

Units 1 to 4 Key Skills

Investigate and inquire scientifically

- formulate questions and construct hypotheses appropriate for conducting first-hand and secondhand investigations
- plan, design and conduct first-hand investigations: select and use equipment and materials appropriate to the investigation; evaluate experimental procedures and reliability of data
- collect, process and record information systematically; analyse and synthesise data; draw conclusions consistent with the question under investigation and the evidence obtained
- act responsibly when conducting investigations: maintain safe practices; work independently and collaboratively as appropriate.

Apply biological understandings

- apply understandings to familiar and new contexts; make connections between concepts; solve problems
- analyse issues and implications relating to scientific and technological developments
- analyse and evaluate the reliability of information and opinions presented in the public domain.

Communicate biological information and understandings

- interpret, transpose and communicate information and ideas effectively
- use techniques of communication appropriate to different audiences and purposes
- use scientific terminology and conventions appropriately.

Unit 1: Unity and Diversity

Area of study 1

Cells in action

This area of study focuses on the activities of cells. Students investigate the relationship between specialised structures of cells and the processes that maintain life. All organisms, whether unicellular or multicellular, require a relatively stable internal environment for optimal functioning. Students examine how membranes contribute to survival of cells by controlling the movement of substances within cells, and between cells and their external environment. Students undertake practical investigations into cell structure and functioning in autotrophs and heterotrophs. They consider the development of ideas and technological advances that have contributed to our knowledge and understanding of cell biology. Students investigate the implications of current and emerging techniques and technologies that make use of, and further our knowledge of, cells as functional units.

Outcome 1

On completion of this unit the student should be able to design, conduct and report on a practical investigation related to cellular structure, organisation and processes.

Key knowledge

- cell structure: prokaryotic and eukaryotic cells at light and electron microscope levels; cellular organisation
- cell functioning: specialised parts of cells and their functions; biochemical processes including photosynthesis and cellular respiration in terms of inputs and outputs; general role of enzymes in biochemical activities of cells
- composition of cells: major groups of organic and inorganic substances including carbohydrates, proteins, lipids, nucleic acids, water, minerals, vitamins; their general role in cell structure and function
- internal and external environments of cells; plasma membranes; membrane transport including diffusion, osmosis, active transport; surface area to volume ratio
- cell replication: purposes of cell replication (mitosis and cytokinesis); cell growth, cell size and cell division.

AREA OF STUDY 2

Functioning organisms

This area of study focuses on the relationship between features of organisms and how organisms meet their requirements for life. Students examine a range of organisms and investigate the ways that structures and systems function in terms of obtaining and releasing energy; obtaining nutrients, water and gases; processing and distributing materials to cells and transporting wastes from cells to points of disposal. They consider the needs for systems to be integrated for the organism to function as a whole. Students examine how patterns of observable similarities and differences in the structure and function of organisms are used in constructing taxonomic systems that are subject to change as new information is obtained. Students undertake practical investigations into the relationship between structures of autotrophs and heterotrophs and their requirements. They consider the development of ideas and technological advances that have contributed to our knowledge and understanding of living things and relationships between them. Students investigate the implications of techniques and technologies that make use of and further our knowledge of organisms and the way they function.

Outcome 2

On completion of this unit the student should be able to describe and explain the relationship between features and requirements of functioning organisms and how these are used to construct taxonomic systems.

Key knowledge

- common requirements of living things
 - obtaining nutrients: organic and inorganic requirements; autotrophs; heterotrophs
 - obtaining energy: inputs and outputs of photosynthesis; structural features of photosynthetic organisms
 - processing nutrients: features of effective systems in heterotrophs; examples of systems in different animals
 - distributing materials: features of effective transport systems; examples of transport systems in multicellular organisms
 - removing wastes: nature of waste products and toxic substances; excretory mechanisms and systems
 - exchanging gases: features of effective surfaces of gaseous exchange; mechanisms and systems of gaseous exchange in multicellular organisms; process of diffusion
- reproduction: asexual and sexual reproduction; mechanisms and systems of reproduction in unicellular and multicellular organisms
- classifying organisms: purposes, principles, hierarchy of biological classification; features typically used in constructing major taxonomic groups.

For this unit students are required to demonstrate achievement of the two outcomes. As a set these outcomes encompass both areas of study. Demonstration of achievement of Outcomes 1 and 2 must be based on the student's performance on a selection of assessment tasks.

Assessment tasks for this unit are:

For Outcome 1:

- a student-designed and/or adapted and/or extended practical investigation;

And

For Outcomes 1 and 2:

at least three from the following:

- practical activities or investigations
- multimedia presentation
- media response
- oral presentation
- annotated poster
- data analysis
- problem solving
- test, multiple choice and/or short answer and/or extended response.

