Government of **Western Australia**
School Curriculum and Standards Authority

Science

Teaching, learning and assessment exemplar

Year 4

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.

Background

This teaching, learning and assessment exemplar (the exemplar) has been developed by the School Curriculum and Standards Authority (the Authority) as part of the *School Education Act Employees (Teachers and Administrators) General Agreement 2017* (Clause 61.1–61.3).

Disclaimer

Any resources, such as texts and websites, that may be referred to in this document are provided as examples of resources that teachers can use to support their learning programs. Their inclusion does not imply that they are mandated or that they are the only resources relevant to the course. Teachers must exercise their professional judgement as to the appropriateness of any resources they may wish to use.

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Contents

The Western Australian Curriculum

The *Western Australian Curriculum and Assessment Outline* (the *Outline* – https://k10outline.scsa.wa.edu.au/) sets out the mandated curriculum, guiding principles for teaching, learning and assessment, and support for teachers in their assessment and reporting of student achievement. The *Outline* recognises that all students in Australian schools, or international schools implementing the Western Australian Curriculum, are entitled to be given access to the eight learning areas described in the *Alice Springs* (*Mparntwe*) *Education Declaration*, December 2019.

The Science curriculum

The mandated curriculum is presented in the year level syllabus documents.

The Science curriculum delivers a sequential and age-appropriate progression of learning with the following key elements:

- a year level description that provides an overview of the context for teaching and learning in the year
- a series of content descriptions, populated through strands and sub-strands, that sets out the knowledge, understanding and skills that teachers are expected to teach and students are expected to learn
- an achievement standard that describes an expected level that the majority of students are achieving by the end of a given year of schooling. An achievement standard describes the quality of learning (e.g. the depth of conceptual understanding and the sophistication of skills) that would indicate the student is well placed to commence the learning required in the next year.

This exemplar

This Science exemplar articulates the content in the *Outline* and approaches to teaching, learning and assessment reflective of the Principles of Teaching, Learning and Assessment. This exemplar presents planning for eight weeks of teaching and learning for each of the four terms, with a time allocation of four hours per week.

Catering for diversity

This exemplar provides a suggested approach for the delivery of the curriculum and reflects the rationale, aims and content structure of the learning area. When planning the learning experiences, consideration has been given to ensuring that they are inclusive and can be used in, or adapted for, individual circumstances. It is the classroom teacher who is best placed to consider and respond to (accommodate) the diversity of their students. Reflecting on the learning experiences offered in this exemplar will enable teachers to make appropriate adjustments (where applicable) to better cater for students' gender, personal interests, achievement levels, socio-economic, cultural and language backgrounds, experiences and local area contexts.

Using this exemplar

This teaching, learning and assessment exemplar provides suggestions to support the delivery of the mandated curriculum content. The exemplar provides:

- a teaching and learning sequence
- the mandated curriculum content to be taught at each point of the teaching and learning sequence, suggested resources, sample assessment tasks and marking keys
- the number of lessons to deliver the teaching and learning experiences
- learning intentions and support notes that may provide focus questions and additional information and/or examples to assist with the interpretation of curriculum content
- support notes to assist teachers to unpack the content and support teaching and learning experiences
- teaching and learning experiences that outline the structure of the lesson. These explicitly state each activity that the lesson will progress through and the key focus area for that activity.

Links to electronic resources

This sequence of lessons may utilise electronic web-based resources, such as videos and image galleries. Teachers should be present while an electronic resource is in use and close links immediately after a resource, such as a video, has played to prevent default 'auto play' of additional videos. Where resources are referred for home study, they should be uploaded through Connect, or an equivalent system, that filters advertising content.

Best practice

Teaching and learning

The teaching and learning opportunities offered in this exemplar are not exhaustive. Thus, teachers are encouraged to make professional decisions about which learning experiences, and the sequence in which they are delivered, are best suited to their classroom context, taking into account the availability of resources and student ability.

This sample may prove a useful starting point for amplifying creativity in the classroom, while presenting the embedded expectations of the Western Australian Curriculum: Science.

Teachers may find opportunities to incorporate the General Capabilities and the Cross-curriculum Priorities into the teaching and learning program.

Ways of teaching – teachers can locate additional information on the Ways of teaching from the School Curriculum and Standards Authority (the Authority) website https://k10outline.scsa.wa.edu.au/home/wa-curriculum/learning-areas/science/overview/science-ways-of-teaching.

Assessing

Assessment, both formative and summative, is an integral part of teaching and learning. Assessment should arise naturally out of the learning experiences provided to students. In addition, assessment should provide regular opportunities for teachers to reflect on student achievement and progress. As part of the support it provides for teachers, this exemplar includes suggested assessment points. It is the teacher's role to consider the contexts of their classroom and students, the range of assessments required, and the sampling of content descriptions selected to allow their students the opportunity to demonstrate achievement in relation to the year-level achievement standard. Teachers are best placed to make decisions about whether the suggested assessment/s are used as formative or summative assessment and/or for moderation purposes.

Ways of assessing – a range of assessment strategies that can enable teachers to understand where students are in their learning is available on the Authority website https://k10outline.scsa.wa.edu.au/home/wa-curriculum/learning-areas/science/overview/science-ways-of-assessing.

Reflecting

Reflective practice involves a cyclic process during which teachers continually review the effects of their teaching and make appropriate adjustments to their planning. The cycle involves planning, teaching, observing, reflecting and replanning.

This exemplar supports reflective practice and provides flexibility for teachers in their planning. The exemplar shows how content can be combined and revisited throughout the year. Teachers will choose to expand or contract the amount of time spent on developing the required understandings and skills according to their reflective processes and professional judgements about their students' evolving learning needs.

Year level description

In the middle to late childhood phase of schooling, students develop a sense of self, their world expands, and they begin to see themselves as members of larger communities. Learning experiences emphasise and lead to an appreciation of both the commonality and diversity of human experience and concerns.

