



SCIENCE IN PRACTICE

Unit GE004 – Sustainability

Unit overview

Year 11

Acknowledgement of Country

Kaya. The School Curriculum and Standards Authority (the Authority) acknowledges that our offices are on Whadjuk Noongar boodjar and that we deliver our services on the country of many traditional custodians and language groups throughout Western Australia. The Authority acknowledges the traditional custodians throughout Western Australia and their continuing connection to land, waters and community. We offer our respect to Elders past and present.

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Unit GE004 – Sustainability

Unit description

The United Nations defines sustainability as ‘meeting the needs of the present without compromising the ability of future generations to meet their own needs’. As a global trend, our current lifestyle is unsustainable with demand for resources being greater than supply, particularly in advanced nations like Australia. This leads to negative impacts on the Earth, including increased greenhouse gases, reduced water availability and excessive plastic waste. Responsibility for reducing the impacts on the Earth lies with all of us, from big businesses to personal lifestyle choices.

In this unit, students conduct a variety of investigations, developing science and presentation skills, as well as increasing their understanding of sustainability, environmental science, chemistry and data management. They develop an understanding of some of the broader aspects of sustainability by exploring a current issue of local relevance. They are encouraged to use information and communication technology to gather and interpret data, and to communicate their findings in a variety of ways.

This unit integrates content from the Earth Science and Chemistry science disciplines.

Unit GE004 – Sustainability is a semester long unit equivalent to one course unit. The notional time for the unit is 55 class contact hours.

Unit content

Scientific method

- research a given topic and construct questions for investigation
- determine the appropriate methodology for investigations
- design scientific investigations, including the formulation of investigable questions and/or hypotheses, materials required, selection and/or modification of a procedure to be followed to collect valid and reliable data, and identification of safety and ethical considerations
- use equipment and techniques safely, competently and methodically to collect valid and reliable data, and use equipment with precision, accuracy and consistency
- represent qualitative and quantitative data in meaningful and useful ways, including the construction of appropriately labelled tables, processing of quantitative data using appropriate mathematical relationships and units, and drawing of appropriate graphs
- analyse data to identify and describe trends, patterns and relationships, and recognise errors and limitations in data
- draw conclusions consistent with the evidence and relevant to the question being investigated, identify further evidence that may be required, and recognise limitations of conclusions
- evaluate the investigative procedure, including the relevance, accuracy, validity and reliability of data, and suggest improvements

- communicate information and ideas in a variety of ways using scientific conventions and terminology, including the selection and presentation of data and ideas to convey meaning to selected audiences in written, oral and multimedia formats

Workplace health and safety

- use and apply workplace health and safety documents, including safety data sheets (SDS), and other relevant documents, such as standard operating procedures (SOP), when performing activities
- use appropriate scientific and technological equipment safely to gather data and information
- conduct risk assessments to identify potential hazards and prevent potential incidents and injuries

Scientific literacy

- distinguish between opinion, anecdote and evidence, and scientific and non-scientific ideas
- use reasoning to construct scientific arguments, and to draw and justify conclusions consistent with the evidence and relevant to the question under investigation
- identify examples of where the application of scientific knowledge may have beneficial and/or harmful and/or unintended consequences
- use scientific knowledge to develop and evaluate projected economic, social and environmental impacts and to design action for sustainability

Science understanding

Introduction to sustainability

- identify how an individual's actions can impact sustainable outcomes
- investigate a number of organisations involved in sustainability

Water use

- through the water cycle, illustrate the concept of water as a finite renewable resource
- outline some sustainable lifestyle changes to reduce water usage

Greenhouse gases

- through the carbon cycle, illustrate the cycling of carbon
- describe the difference between the natural and human-induced greenhouse effects
- explain the link between increased atmospheric carbon and ocean acidification
- use examples to describe the effect of increasing greenhouse gases on biodiversity
- outline the concept of carbon offsets
- outline some sustainable lifestyle changes to reduce greenhouse gas emissions

Plastic waste management

- outline the properties of the different types of plastics, including recyclability, decomposition time and toxicity
- explain the environmental issues associated with excessive use of plastics
- outline some sustainable lifestyle changes to reduce plastic waste

Course outline

The scientific method, workplace health and safety and scientific literacy content will be taught in each unit. The content from these areas aligns with the science understanding content of the unit and are integrated throughout the learning experiences.

