questions that Albert Einstein asked which led him to developing a new theory~~ • ~~researching why Dmitri Mendeleev developed a different representation of the periodic table~~

investigate how cultural perspectives and world views influence the development of scientific knowledge AC9S8H02	~~investigating how world views about the role of women lead to women scientists being placed in subordinate roles and 'written out' of history, a phenomenon known as the Matilda effect~~ • researching how cultural building techniques such as houses built of bamboo led to the development of structures and materials better able to withstand the effects of earthquakes ~~investigating how collaboration between Swami Vivekananda and Nikola Tesla, who held different world views, led to an exploration of the relationship between mass and energy~~ ~~analysing how world views relating to fairness in sport have led to the development of rapid chemical tests to identify performance enhancing drugs~~ ~~investigating how First Nations Australians develop material culture through holistic world views that employ multidisciplinary knowledges and skills~~
Sub-strand: Use and influence of science	
examine how proposed scientific responses to contemporary issues may impact on society and explore ethical, environmental, social and economic considerations AC9S8H03	~~researching and discussing ethical issues that arise from organ transplantation~~ • discussing how scientists' development of organoids has impacted on the ethical, environmental, social and economic issues that arise from using live animals in a laboratory to research diseases and treatments • investigating how scientific responses including new building materials, improved predictions and early warning systems have supported communities living in a country in the Asia-Pacific region located near plate boundaries, for example Japan, Indonesia or New Zealand • examining how the development of hybrid and solar, electric and hydrogen-powered vehicles are applications of contemporary science responses to the depletion of fossil fuels and exploring environmental considerations • exploring how the development of biodegradable materials has led to more sustainable packaging and reduction in landfill
explore the role of science communication in informing individual viewpoints and community policies and regulations AC9S8H04	~~investigating campaigns designed to increase rates of organ donation~~ • exploring how seismic data is collected and shared between governments across the Asia-Pacific region and how governments use this data including for tsunami alerts • investigating how promotion of biodegradable materials and the importance of using them has informed individual viewpoints ~~researching how science organisations and high profile science communicators such as Professor Lisa Harvey-Smith or Dr Karl Kruszelnicki influence people's attitudes to science~~

AC: Science - Curriculum elements

Year 9

Year level description
In Year 9 students consider the operation of systems at a range of scales and how those systems respond to external changes in order to maintain stability. They explore ways in which the human body system responds to changes in the external environment through physiological feedback mechanisms and the reproductive processes that enable a species to respond to a changing environment over time. They are introduced to the notion of the atom as a system of protons, electrons and neutrons, and how this system can change through nuclear decay. They learn that matter can be rearranged through chemical change and that these changes play an important role in many systems. They are introduced to the concepts of conservation of matter and energy and begin to develop a more sophisticated view of energy transfer. They explore these concepts as they relate to the global carbon cycle. Students begin to consider how well a sample or model represents the phenomena under study and use a range of evidence to support their conclusions. Inquiry questions can help excite students' curiosity and challenge their thinking. Following are examples of inquiry questions that could be used to prompt discussion and exploration: • Why was the discovery of neutrons important? • How is scientific consensus established? What if it isn't? • Could synthesised organs make organ donation obsolete? • How does the carbon cycle affect life on Earth? • How do different technologies help humans to communicate?
Achievement standard
By the end of Year 9 students explain how body systems provide a coordinated response to stimuli. They describe how the processes of sexual and asexual reproduction enable survival of the species. They explain how interactions within and between Earth's spheres affect the carbon cycle. They analyse energy conservation in simple systems and apply wave and particle models to describe energy transfer. They explain observable chemical processes in terms of changes in atomic structure, atomic rearrangement and mass. Students explain the role of publication and peer review in the development of scientific knowledge and explain the relationship between science, technologies and engineering. They analyse the different ways in which science and society are interconnected. Students plan and conduct safe, reproducible investigations to test or identify relationships and models. They describe how they have addressed any ethical and intercultural considerations when generating or using primary and secondary data. They select and use equipment to generate and record replicable data with precision. They select and construct appropriate representations to organise, process and summarise data and information. They analyse and connect data and information to identify and explain patterns, trends, relationships and anomalies. They analyse the impact of assumptions and sources of error in methods and evaluate the validity of conclusions and claims. They construct logical arguments based on evidence to support conclusions and evaluate claims. They select and use content, language and text features effectively to achieve their purpose when communicating their ideas, findings and arguments to specific audiences.