Science provides opportunities for students to explore their physical, social, cultural and technological surroundings. As students develop the ability to work collaboratively, they work with others to plan and make decisions in constructing knowledge.

In Year 4, students represent the relationships between consumers, producers and decomposers using food chains. They investigate different materials and their properties and relate these to their use. Students appreciate that Earth's surface changes over time due to a variety of processes. They observe and investigate forces that operate from a distance, such as magnetism, and direct contact, such as friction.

Students pose questions involving a changed variable and make predictions using their observations and science knowledge. Students plan investigations that include elements of fair tests and consider the material and equipment risks. They make and record observations and use formal measurements and familiar scaled instruments to collect and record data that they organise and represent using tables and column graphs to identify patterns. Students use science knowledge to propose explanations and solutions to problems and identify questions for further investigation.

Achievement standard

By the end of the year:

Students describe the interaction between producers, consumers and decomposers in an ecosystem and represent these using food chains. They connect raw materials to the processed materials that are made from them and relate the use of materials to their observable properties. Students identify the processes that result in slow and rapid changes to Earth's surface over time. They identify contact and non-contact forces and describe, with examples, how they affect the behaviour of objects.

Students explore science ideas by posing questions, with guidance, that include variables to measure and change. They make predictions based on observations and test them by planning and conducting scaffolded investigations. They make and record observations in a variety of ways and using a diversity of scaled instruments. They organise and represent data in tables, column graphs and models to identify patterns. They communicate findings using scientific vocabulary in correct contexts. Students use science knowledge to propose explanations for observed phenomena and solutions to problems.

Term 1

Weeks 1–8: Physical sciences

Term 1 Overview

Physical sciences Forces are exerted by one object on another through direct contact, such as friction, or from a distance, such as magnetism and gravity							
Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**	**Week 8**
Forces introduction	Investigation: gravity	Investigation: gravity	Investigation: friction	Investigation: friction	Practical: magnetism	Investigation: magnetism	Balanced and unbalanced forces – summative assessment *Multistorey car park* (Appendix B)
Practical: Push/pull catapult	Investigation: gravity	Practical: gravity	Investigation: friction	Practical: air resistance	Investigation: magnetism	Balanced forces introduction	Balanced and unbalanced forces – summative assessment *Multistorey car park* (Appendix B)
Resources							
Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**	**Week 8**
• chairs • popsticks • rubber bands • counters • measuring instruments	• toy cars • blocks, books or other items to build a ramp	• sandbags • soft toys • variety of leaves • variety of sports balls	• measuring equipment • soccer balls	• scrap paper • metre rulers	• variety of magnets • materials that are/aren't attracted to magnets • paper filings	• tug-of-war rope	Summative assessment • cardboard boxes • cardboard tubes • tape

Physical sciences Forces are exerted by one object on another through direct contact, such as friction, or from a distance, such as magnetism and gravity							
		• heavy ball – bowling ball or medicine ball			• paper clips		• straws • other available construction materials

Term 1 Week 1

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Physical sciences** Forces are exerted by one object on another through direct contact, such as friction, or from a distance, such as magnetism and gravity **Science inquiry** **Questioning and predicting** Pose questions and make predictions based on planned observations of phenomena that include variables to be measured and changed **Planning and conducting** Make and record observations, including formal measurements using familiar scaled instruments **Communicating** Communicate ideas using scientific vocabulary **Collaborating and applying** Use science knowledge to propose explanations for observed phenomena and solutions to problems	**Focus questions** • What is a force? • What is gravity? • How do people remain upright, regardless of where they are on the planet? • What can change the way a force acts? **Support notes** This week's lessons review what the students already know about forces and introduce the idea that 'every action has an equal and opposite reaction' (Newton's third law of motion). Students should begin to recognise that there is always more than one force acting on an object at any time. **Resources** • Chairs • Digital device for filming • Measuring instruments • Popsticks • Rubber bands • Counters **Safety considerations** Provide guidelines on the safe use of catapults. For example, not pointing them at other people, using them in a space away from others and using small things to	**Learning experience 1** 1. Ask students to call out what they think of when they hear the word force and record any significant vocabulary on the board, e.g. push/pull and gravity. Ask students to clarify with examples. 2. Provide a definition of a force as a push or pull between objects that causes a change of speed, direction or shape. Explain that some forces require direct contact to work, and others can work over a distance or a field. 3. Students stand and jump on the spot. Explain the role of the body: muscles, joints and energy are involved in creating the force required (the greater the force or energy exerted, the greater the height off the ground). 4. Make predictions about what happens when you try harder or exert more energy to the action. 5. A digital device for filming with time-lapse photography to record the action. Determine a suitable tool to measure the height of the jump reached (a ruler or tape in the background). 6. Provide time for students to investigate how to make the highest jump possible, and then how to make the smallest jump possible. Explain that gravitational force brings objects back to the Earth, as the planet draws other objects with mass towards it. 7. In pairs, students pull a chair on a variety of surfaces, such as vinyl flooring, carpet and grass. As well as pulling

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	catapult that can't hurt others. Only choose very light, small objects to catapult. **Suggested assessment points** **Diagnostic assessment** • Brainstorm about forces. • Investigate ways to change the height of their jump. **Formative assessment** Observe if students can: • create force arrow diagrams • identify factors that affect forces.	the chair on different surfaces, students can take turns sitting in the chair while their partner tries to pull it. 8. Discuss as a class the factors that affected the pulling of the chair; for example, how smooth the surface was or how big the chair was. 9. Ask students to draw force arrow diagrams to show the pull forces working on the chair. Students can show the force of the student pulling the chair as well as the gravitational force keeping the chair on the ground. **Learning experience 2** 1. Show students an online tutorial or video of how to make a popstick catapult. Assist students to make a catapult (individually or in small groups). 2. Students investigate how to push counters the furthest or the highest using the catapult, taking note of the changes they are making. 3. Have a competition to see who can send their counter the furthest. As a class, discuss what strategy the winning group/person used with their catapult. 4. Model drawing a diagram on the board with force arrows showing what happens when the catapult is used.