Unit 2: Organisms and their environment

The rich diversity of Australian ecosystems provides a variety of contexts for students to study the relationships between living things and their environment. Students investigate particular sets of biotic and abiotic factors that operate in different places in the biosphere, and how these factors influence the kinds of organisms that live there. Students examine how organisms in their particular habitats are part of the integrated and naturally self-sustaining systems in which energy flows and matter is cycled between the living and non-living components of the environment. Students investigate how features possessed by organisms affect their fitness and reproductive success, in relation to their habitats. They consider how species are affected by changes in environmental conditions, whether natural or human-induced. In this unit students investigate what changes have taken place in selected ecosystems, and how ecological principles can be applied to conserve natural ecosystems, to restore damaged ones and to ensure sustainability of the biosphere. Students investigate how technologies are being applied to monitor natural ecosystems and to manage systems developed to provide resources for humans.

Area of study 1

Adaptations of organisms

This area of study focuses on the kinds of environmental factors that are common to all habitats. Students investigate the adaptations of organisms that enable them to exploit the resources of their particular ecological niche. Adaptations are interrelated and can be grouped into structural, physiological, and behavioural categories. Students make connections between the conditions that operate in habitats, the tolerance range of organisms and the distribution of organisms. They examine individual and collective behaviours that organisms exhibit and relate them to an organism's survival. Students undertake practical investigations into selected factors operating in habitats and adaptations of organisms to those habitats. They investigate techniques and technologies that monitor and record environmental factors and track the distribution of species.

Outcome 1

On completion of this unit the student should be able to explain and analyse the relationship between environmental factors, and adaptations and distribution of living things.

Key knowledge

- environmental factors: biotic and abiotic factors; availability of resources
- structural adaptations: relating major features of organisms to survival value
- physiological adaptations
 - tolerance range of organisms; maintaining equilibrium by detecting and responding to changes in environmental conditions
 - nerve control in complex multicellular organisms: major sense organs and pathways of transmission of nerve impulses
 - hormonal control in complex multicellular organisms
 - regulating water balance and controlling temperature
- plant tropisms: growth responses, rhythmic activities
- behavioural adaptations: individual and group behaviours of animals including rhythmic activities,
- feeding behaviours; communication; social and territorial behaviours
- reproductive adaptations: systems and strategies; development and life cycles
- techniques used to monitor environmental change and species distribution.

AREA OF STUDY 2

Dynamic ecosystems

With an emphasis on Australian ecosystems, this area of study focuses on the complex and finely balanced relationships that exist between living things and the resources in their particular habitat. This network of relationships can be understood as a system with inputs, processing and outputs: there is a flow of energy and cycling of matter between the living and non-living components of the ecosystem. Ecosystems do not exist in isolation from each other; they form a network of ecosystems that constitute the global system of the biosphere. Students examine how ecosystems are subject to changes that differ in scope, intensity and regularity. They investigate how human activities such as habitat destruction, resource use and disposal of wastes, affect not only the ecological niche that individual species occupy, but the functioning of ecosystems at local and global levels.

Students undertake practical investigations into interactions between members of the same and different species and between organisms and their non-living environment. They examine the effect on ecosystems of historical practices, and investigate emerging techniques and technologies that help to monitor and maintain them. Students consider the issues and implications associated with human activities that affect the sustainability of ecosystems.

Outcome 2

On completion of this unit the student should be able to design, conduct and report on a field investigation related to the interactions between living things and their environment, and explain how ecosystems change over time.

Key knowledge

- components of ecosystems: communities of living organisms, ecological groupings; ecological niche
- relationships between organisms: feeding including parasite/host, predator/prey, of mutual benefit including mutualism and symbiosis
- flow of energy: inputs and outputs of the system; productivity; trophic levels and trophic efficiency
- cycling of matter: principle of exchange between living and non-living components of the ecosystem, including inputs and outputs; biogeochemical systems including those of water, carbon, oxygen, nitrogen; bioaccumulation
- population dynamics: carrying capacity of ecosystems; factors affecting distribution and abundance of organisms including birth and death rates, migration
- change to ecosystems over time
 - scope and intensity of regular and irregular natural changes; succession
 - human activity and the sustainability of ecosystems
 - historical practices of indigenous peoples and settlers
- Techniques for monitoring and maintaining ecosystems.

Demonstration of achievement of Outcomes 1 and 2 must be based on the student's performance on a selection of assessment tasks. Assessment tasks for this unit are:

For Outcome 1:

at least three of the following:

- practical activities
- multimedia or web page presentation
- response to a media article
- oral presentation
- annotated poster
- data analysis
- test, multiple choice and/or short answer and/or extended response.

And

For Outcome 2:

- a written report on fieldwork (fieldwork may include a study of habitat within or outside the classroom).