Weeks	Teaching points
1–2	<p>Introduction to sustainability</p> <ul style="list-style-type: none"> • identify how an individual's actions can impact sustainable outcomes • investigate a number of organisations involved in sustainability • use equipment and techniques safely, competently and methodically to collect valid and reliable data, and use equipment with precision, accuracy and consistency • communicate information and ideas in a variety of ways using scientific conventions and terminology, including the selection and presentation of data and ideas to convey meaning to selected audiences in written, oral and multimedia formats • use appropriate scientific and technological equipment safely to gather data and information • conduct risk assessments to identify potential hazards and prevent potential incidents and injuries • distinguish between opinion, anecdote and evidence, and scientific and non-scientific ideas • use reasoning to construct scientific arguments, and to draw and justify conclusions consistent with the evidence and relevant to the question under investigation • identify examples of where the application of scientific knowledge may have beneficial and/or harmful and/or unintended consequences • use scientific knowledge to develop and evaluate projected economic, social and environmental impacts and to design action for sustainability
3	<p>Plastic waste management</p> <ul style="list-style-type: none"> • outline the properties of the different types of plastics, including recyclability, decomposition time and toxicity • explain the environmental issues associated with excessive use of plastics • outline some sustainable lifestyle changes to reduce plastic waste • represent qualitative and quantitative data in meaningful and useful ways, including the construction of appropriately labelled tables, processing of quantitative data using appropriate mathematical relationships and units, and drawing of appropriate graphs • analyse data to identify and describe trends, patterns and relationships, and recognise errors and limitations in data • draw conclusions consistent with the evidence and relevant to the question being investigated, identify further evidence that may be required, and recognise limitations of conclusions • evaluate the investigative procedure, including the relevance, accuracy, validity and reliability of data, and suggest improvements • communicate information and ideas in a variety of ways using scientific conventions and terminology, including the selection and presentation of data and ideas to convey meaning to selected audiences in written, oral and multimedia formats • conduct risk assessments to identify potential hazards and prevent potential incidents and injuries
4	<p>Water use</p> <ul style="list-style-type: none"> • through the water cycle to illustrate the concept of water as a finite renewable resource

Weeks	Teaching points
	<ul style="list-style-type: none"> • outline some sustainable lifestyle changes to reduce water usage • use equipment and techniques safely, competently and methodically to collect valid and reliable data, and use equipment with precision, accuracy and consistency • represent qualitative and quantitative data in meaningful and useful ways, including the construction of appropriately labelled tables, processing of quantitative data using appropriate mathematical relationships and units, and drawing of appropriate graphs • analyse data to identify and describe trends, patterns and relationships, and recognise errors and limitations in data • draw conclusions consistent with the evidence and relevant to the question being investigated, identify further evidence that may be required, and recognise limitations of conclusions • evaluate the investigative procedure, including the relevance, accuracy, validity and reliability of data, and suggest improvements • communicate information and ideas in a variety of ways using scientific conventions and terminology, including the selection and presentation of data and ideas to convey meaning to selected audiences in written, oral and multimedia formats • use appropriate scientific and technological equipment safely to gather data and information • conduct risk assessments to identify potential hazards and prevent potential incidents and injuries
5–6	<p>Greenhouse gases</p> <ul style="list-style-type: none"> • through the carbon cycle, illustrate the cycling of carbon • describe the difference between the natural and human-induced greenhouse effects • outline the concept of carbon offsets • outline some sustainable lifestyle changes to reduce greenhouse gas emissions • use equipment and techniques safely, competently and methodically to collect valid and reliable data, and use equipment with precision, accuracy and consistency • represent qualitative and quantitative data in meaningful and useful ways, including the construction of appropriately labelled tables, processing of quantitative data using appropriate mathematical relationships and units, and drawing of appropriate graphs • analyse data to identify and describe trends, patterns and relationships, and recognise errors and limitations in data • draw conclusions consistent with the evidence and relevant to the question being investigated, identify further evidence that may be required, and recognise limitations of conclusions • evaluate the investigative procedure, including the relevance, accuracy, validity and reliability of data, and suggest improvements • communicate information and ideas in a variety of ways using scientific conventions and terminology, including the selection and presentation of data and ideas to convey meaning to selected audiences in written, oral and multimedia formats • use and apply workplace health and safety documents, including safety data sheets (SDS), and other relevant documents, such as standard operating procedures (SOP), when performing activities • use appropriate scientific and technological equipment safely to gather data and information • conduct risk assessments to identify potential hazards and prevent potential incidents and injuries <p>Assessment task 1 – Supervised written assessment (20%)</p>