Term 1 Week 2

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Physical sciences** Forces are exerted by one object on another through direct contact, such as friction, or from a distance, such as magnetism and gravity **Science inquiry** **Questioning and predicting** Pose questions and make predictions based on planned observations of phenomena that include variables to be measured and changed **Planning and conducting** Plan and conduct investigations including elements of fair tests, and consider the material and equipment risks Make and record observations, including formal measurements using familiar scaled instruments **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns	**Focus questions** • What is the effect of gravity on an object? • How does gravity affect how far a toy car rolls? • How can we increase the distance a toy car will roll? • How can we represent data to show a pattern? **Support notes** Gravitational force is something that all things with mass have. A common misconception is that gravity is a force that pulls things down to Earth. In fact, gravitational force is a force that pulls things with mass together. The student-directed activity will become an investigation with variables that can be changed. The information in brackets is provided for the teacher only: • What will I change? (independent variable) • What will I measure? (dependent variable) • What will I keep the same? (controlled variable) **Resources** • Adjustable ramp (a stack of books is useful) • Tape measure • Toy or model cars • *Fair test investigation* template (Appendix A)	**Learning experience 1** 1. Watch an online video that shows mountain bike racing. Discuss the forces involved: Where is the speed coming from? What factors affect the roll of the bike? (slope, friction of tyres and brakes) 2. Run a toy car down an adjustable ramp. Discuss and list the factors that affect how the car moves? 3. Explain to students that they will be working in groups to carry out an investigation to test the effect of a chosen factor, such as the size of the wheels, wheel materials, or steepness of the slope. 4. Each group selects an attribute of the investigation they can manipulate and decide what they will need to change, measure and keep the same. Students should record these in the appropriate place on their planning sheet. 5. Instruct each group to write a question and a prediction for their investigation. For example, a question such as, ‘What effect will the steepness of the ramp have on the distance the car rolls?’ and a prediction such as, ‘If we increase the steepness of the ramp, the car will roll further’. 6. Demonstrate how to use the tape measure to measure the distance the car rolls and record the distance on the planning sheet. 7. Students conduct the investigation and record their results in a table.

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	Safety considerations Discuss the need to use equipment sensibly and look out for tripping hazards. **Suggested assessment points** **Formative assessment** Observe if students can: • identify a variable to change and, with assistance, plan an investigation around the variable • create reasonable questions and predictions • create an accurate column graph with guidance.	8. Each group briefly shares what they changed and what their general results were. For example, 'We changed the steepness of the ramp, and the steeper it got the further the car rolled.' **Learning experience 2** 1. Watch an online video of a rollercoaster. Discuss how gravity drives the ride and what forces affect the passengers. Link this to the learning in Learning experience 1. 2. Discuss with students the factors that affected the movement of the car on the ramp in the investigation from the last lesson. 3. Show students a column graph of sample data from their investigation on the same scaffold that they will use. Draw attention to features of the graph such as: • the X axis (changed variable, e.g. height of ramp) and Y axis (distance rolled) • title • axis-labels. 4. Model the construction of a graph and guide students through the steps using the data they gathered in their investigation. 5. Students create their own graph with their data.

Term 1 Week 3

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Physical sciences** Forces are exerted by one object on another through direct contact, such as friction, or from a distance, such as magnetism and gravity **Science inquiry** **Questioning and predicting** Pose questions and make predictions based on planned observations of phenomena that include variables to be measured and changed **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns **Evaluating** Compare findings with those of others, and to predictions; consider if investigations were fair; and identify questions for further investigation **Communicating** Communicate ideas using scientific vocabulary	**Focus questions** • How do your predictions and data compare? • Why might these differ? • What other investigations could you conduct? • How can you communicate your findings? • What pattern did you notice when dropping objects? • What conclusions can you make from that pattern? **Support notes** A common misconception is that heavier or bigger items fall faster because there is more gravity acting on them. The gravitational pull of Earth is constant and does not act more on heavier objects. For example, a feather takes longer to float to the ground than a ball. This is not because gravity is acting differently on the feather, but because another force, air resistance, is also at work. **Resources** • Sandbags/beanbags • Soft toys • Variety of leaves • Variety of sports balls • Heavy ball (bowling ball or medicine ball)	**Learning experience 1** 1. Students look at their graphs and make a statement about the conclusions they can make based on what they see in their graph. For example, 'The car rolled furthest when the ramp was at the steepest angle'. 2. Students add their ideas to the 'Explain your results' section of the investigation template. 3. Ask students how far the car rolled compared to their predictions. Students write a statement comparing the two. Discuss why they might be the same/different. Stress that there is no right or wrong prediction. 4. Remind students that a fair test is when only one thing is changed. Ask each group to share what variable they changed. 5. Ask students if they think their investigation was fair, with some explanation. They fill in these ideas on their investigation template. 6. Students share their questions for further investigation. **Learning experience 2** 1. Watch an online video of astronauts walking on the moon. Highlight how much time they spend in the air. Ask students to infer why that is. (The gravitational pull of Earth is stronger than the gravitational pull of the moon.) 2. Show students a heavy ball (like a bowling ball or medicine ball) and a light ball (like a basketball or soccer ball) of approximately the same size. Let the students heft each one and make a prediction of which one they think will hit the