Sub-strand: Earth and space sciences	
represent the carbon cycle and examine how key processes including combustion, photosynthesis and respiration rely on interactions between Earth's spheres (the geosphere, biosphere, hydrosphere and atmosphere) AC9S9U03	• identifying Earth as a system, describing Earth's spheres and discussing examples of interactions between different spheres • examining the carbon cycle using diagrams, animations or simulations and explaining the role of photosynthesis and respiration in that cycle • identifying the impact of combustion reactions as a result of human activity on the carbon cycle • investigating the greenhouse effect and relating it to the role carbon dioxide plays in maintaining temperatures that support life on Earth • conducting a field investigation to evaluate carbon sequestration in an ecosystem, such as measuring tree biomass, deadwood, leaf litter and soil depth, and using formulas to calculate approximate carbon storage • investigating how First Nations Australians use fire-mediated chemical reactions to facilitate energy and nutrient transfer through the practice of firestick farming • investigating how First Nations Australians are reducing Australia's greenhouse gas emissions through the reinstatement of traditional fire management regimes • identifying how carbon dioxide is captured and stored naturally or through the use of technologies • calculating an individual's carbon footprint, examining the impact of human activities and suggesting strategies to reduce carbon dioxide emissions
Sub-strand: Physical sciences	
use wave and particle models to describe energy transfer through different mediums and examine the usefulness of each model for explaining phenomena AC9S9U04	• describing the processes underlying convection and conduction of heat in terms of the particle model • modelling the transfer of sound energy as waves using slinky springs and relating to the medium through which the sound is transferred • examining how the particle model of electricity explains static electricity and electrical current and relating this to voltage, conductors and insulators • discussing the wave and particle models of energy transfer, including the concept of photons, and how they are useful for understanding aspects of light and other forms of electromagnetic radiation • investigating aspects of heat transfer and conservation in the design of First Nations Australians' bedding and clothing in the various climatic regions of Australia

	• investigating the impact of material selection on the transfer of sound energy in First Nations Australians' traditional musical, hunting and communication instruments • examining the forms of electromagnetic radiation that are used in different modern communication technologies and identifying any limitations
~~apply the law of conservation of energy to analyse system efficiency in terms of energy inputs, outputs, transfers and transformations~~ ~~AC9S9U05~~	• ~~explaining that the law of conservation of energy explains that total energy is maintained in energy transfer and transformation in a system~~ • ~~explaining efficiency and recognising that in energy transfer and transformation a variety of processes can occur, so that the amount of usable energy is reduced and the system is not 100% efficient~~ • ~~using and critiquing representations such as Sankey diagrams to show energy inputs, changes and outputs in a system~~ • ~~investigating the efficiency of ground ovens used by First Nations Australians~~ • ~~comparing the efficiency of electricity generation from coal and other sources such as nuclear, hydroelectricity, gas, solar and wind~~ • ~~examining the meaning of energy star ratings given to appliances such as refrigerators and washing machines and criteria used to determine these ratings~~ • ~~examining how improving efficiency in energy transfer and transformations in sporting activities such as pole vaulting or archery improves athletic performance~~
Sub-strand: Chemical sciences	
explain how the model of the atom changed following the discovery of electrons, protons and neutrons and describe how natural radioactive decay results in stable atoms AC9S9U06	• ~~comparing the mass and charge of protons, neutrons and electrons~~ • ~~examining how the discovery of electrons, protons and neutrons resulted from experimental evidence and answered questions related to properties and behaviours of atoms~~ • explaining that differences in the number of neutrons in atoms of the same element results in isotopes and that naturally occurring isotopes of some elements are unstable • describing in simple terms how different unstable isotopes decay such as radon-222 releasing an alpha particle, iodine-131 releasing a beta particle and cobalt-60 releasing gamma radiation to form stable atoms • defining half-life, examining the timescales of decay of different elements such as carbon-14 and uranium-238 and simulating or using digital simulations to examine radioactive decay including half-life • ~~investigating how radiocarbon and other dating methods have been used to establish that First Peoples of Australia have been present on the Australian continent for more than 60,000 years~~