Weeks	Teaching points
7	<p>Individual baseline audits</p> <ul style="list-style-type: none"> • outline some sustainable lifestyle changes to reduce water usage • outline some sustainable lifestyle changes to reduce greenhouse gas emissions • outline some sustainable lifestyle changes to reduce plastic waste • represent qualitative and quantitative data in meaningful and useful ways, including the construction of appropriately labelled tables, processing of quantitative data using appropriate mathematical relationships and units, and drawing of appropriate graphs • analyse data to identify and describe trends, patterns and relationships, and recognise errors and limitations in data • draw conclusions consistent with the evidence and relevant to the question being investigated, identify further evidence that may be required, and recognise limitations of conclusions • evaluate the investigative procedure, including the relevance, accuracy, validity and reliability of data, and suggest improvements • distinguish between opinion, anecdote and evidence, and scientific and non-scientific ideas • use reasoning to construct scientific arguments, and to draw and justify conclusions consistent with the evidence and relevant to the question under investigation • identify examples of where the application of scientific knowledge may have beneficial and/or harmful and/or unintended consequences • use scientific knowledge to develop and evaluate projected economic, social and environmental impacts and to design action for sustainability <p>Commence Assessment task 2 – Project (30%)</p>
8	<p>Investigating individual sustainable practice</p> <p>Commence Assessment task 3 – Investigation (40%)</p> <ul style="list-style-type: none"> • outline some sustainable lifestyle changes to reduce water usage • outline some sustainable lifestyle changes to reduce greenhouse gas emissions • outline some sustainable lifestyle changes to reduce plastic waste • research a given topic and construct questions for investigation • determine the appropriate methodology for investigations • design scientific investigations, including the formulation of investigable questions and/or hypotheses, materials required, selection and/or modification of a procedure to be followed to collect valid and reliable data, and identification of safety and ethical considerations • use equipment and techniques safely, competently and methodically to collect valid and reliable data, and use equipment with precision, accuracy and consistency • represent qualitative and quantitative data in meaningful and useful ways, including the construction of appropriately labelled tables, processing of quantitative data using appropriate mathematical relationships and units, and drawing of appropriate graphs • distinguish between opinion, anecdote and evidence, and scientific and non-scientific ideas • use reasoning to construct scientific arguments, and to draw and justify conclusions consistent with the evidence and relevant to the question under investigation • identify examples of where the application of scientific knowledge may have beneficial and/or harmful and/or unintended consequences • use scientific knowledge to develop and evaluate projected economic, social and environmental impacts and to design action for sustainability

Weeks	Teaching points
9–10	<p>Effect of increasing greenhouse gasses on biodiversity</p> <ul style="list-style-type: none"> • explain the link between increased atmospheric carbon and ocean acidification • use examples to describe the effect of increasing greenhouse gases on biodiversity • use equipment and techniques safely, competently and methodically to collect valid and reliable data, and use equipment with precision, accuracy and consistency • represent qualitative and quantitative data in meaningful and useful ways, including the construction of appropriately labelled tables, processing of quantitative data using appropriate mathematical relationships and units, and drawing of appropriate graphs • analyse data to identify and describe trends, patterns and relationships, and recognise errors and limitations in data • draw conclusions consistent with the evidence and relevant to the question being investigated, identify further evidence that may be required, and recognise limitations of conclusions • evaluate the investigative procedure, including the relevance, accuracy, validity and reliability of data, and suggest improvements • communicate information and ideas in a variety of ways using scientific conventions and terminology, including the selection and presentation of data and ideas to convey meaning to selected audiences in written, oral and multimedia formats • use and apply workplace health and safety documents, including safety data sheets (SDS), and other relevant documents, such as standard operating procedures (SOP), when performing activities • use appropriate scientific and technological equipment safely to gather data and information • conduct risk assessments to identify potential hazards and prevent potential incidents and injuries <p>Continue Assessment task 3 – Investigation</p>
11–12	<p>Ocean acidification</p> <p>Assessment task 4 – Practical assessment (10%)</p> <ul style="list-style-type: none"> • explain the link between increased atmospheric carbon and ocean acidification • represent qualitative and quantitative data in meaningful and useful ways, including the construction of appropriately labelled tables, processing of quantitative data using appropriate mathematical relationships and units, and drawing of appropriate graphs • analyse data to identify and describe trends, patterns and relationships, and recognise errors and limitations in data • draw conclusions consistent with the evidence and relevant to the question being investigated, identify further evidence that may be required, and recognise limitations of conclusions • communicate information and ideas in a variety of ways using scientific conventions and terminology, including the selection and presentation of data and ideas to convey meaning to selected audiences in written, oral and multimedia formats • use and apply workplace health and safety documents, including safety data sheets (SDS), and other relevant documents, such as standard operating procedures (SOP), when performing activities • use appropriate scientific and technological equipment safely to gather data and information • conduct risk assessments to identify potential hazards and prevent potential incidents and injuries <p>Complete Assessment task 2 – Project</p>