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	Safety considerations If dropping a particularly heavy object, such as a bowling ball, ensure students are a distance away. **Suggested assessment points** **Formative assessment** Students can: • make some reasonable conclusions based on their graph. • explain one reason why it was a fair investigation or not • compare their results to the prediction • identify a pattern in the gravity stations • explain why objects fall at the same rate.	ground first if they are both dropped at the same time. Make a tally chart of their predictions. 3. On a soft area, drop both balls. Ask a student to film the drop in slow motion so it can be watched back by the class. Students should find that the balls hit the ground at the same moment. Compare the results to the class tally chart. 4. Before discussing what happened, allocate students to small groups to complete activities at stations: • dropping big and small sandbags • dropping different sports balls (soccer ball, basketball, tennis ball, handball) • dropping different leaves • dropping different sized soft toys. Discuss with students how to keep each drop fair and how to stay safe while completing the activities. If appropriate, students may record their results in a table. 5. As a class, discuss the results. The students should have observed that all the objects dropped at the same time. There may have been some outliers, like a leaf that was particularly thin and large. 6. Explain to students that gravitational force acts the same on all objects, regardless of the mass or size of the object. Sometimes objects fall slower due to other forces at work, but gravity on Earth is constant. 7. Ask students to vote whether they think gravity is a contact or non-contact force. Gravity is a non-contact force, the object with greater mass doesn't need to be touching other objects to pull them.

Term 1 Week 4

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Physical sciences** Forces are exerted by one object on another through direct contact, such as friction, or from a distance, such as magnetism and gravity **Science inquiry** **Questioning and predicting** Pose questions and make predictions based on planned observations of phenomena that include variables to be measured and changed **Planning and conducting** Plan and conduct investigations, including elements of fair tests, and consider the material and equipment risks Make and record observations, including formal measurements using familiar scaled instruments **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns	**Focus questions** • Why do moving objects slow down? • What is friction? • What happens if there is less or more friction? • How can you use friction? • How can you best display your data? **Support notes** Friction is a contact force that works to slow momentum between two objects that are touching. The rougher the surface, the more contact that slows down objects. Friction is used in many functional ways every day. For example, the brakes on a car and bike use friction. Students might even use their foot to create friction to stop or slow down a scooter. Friction keeps humans standing as they walk. To measure the distance the ball rolls, a measuring wheel may be the best equipment, if available. **Resources** • Soccer ball • Measuring instruments (measuring wheel) • *Fair test investigation* template (Appendix A)	**Learning experiences** 1. Ask students to take their shoes off and, in their socks, rub their feet on a mat/carpet and then on a vinyl-type floor. Discuss how each surface felt, and how their foot moved on each surface. The students should deduce that on the vinyl floor their foot moved much easier and smoother, while on the carpeted floor their foot had difficulty moving and it felt rougher. This is due to friction. 2. Explain that they will be investigating friction which is a contact force. Show students a clip of people slipping on icy surfaces. Why do people keep slipping and how do they overcome the loss of traction? 3. Take students to the school playground and ask them to go down the slide. Ask them how they can stop themselves sliding. Students may indicate using their feet or hands. How does this slow them down? Why do we go fast on water slides? 4. In small groups have students kick a ball on different surfaces and measure the distance it travels. The ball needs to travel along the floor and not be airborne. Students should choose four surfaces in their group to test their ball on. For example, vinyl flooring, carpet, concrete, grass, basketball court, Softfall or sand. 5. Lead students through the process of planning the investigation using the template, including: • What will we change? (the surface the ball is being kicked on)

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	Suggested assessment points **Formative assessment** Observe if students can: • choose a variety of appropriate surfaces to test their soccer ball on • create an investigable question and reasonable prediction • conduct their investigation in a safe and sensible manner • take accurate measurements • create readable data displays.	• What will we measure? (distance the ball rolls) • What will we keep the same? (the force of the kick, the type of ball) 6. Each group writes a question and a prediction for their investigation For example, a question such as, 'What effect will the surface have on the distance the ball rolls?' and a prediction such as, 'The smoother the surface the further the ball will roll'. 7. Demonstrate how to use the measuring equipment. Allow time for students to practise with the equipment. 8. Conduct the investigation and share preliminary results. Students should have found that the smoother the surface, the further the ball was able to roll before coming to a stop. 9. Guide students to create a column graph with the gathered data. Draw attention to features of the graph such as: • the X axis (surface) and Y axis (distance rolled) • title • axis labels. 10. Ask students to self-assess the accuracy of their graph, e.g. the scale on the Y axis and how clear the columns are. Students determine a goal for their next graph/data display.

Term 1 Week 5

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Physical sciences** Forces are exerted by one object on another through direct contact, such as friction, or from a distance, such as magnetism and gravity **Science inquiry** **Questioning and predicting** Pose questions and make predictions based on planned observations of phenomena that include variables to be measured and changed **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns **Evaluating** Compare findings with those of others, and to predictions; consider if investigations were fair; and identify questions for further investigation **Communicating** Communicate ideas using scientific vocabulary	**Focus questions** • What information can you see from your graph? • How can you explain your results? • How does your prediction compare to the results? • Was this a fair investigation? • How does repeating an investigation make the data more reliable? • What is air resistance? **Support notes** The friction investigation provides an opportunity to discuss a fair investigation. It is not possible to measure the strength of the kick the students used and make sure it was the same every time. It required the students to subjectively decide how much force they used and attempt to replicate it. Some investigations do require subjective elements. A way to lessen the effect of subjective elements of investigations is to repeat the investigation several times and use all the data to look for patterns. In the second learning experience, gravity is working on both pieces of paper the same; however, the flat piece of paper has a lot more	**Learning experience 1** 1. Review the surfaces used from the investigation in the previous week. List them from furthest roll to shortest roll and ask students to look for a pattern. Students should conclude that the rougher surfaces stopped the ball quicker than the smoother surfaces. 2. Ask students to compare their results to their prediction and discuss whether it was a fair test. Fill out the evaluating section of the *Fair test investigation* template. 3. Groups share their ideas of how to make the investigation fairer. Have a class discussion about determining the strength of the kick of the ball. 4. Discuss the repetition of results, and how that might add to the reliability of the data collected (see support notes). 5. As an exit ticket, students write any questions about friction they would like to investigate. **Learning experience 2** 1. Write the words ‘gravity’ and ‘friction’ on the board. On sticky notes or small whiteboards, ask students to write a definition for each one. Discuss similarities in the definitions and come up with a class definition for both. 2. Show students two pieces of A4 paper and scrunch one up. Pose the question: Which piece of paper will hit the ground first if I drop them? 3. In pairs, students discuss how to test the question. Guide students to repeated drops, reinforcing the ideas from the last lesson that repeated results are more reliable.