	• identifying where applications of radioactivity are used in medicine and industry such as diagnosing and treating cancer and checking for faults in materials used in aircraft and spacecraft • discussing how mass and energy are connected at all scales and energy conversion processes within atomic nuclei
model the rearrangement of atoms in chemical reactions using a range of representations, including word and simple balanced chemical equations, and use these to demonstrate the law of conservation of mass AC9S9U07	• identifying reactants and products in chemical reactions • using models and representations to show the rearrangement of atoms in chemical reactions • investigating chemical reactions in closed and open systems and relating data obtained to the law of conservation of mass • writing symbolic equations that are easy to balance and explaining, using the law of conservation of mass, and atoms, the rationale for balancing chemical equations • investigating why most elements are not found in their elemental state and processes which are used to obtain the element • predicting how ideas of green chemistry such as minimising the amount of unusable waste products, energy use and using more environmentally friendly chemical processes will affect the environment

Strand: Science as a human endeavour	**Year 9**
Sub-strand: Nature and development of science	
Content descriptions *Students learn to:*	**Content elaborations** *This may involve students:*
explain how scientific knowledge is validated and refined, including the role of publication and peer review AC9S9H01	• ~~investigating the process of publishing a paper in a scientific journal such as *Science*, which receives about 12,000 submissions per year, and considering how editors evaluate submitted papers~~ • investigating how the publication of data and findings related to the reintroduction of First Nations Australians' traditional fire regimes has informed more effective fire-reduction strategies and policies • exploring why the work of Professor Barry Marshall and Dr Robin Warren related to the cause of peptic ulcers was first rejected for publication then later validated • examining the scientific consensus supporting global warming • researching how JJ Thomson's discovery of the electron, Robert Millikan's oil drop experiment, and Ernest Rutherford's gold foil experiment provide consistency of evidence for the particle model of electricity • examining how Marie and Pierre Curie's discovery of new elements was validated

investigate how advances in technologies enable advances in science, and how science has contributed to developments in technologies and engineering AC9S9H02	• ~~analysing how the development of imaging technologies has improved our understanding of the functions and interactions of body systems~~ • ~~considering the impact of technological advances developed in Australia such as the cochlear implant pioneered by Professor Graeme Clark, the Monash Vison Group's work on a bionic eye, Professor Fiona Woods's development of spray on skin and Doctor John O'Sullivan and CSIRO's invention of wi fi~~ • researching how technological advances in monitoring greenhouse gas emissions and other environmental factors have contributed to the reinstatement of traditional fire management practices as a strategy to reduce atmospheric pollution • examining how properties of electromagnetic radiation relate to its uses, such as radar, medicine, mobile phone communications, remote sensing and microwave cooking • ~~exploring how scientists and engineers make machines more energy efficient~~ • ~~exploring how understanding of the nature of matter and energy has changed over time, and how modern technology has enabled exploration of energy conversion processes at all scales, from black holes to atoms to sub-atomic particles~~ • examining how advances in understanding of radioactivity and radioisotopes have led to new applications and technologies
Sub-strand: Use and influence of science	
analyse the key factors that contribute to science knowledge and practices being adopted more broadly by society AC9S9H03	• ~~researching citizen science projects related to public health and examining why people would choose to be involved~~ • ~~investigating how the practices adopted by society based on research by Australian Dr Helen Mayo led to a reduction in infant mortality~~ • ~~examining how assisted reproductive technologies have become widely used since their initial development~~ • examining how government initiatives such as Landcare support adoption of effective land restoration practices that improve soil quality and increase carbon sequestration in soils • investigating how First Nations Australians' fire management practices are informing and being adopted in contemporary fire management • analysing factors that have led to the adoption of solar panels and battery storage by individuals, industries and communities • investigating how an understanding of materials and concern for the environment have led to the adoption of widespread recycling practices