Weeks	Teaching points
13–14	<p>Plastic waste decomposition</p> <ul style="list-style-type: none"> • outline the properties of the different types of plastics, including recyclability, decomposition time and toxicity • use equipment and techniques safely, competently and methodically to collect valid and reliable data, and use equipment with precision, accuracy and consistency • represent qualitative and quantitative data in meaningful and useful ways, including the construction of appropriately labelled tables, processing of quantitative data using appropriate mathematical relationships and units, and drawing of appropriate graphs • analyse data to identify and describe trends, patterns and relationships, and recognise errors and limitations in data • draw conclusions consistent with the evidence and relevant to the question being investigated, identify further evidence that may be required, and recognise limitations of conclusions • communicate information and ideas in a variety of ways using scientific conventions and terminology, including the selection and presentation of data and ideas to convey meaning to selected audiences in written, oral and multimedia formats • use and apply workplace health and safety documents, including safety data sheets (SDS), and other relevant documents, such as standard operating procedures (SOP), when performing activities • conduct risk assessments to identify potential hazards and prevent potential incidents and injuries <p>Continue Assessment task 3 – Investigation</p>
15	<p>Water cycle – terrarium</p> <ul style="list-style-type: none"> • through the water cycle, illustrate the concept of water as a finite renewable resource • draw conclusions consistent with the evidence and relevant to the question being investigated, identify further evidence that may be required, and recognise limitations of conclusions • evaluate the investigative procedure, including the relevance, accuracy, validity and reliability of data, and suggest improvements <p>Complete Assessment task 3 – Investigation</p>

Assessment outline

Assessment type	Assessment type weighting	Assessment task weighting	When	Assessment task
Investigation	40%	40%	Weeks 8–15	<p>Assessment task 3 – Individual sustainable practice</p> <p>Students work in groups to plan and conduct the investigation and summarise their findings in a live or virtual poster presentation. Each student will prepare a written report to communicate their findings. Planning, working safety and group contributions will be monitored via student logbooks, responses to reflection questions, peer and self-assessments and teacher observations.</p> <p>Time: 13 hours</p>
Project	30%	30%	Weeks 7–12	<p>Assessment task 2 – Sustainable lifestyle changes</p> <p>Students will work individually to analyse and synthesise information from at least two different sources to illustrate a claim by explaining the relevant scientific concepts and describing the impact and/or influence on society.</p> <p>Students will use their research to produce a persuasive news report (radio, television or online).</p> <p>Time: 10 hours</p>
Practical assessment	10%	10%	Week 11–12	<p>Assessment task 4 – Ocean acidification</p> <p>Students will work groups to demonstrate their ability to perform accurate tests to safely collect meaningful data and individually to process and analyse the collected data.</p> <p>Time: 60 minutes</p>
Supervised written assessment	20%	20%	Week 6	<p>Assessment task 1 – Water usage, greenhouse gases and plastic waste management</p> <p>Students will work individually to answer short and extended answer questions on identified syllabus content.</p> <p>Time: 50 minutes</p>
Total	100%	100%		

Acknowledgements

Adapted from: World Commission on Environment and Development. (1987). *Our Common Future*. United Nations. Retrieved September 2023, from <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>