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<tr><th>Western Australian Curriculum content</th><th>Teaching and learning intentions</th><th>Learning experiences</th></tr>
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<td>surface area for the molecules in the air to work against. This rubbing of atoms against the paper slows the flat paper down and makes it float down slowly. The scrunched-up piece of paper has a lot less surface area for air resistance to work on, so it drops quickly. Air resistance is a contact force: even though we can’t see air, the molecules in air still must be touching an object to slow it down.

Resources
• Scrap paper
• Metre rulers

Suggested assessment points
Formative assessment
Observe if students can:
• identify and explain patterns in data
• discuss the fairness of an investigation, and how to make it fairer
• define air resistance and describe why it is a contact force.</td>
<td>4. As a class, come up with a list of things that need to stay the same: the size of the paper, the height of the drop, the timing of the drop and the force of the drop.
5. Each partner group devises a table to record their results. For example, keeping a tally of each one of the pieces of paper hits the ground first each time they are dropped.
<table>
<tr><th>Flat paper</th><th>Scrunched paper</th></tr>
<tr><td></td><td></td></tr>
</table>
6. Give each pair a metre ruler to measure the height of the drop and direct them to conduct the investigation several times.
7. As a class, discuss the results. The students will have found that in every drop the scrunched paper hit the ground first whilst the flat paper floated down slowly. Ask students to attempt to explain what is happening, given they know that gravity acts the same on every object on Earth.
8. Explain air resistance to students (see support notes). Reinforce the idea that air is made up of molecules, even though it can’t be seen. These molecules rub against things falling. Like friction, air resistance slows down momentum. Air resistance is a contact force and can be useful; for example, slowing down a skydiver when they open their parachute.
9. Watch an online video of a feather and a heavy object, such as a bowling ball or hammer being dropped in a vacuum chamber, or on the moon. In those cases, the two items will drop at the same time because of the lack of air resistance.</td>
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Term 1 Week 6

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Physical sciences** Forces are exerted by one object on another through direct contact, such as friction, or from a distance, such as magnetism and gravity **Science inquiry** **Questioning and predicting** Pose questions and make predictions based on planned observations of phenomena that include variables to be measured and changed **Planning and conducting** Plan and conduct investigations, including elements of fair tests, and consider the material and equipment risks Make and record observations, including formal measurement using familiar scaled instruments **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns	**Focus questions** • What materials are magnetic? • How can you test for magnetism? • How are magnets used in everyday situations? • What is a magnetic field? **Support notes** Magnetism is another example of a non-contact force. It doesn't need to be touching an object to attract and repel it. It can also work through other objects. For example, a magnet under a desk can attract or repel an object above the desk. **Resources** • Various magnets • Iron filings • Materials that are and aren't attracted to magnets • Paperclips • Measuring tape/ruler • *Fair test investigation template* (Appendix A) **Safety considerations** Iron filings can be damaging to eyes and get under skin easily. Teachers themselves should handle the iron filings and ensure they are properly disposed of.	**Learning experience 1** 1. Provide students access to a range of magnets of different sizes, shapes and strengths. Allow them time to play with the magnets and test them. 2. Explain that magnetism is a non-contact force like gravity. It is most obvious in magnets and magnetic material. It can both attract and repel. 3. Show students a bar magnet and ask them to draw it. Have them label the poles of the magnet. Give each student a magnet and ask them to work with a partner to see what happens when the poles of the magnet are placed near each other. 4. As a class, put a bar magnet under a piece of paper or a clear container lid. Carefully sprinkle iron filings on top and view the pattern the filings take. The filings show the magnetic field of the bar magnet. Have students add this magnetic field to their diagram. 5. Show students an assortment of objects, such as a pencil, wooden spoon, metal spoon, metal paperclip, kitchen foil, plastic object, nail, key, different coins, stone, a soft drink can, a metal can, steel wool or plastic-covered paperclip. 6. Have students work with partners to test the objects to see what objects are attracted to the magnet. After the testing is completed, sort the objects as a class into the categories attracted to the magnet and not

	Suggested assessment points **Formative assessment** Observe if students can: • record data in a table accurately • create reasonable questions and predictions • investigate in a safe and reasonable manner.	attracted to the magnet. Discuss what all the objects that were attracted have in common. **Learning experience 2** 1. Show students a paperclip and ask them to remember from the last lesson whether it is attracted to a magnet. Ask a student to hold the paperclip and stand at one side of the room. Give another student a magnet and ask them to stand at the other side of the room. 2. Ask the students why the paperclip is not attaching to the magnet (the magnetic field of the magnet cannot reach that far). 3. Have the students take steps towards each other until the paperclip and the magnet finally attach. 4. Explain that, just like gravity, magnetism is a non-contact force. It does not have to be touching an object to attract or repel it; however, it does have a limited field over which it will work. 5. Show students a variety of magnets, such as horseshoe, bar, ball, and flat fridge magnets. Tell students they are going to test the size of the magnetic field of each one in small groups. 6. Lead students through the process of planning the investigation using the template including: • what will we change? (the type of magnet) • what will we measure? (distance before the paperclip is attracted) • what will we keep the same? (the paperclip, ways of measuring and the surface where the investigation is carried out)

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
		7. Each group writes a question and a prediction for their investigation. For example, a question such as, 'When we change the type of magnet what will happen to the distance of the magnetic field?' and a prediction such as, 'The magnetic field will be the same size for all the magnets.' 8. Fill out the questioning and predicting, planning and conducting sections of the investigation template. 9. Give each group time to decide how to measure the magnetic field. Students might need some assistance to find the edge of the magnetic field to begin with. 10. Allow students time to conduct the investigation and share some preliminary results.