examine how the values and needs of society influence the focus of scientific research AC9S9H04	• exploring how governments determine which scientific research projects should be funded • ~~exploring how Australia has developed an artificial intelligence system which is used to predict the likelihood of a viable pregnancy from transfer of a single embryo to a woman undergoing in vitro fertilisation~~ • researching how First Nations Peoples of the Torres Strait are at the forefront of the development of scientific measures to prevent the transfer of certain infectious diseases and pests to the Australian continent • investigating how the need to minimise greenhouse gas production has led to scientific and technological advances • ~~considering innovative energy transfer devices, including those used in transport and communication~~ • ~~considering how the development of new materials and procedures has contributed to safe sound levels for humans in the workplace and leisure activities~~ • examining why many manufacturers are adopting green chemistry processes

AC: Science - Curriculum elements

Year 10

Year level description
In Year 10 students explore the biological, chemical, geological and astronomical evidence for different theories, such as the theory of natural selection and the big bang theory. Through investigating natural selection and processes of heredity they come to understand the evolutionary feedback mechanisms that ensure the continuity of life. They appreciate how energy drives the Earth system and how climate models simulate the flow of energy and matter within and between Earth's spheres. Students develop a more sophisticated understanding of atomic theory to understand patterns and relationships within the periodic table. They understand that motion and forces are related by applying physical laws and can be modelled mathematically. Students analyse and synthesise data from systems at multiple scales to develop evidence-based explanations for phenomena. They learn that all models involve assumptions and approximations, and that this can limit the reliability of predictions based on those models. Inquiry questions can help excite students' curiosity and challenge their thinking. Following are examples of inquiry questions that could be used to prompt discussion and exploration: • Why is the periodic table such a big deal? • How do we know what is science and what is pseudoscience? • Why is accelerating climate change a threat to biodiversity?

- Just because we can, should we?
- How have advanced computing and big data changed science?

Achievement standard

By the end of Year 10 students explain the processes that underpin heredity and genetic diversity and describe the evidence supporting the theory of evolution by natural selection. They sequence key events in the origin and evolution of the universe and describe the supporting evidence for the big bang theory. They describe trends in patterns of global climate change and identify causal factors. They explain how Newton's laws describe motion and apply them to predict motion of objects in a system. They explain patterns and trends in the periodic table and predict the products of reactions and the effect of changing reactant and reaction conditions. Students analyse the importance of publication and peer review in the development of scientific knowledge and analyse the relationship between science, technologies and engineering. They analyse the key factors that influence interactions between science and society.

Students plan and conduct safe, valid and reproducible investigations to test relationships or develop explanatory models. They explain how they have addressed any ethical and intercultural considerations when generating or using primary and secondary data. They select equipment and use it efficiently to generate and record appropriate sample sizes and replicable data with precision. They select and construct effective representations to organise, process and summarise data and information. They analyse and connect a variety of data and information to identify and explain patterns, trends, relationships and anomalies. They evaluate the validity and reproducibility of methods, and the validity of conclusions and claims. They construct logical arguments based on analysis of a variety of evidence to support conclusions and evaluate claims. They select and use content, language and text features effectively to achieve their purpose when communicating their ideas, findings and arguments to diverse audiences.

Strand: Science understanding	**Year 10**
Sub-strand: Biological sciences	
Content descriptions *Students learn to:*	**Content elaborations** *This may involve students:*
explain the role of meiosis and mitosis and the function of chromosomes, DNA and genes in heredity and predict patterns of Mendelian inheritance AC9S10U01	• using models and diagrams to represent the relationship between genes, chromosomes, and DNA of an organism's genome • explaining how genetic information passed on to offspring from both parents by meiosis and fertilisation increases the variation of a species • using Mendelian inheritance to predict the ratio of offspring genotypes and phenotypes in monohybrid crosses involving dominant and recessive alleles or in genes that are sex-linked • using pedigree diagrams to show patterns of inheritance of simple dominant and recessive characteristics through multigenerational families • investigating First Nations Australians' knowledges of heredity as evidenced by the strict adherence to kinship and family structures, especially marriage laws