Term 1 Week 7

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Physical sciences** Forces are exerted by one object on another through direct contact, such as friction, or from a distance, such as magnetism and gravity **Science inquiry** **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify the patterns **Communicating** Communicate ideas using scientific vocabulary	**Focus questions** • What patterns can you see in the data? • How can you communicate that information? • What is a balanced and unbalanced force? • What are some examples of balanced and unbalanced forces? • How can you represent these forces in a diagram? **Support notes** In the second learning experience, students are introduced to balanced and unbalanced forces. At any time, there are two or more forces acting on an object; when these forces are equal it is a balanced force. When these forces aren't equal, it is an unbalanced force. In general, an object that is still is experiencing balanced forces, while an object that has a change in movement is experiencing unbalanced forces. **Resources** • Tug of war rope **Safety considerations** Discuss with students how to complete the outside activities sensibly and safely. Students should not push their partner or pull on the tug of war rope too hard. Students could become injured if the rope is pulled too roughly, or they wrap the rope around their hands.	**Learning experience 1** 1. Have students stand in the middle of the room. Call out forces, such as push, pull, friction, magnetism and gravity. Ask students to move to one side of the room if the force is contact, and the other side if the force is non-contact. Clear up any misconceptions. 2. Review the investigation from the previous week and discuss the varying sizes of the magnetic field. Did the students see any patterns? 3. Have students fill out the 'explain your results' section of the *Fair test investigation* template using their observations. 4. Students discuss how to communicate their results in their groups using diagrams and arrows to show the direction of the force. Students could create a visual poster that shows the various magnets and their magnetic fields or draw just some of the magnets in detail. Provide students time to execute their idea. 5. Each group shares the visual display of their results and the choices they made. **Learning experience 2** 1. Move to an open space. In pairs, students face each other and put their hands palm-to-palm with their partner. Students lean towards each other, maintaining pressure on their hands so that both they and their partner are balanced. Ask one student in each pair to

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	Suggested assessment points **Diagnostic assessment** Observe if students can: • define balanced and unbalanced forces • give examples of balanced and unbalanced forces. Formative • Students draw a diagram, displaying forces with labelled arrows. Summative • Students communicate their findings and justify their choices in their communication style.	push harder so that their partner is forced to move backwards. Swap roles. 2. Draw a diagram in class of two students facing and the difference between balanced and unbalanced forces. Use different sized arrows to show the differences in forces. 3. Define balanced and unbalanced forces (see support notes) and ask students to share some examples they can think of. 4. Back outside in a suitable area, give students a tug of war rope and allow them to play a game. 5. Once one team has won, explain to students that they are going to try and make the tug of war game have a balanced force from each side. 6. Give students time to work together to figure out who needs to change sides or adjust their pulling to create a balanced force. 7. Once the students have established a balanced game, take a photo. 8. Back inside, display the image and ask students to share their observations from the image. For example, maybe one side needed more people than the other, or students had to adjust their stance or pull strength to create a balanced force. 9. Ask students to draw a diagram of the image, using arrows to show the force that everyone was using.

Term 1 Week 8

Western Australian curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Physical sciences** Forces are exerted by one object on another through direct contact, such as friction, or from a distance, such as magnetism and gravity **Science inquiry** **Communicating** Communicate ideas using scientific vocabulary **Collaborating and applying** Use science knowledge to propose explanations for observed phenomena and solutions to problems	**Focus questions** • What are some examples of balanced and unbalanced forces? • What forces are at work in the building? • What is helping the building maintain balanced forces? • What shapes can you see and how are they helping? • What materials can you use to help you achieve your goals? • What changes have you made to your original design? • How could you improve on your structure? **Support notes** Students could construct their car parks in small teams, but the planning templates should be completed individually. Students may be able to bring in cardboard tubes and cereal boxes from home to help with the construction. **Resources** • Cardboard tubes • Cereal boxes • Straws • Masking tape • *My Multistorey car park planning documents* photocopied (Appendix B) **Suggested assessment points** **Summative assessment** (using Appendix B) Observe whether students can:	**Learning experiences** 1. In pairs, give students five minutes to come up with a way to demonstrate balanced and unbalanced forces. This could include using a chair or another item. Students present their ideas. Question the students and clear up any misconceptions. 2. Show students pictures of multistorey car parks using maps or another online source. Discuss the shapes you can see and what forces are at work in the multistorey car park. 3. Students should conclude that the building shows balanced forces. The force of the upper floors pushing downwards is equal to the force of the columns and other support structures pushing upwards. Ask students what would happen if these forces weren't equal and balanced. 4. Explain to students that all the people involved in designing and constructing the building need to take these forces into consideration to ensure the building is strong and remains standing and safe for the people using it. These occupations include architects, engineers, construction workers and others. 5. Tell the students they are going to be engineers and design and build their own multistorey car park, using columns, carboard, tape and any other available materials. The finished car park needs to be at least three storeys high and hold a certain amount of

Western Australian curriculum content	Teaching and learning intentions	Learning experiences
	• identify and represent balanced forces • make a clear diagram showing use of materials • identify contact and non-contact forces • evaluate the success of their plan and identify areas for improvement.	weight. Draw attention to changes students might make, including the use of materials, the shape of the columns, the shape of the flat floors. 6. Students draw their design, identifying the materials they will need to construct their car park and demonstrating the forces they need to consider. 7. Give students time to construct their design and make changes along the way. Any changes should be updated in their diagram. 8. Students test their designs all together, and reflect on and evaluate the success of their design using the planning sheets.

Term 2

Weeks 1–8: Biological sciences

Term 2 Overview

Biological sciences Producers, consumers and decomposers have roles within an ecosystem and interact in ways that can be represented by food chains							
Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**	**Week 8**
Ecosystem introduction	Food webs	Investigation: decomposers	Ecosystem impacts: pakulyarra	Investigation: bees and flowers	Pollinator garden	Invasive species review: cane toads	Investigation: decomposers
Food chain introduction	Decomposers introduction	Ecosystem review: Black flanked wallaby (pakulyarra)	Fieldwork: bees and flowers	Investigation: bees and flowers	Pollinator garden	Invasive species solutions: cane toads	Tree ecosystem
Resources							
Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**	**Week 8**
• strips of paper	• *What Eats What* resource from Primary Connections	• organic and inorganic materials • clear container • soil		• fresh flowers		• animal pictures (see support notes) • poster paper • books and brochures about cane toads	• blank paper

Term 2 Week 1

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Biological sciences** Producers, consumers and decomposers have roles within an ecosystem and interact in ways that can be represented by food chains **Science inquiry** **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns **Communicating** Communicate ideas using scientific vocabulary	**Focus questions** • What do living things need to survive? • Where do living things get the things they need to survive? • What is a habitat? • What is an ecosystem? • What changes could happen to an ecosystem? **Support notes** An ecosystem is an area of living things interacting with each other and the non-living things in their environment. For example, the rocks, soil and water are non-living things that help sustain the living things in that environment. Ecosystems are a delicate balance of all the things within it, and changing one aspect, whether living or non-living, can have a detrimental effect. All ecosystems rely on a balance of producers, consumers and decomposers to keep functioning in a healthy manner. All three of these are essential to an ecosystem. Students sometimes think of food chains as a chain of things that can kill each other. For example, a bear could kill a shark; a lion could kill a moose. A food chain refers to food sources and the flow of energy. It only includes things that would be eaten by other living things as a	**Learning experience 1** 1. Play a version of *I Spy* with objects in the room. Once an item has been guessed, sort it into living and non-living on the board. Remind students of some of the characteristics of living and non-living things to review learning from the previous year. 2. Write the word ecosystem on the board and ask students to share any ideas that come to mind. Explain that an ecosystem is all the things in an area that contribute to it, including living and non-living things. 3. Walk around the school and ask students to record all the things they see including playgrounds, grass, water fountains, people and insects. 4. Return to the classroom and ask students to share one thing they observed outside until everything has been listed. Ask the students to help sort their observations into living and non-living. 5. Reinforce that an ecosystem is made up of living and non-living things that work together to create a liveable habitat. Choose some of the things observed in the school and discuss how the school would change if they were removed. For example: • How would the school change if we didn't have water? • How would the school change if we didn't have teachers?

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	consistent source of energy. The living things would have to live in the same ecosystem to be part of the same food chain. **Resources** • Strips of paper **Suggested assessment points** **Diagnostic assessment** Observe if students can: • identify the parts that make up an ecosystem • discuss some impacts that changes can have on an ecosystem • identify some simple food chains.	• How would the school change if we didn't have books? 6. Explain that a habitat is the place where a living thing has its needs met and that they consist of living and non-living things. As a class, use a collaborative strategy to generate a list of questions you might ask about a habitat/ecosystem, such as: • What plants and animals live in this habitat? • Is it a wet or dry habitat? • What are some non-living things that are an important part of this habitat? • What is the temperature range? • Where are some places this habitat can be found? **Learning experience 2** 1. Show students images of common predators, such as a lion, dolphin, eagle or snake. Ask the students, 'Where do these predators get their energy?' When students respond, ask, 'Where do the prey animals get their energy from?' Continue until they reach a plant or algae as the energy source. 2. Ask students to think about where plants and algae get their energy. Draw a plant or algae. Tell students these organisms are known as producers, because they produce their own energy from the Sun in a process called photosynthesis. 3. Draw the rest of the food chain, with all arrows pointing away from the producer. A good way for students to

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
		remember is to think that the arrows point into the mouth of the thing eating, not away from it. 4. Tell students the rest of the organisms in the food chain are consumers because they need to consume plants and animals to get their energy. Students vote with their hands if they believe humans are consumers or producers. 5. In small groups, students devise their own short food chain and turn it into a paper chain with each link being a part of the food chain. 6. Each group shares their chain. The class discusses the food chain and provides feedback. Groups can edit their chain by removing and adding links. Ask students to think about organisms that come from the same ecosystem. For example, a tiger could possibly consume a kangaroo, but they do not live in the same habitat so it doesn't make sense for them to be in the same food chain. 7. Collect the edited food chains to use in the next lesson.

Term 2 Week 2

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Biological sciences** Producers, consumers and decomposers have roles within an ecosystem and interact in ways that can be represented by food chains **Science inquiry** **Communicating** Communicate ideas using scientific vocabulary **Collaborating and applying** Use science knowledge to propose explanations for observed phenomena and solutions to problems	**Focus questions** • What is a food web? • How do food webs benefit ecosystems? • How is waste dealt with in an ecosystem? • What is a decomposer? • How do decomposers benefit an ecosystem? **Support notes** Part of this learning sequence is based on Primary Connections Year 4 Sustain the Chain. Food webs benefit the sustainability of an ecosystem because they can withstand some catastrophic events. For example, if one food source is removed from an ecosystem due to natural or manmade disasters, there are other food sources available until the original food source replenishes. Decomposers can be broken down into two categories: decomposers and detritivores. Decomposers are essential to an ecosystem as they break down waste and then return the energy and nutrients back into the system. Producers get their nutrients from the soil, which is enriched from the activity of decomposers. This energy is then able to re-enter the food web. Discussions in Biological sciences often include talking about death. Teachers should use their	**Learning experience 1** 1. Provide students with a copy of the *What Eats What* resource sheet from Primary Connections *Sustain the Chain*. Students label each picture with what is depicted. They cut out the living things represented and sort them into groups or categories. Students share their groups or categories. 2. Students sort the animals into the groups producers and consumers. Review the concept of food chains introduced earlier. 3. Students create food chains on paper using the pictures. 4. Students write down all the food they have been eaten that day on a small whiteboard. Most living things have more than one food source and, like humans, they don't only eat one thing. Students share their ideas of how it could be helpful to an ecosystem for living things to have more than one food source. 5. Explain to students that although food chains do exist in nature, it would be more accurate to represent it as a food web, as living things can consume many things and be consumed by many things. 6. Revisit the food chains from the previous lesson and look for ways they can link together. For example, there might be a bird that eats fruit and insects and so should be attached to both links. 7. Take a photo of the connected chains from above and display it for students.