	• exploring environmental and other factors that cause mutations and identifying changes in DNA or chromosomes • exploring the role of DNA in cancer or genetic disorders such as haemochromatosis, sickle cell anaemia, cystic fibrosis or Klinefelter syndrome
use the theory of evolution by natural selection to explain past and present diversity and analyse the scientific evidence supporting the theory AC9S10U02	• outlining processes involved in natural selection including variation, isolation and selection • examining biodiversity as a function of evolution • analysing evidence for the theory of evolution by natural selection including the fossil record, chemical and anatomical similarities, and geographical distribution of species • investigating changes caused by natural selection in a particular population as a result of a specified selection pressure such as artificial selection in breeding for desired characteristics • relating genetic characteristics to survival and reproductive rates • investigating some of the structural and physiological adaptations of First Nations Australians to the Australian environment

Sub-strand: Earth and space sciences	
describe how the big bang theory models the origin and evolution of the universe and analyse the supporting evidence for the theory AC9S10U03	• describing the major components of the universe using appropriate scientific terminology and units including astronomical units, scientific notation and light-years • constructing a timeline to show major changes in the universe which are thought to have occurred from the Big Bang until the formation of the major components such as stars and galaxies • examining how stars' light spectra and brightness is used to identify compositional elements of stars, their movements and their distances from Earth • explaining how each different type of evidence, such as cosmic microwave background radiation, red or blue shift of galaxies, Edwin Hubble's observations and proportion of matter in the universe, provides support for the acceptance of the big bang theory • researching First Nations Australians' knowledges of celestial bodies and explanations of the origin of the universe

	• identifying the different technologies used to collect astronomical data and the types of data collected • exploring recent advances in astronomy, including the Australian Square Kilometre Array Pathfinder, and astrophysics, such as the discovery of gravitational waves, dark matter and dark energy; and identifying new knowledge which has emerged
use models of energy flow between the geosphere, biosphere, hydrosphere and atmosphere to explain patterns of global climate change AC9S10U04	• examining the role of radiation from the sun and how its interactions with the atmosphere, ocean and land are the foundation for the global climate system • investigating indicators of climate change such as changes in ocean and atmospheric temperatures, sea levels, biodiversity, species distribution, permafrost and sea ice • identifying changes in global climate over time, exploring visualisations and using simulations to explore why energy balances have changed • examining the factors, including energy, that drive deep ocean currents, their role in regulating global climate and their effects on marine life • investigating how quantum computers enhance modelling of complex weather and climate systems • predicting changes to the Earth system and identifying strategies designed to reduce climate change or mitigate its effects

5.1 Science

6. Actions to align

Take a strengths-based approach

A strengths-based approach recognises that students have varying levels of access to personal skills, strengths, assets and community resources to maintain and promote their own and others' wellbeing. Health and Physical Education recognises that contextual factors impact peoples' decisions and behaviours in relation to their health, safety, wellbeing and participation in physical activity.

This proposition focuses on personal skills and community resources that can build students' agency in various health and movement contexts. It recognises that the skills, resources and capacities each student has available to them will differ immensely. However, all students, no matter what their background or life situation, have capacities that can be drawn on to support them to make healthy, safe and active choices. Applying a strengths-based approach requires teachers to view health and physical activity participation as processes that students need to make sense of for themselves, rather than a single outcome students need to achieve.

When this proposition is considered as part of the planning process, classroom programs:

- support students to find solutions and plans of action that work for them as individuals rather than promoting a "one-size-fits-all" approach to being healthy, safe or active
- explore strategies to access community resources and the role individuals play in contributing to the health, safety and wellbeing of their families and communities.

7. Other actions

- Update reminder about triple zero to include mobile contact (page 5)
- Chapter 1 – consider splitting content into two chapters so that one chapter provides information on What are hazards and disasters? and the other contains information specific to How do we cope with hazards and disaster? (While this is the current title of the chapter, information does not appear until the end of the chapter).
- Revise State and Territory Emergency Services organisations (page 71)
- Include a glossary

8. School use of a revised resource to deliver the Australian Curriculum