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	knowledge of students when approaching this topic. Parents may need to be informed of these discussions happening in class. **Resources** • *What Eats What* resource sheet from Primary Connections • Food chains made in the last lesson **Suggested assessment points** **Formative assessment** Observe if students can: • identify that most living things have more than one food source and how that aids their survival • propose explanations for the speed in which the fruit decays • identify the role of decomposers in an ecosystem.	**Learning experience 2** 1. Show students a series of images of living things from the local ecosystem and, together, label them as producers or consumers. 2. Ask students, 'What happens to organisms in a habitat after they die? Where do they go? Why do we not have dead creatures and plants all around us?' 3. Ask students to think of a time they have forgotten a sandwich or a piece of fruit in their bag or on the counter. What happened when they found the food again? 4. Show students the video *Fruit and Vegetable Decomposition, Time-lapse* by webicosm at https://www.youtube.com/watch?v=c0En-_BVbGc (or similar). Ask students to describe what happens as the fruit rots, what appears on the fruit, and what other changes can be seen. Explain that the changes are caused by decomposers and detritivores. 5. Students select a fruit depicted in the video and sketch a series of images showing it changing from fresh to decayed, like a comic strip. Discuss which fruit decomposed the fastest and the slowest. Ask students to suggest an explanation, such as the presence or absence of a thick skin, firm or soft flesh. 6. Draw attention to the potato growing shoots at the end of the video and discuss the needs of plants. To keep growing, plants require sunlight, water, nutrients and air. Ask students to think about where the potatoes get their nutrients. 7. Revisit the food chains from earlier lessons and discuss where decomposers would fit in. They wouldn't just go at the end of the chain. Every living thing in a food chain would have arrows leading back to some sort of decomposer.

Term 2 Week 3

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Biological sciences** Producers, consumers and decomposers have roles within an ecosystem and interact in ways that can be represented by food chains **Science inquiry** **Questioning and predicting** Pose questions and make predictions based on planned observations of phenomena that include variables to be changed and measured **Planning and conducting** Plan and conduct investigations, including elements of fair tests, and consider the material and equipment risks Make and record observations, including formal measurements using familiar scaled instruments **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns	**Focus questions** • What is a decomposer? • How can you find out what material decomposers break down the quickest? • How can you keep this test fair? • What threats were there to the rock wallaby? • What role did Martu knowledge play in the conservation of the rock wallabies? **Support notes** A clear container, such as an aquarium or terrarium, is needed. The investigation should be left at least a couple of months to see clear results. Ideally the soil from the garden bed should be slightly moist and have earthworms or slaters in it. A documentary produced by Kanyirninpa Jukurrpa (KJ), a Martu-led organisation, can be accessed freely at kj.org.au, with the full film called *Keeping Pakulyarra Safe – A 40 year success story*. This film should be shown with cultural responsiveness to the Aboriginal and Torres Strait Islander people in the class and school. **Resources** • Variety of materials (organic and inorganic) • Clear container • Soil from a garden bed • *Fair test investigation template* (Appendix A) • *Keeping Pakulyarra Safe – A 40 year success story*	**Learning experience 1** 1. Review decomposers and ask students to imagine and describe what the school habitat might be like if there were no decomposers. 2. Students verbally predict what kind of materials decomposers break down, and which they don't. Consider whether decomposers might break down some materials quicker than others. 3. Show students a variety of materials, such as a piece of carrot or apple, a metal paperclip, a piece of paper, a piece of fabric, a plastic bottle top, a glass marble. Explain to students that these materials are going to be buried in some soil with decomposers and left for the rest of the term to see what materials break down quickly, slowly or not at all. Remind students that some decomposers can be seen with our eyes and some can't because they are too small. 4. Lead students through the process of planning the investigation using the template including: • what will we change? (the type of material) • what will we measure? (how long they take to break down) • what will we keep the same? (the decomposers present, the size of the material, the time and the environment they are left in) 5. Each group writes a question for their investigation such as, 'Will changing the type of material have an effect on

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	Connected learning In the second learning experience there are connections to the Cross-curriculum Priorities of Sustainability and Aboriginal and Torres Strait Islander histories and cultures. This activity can also be connected to the Humanities and Social Sciences learning area in the Geography and History sub-strands. **Safety considerations** Students should wash their hands thoroughly after handling soil or use non-latex gloves. **Suggested assessment points** **Diagnostic assessment** Observe if students can: • differentiate between introduced and indigenous species • identify some impacts introduced species may have on an ecosystem. **Formative assessment** Observe if students can: • create a reasonable question and prediction that suits the investigation • conduct the investigation in a safe and sensible manner • create detailed, clear diagrams.	the time it takes to decompose?' and a prediction, such as, 'The food will break down the fastest'. 6. Have students fill in the questioning and predicting, and planning and conducting sections of the *Fair test investigation* template. 7. Set up the clear container with soil from a garden bed and the materials. Place the materials near the side of the container so they can be seen. 8. Students draw a diagram of what they see. 9. Take a digital photo of the materials to compare to later in the term. **Learning experience 2** 1. Display a picture of a rabbit on the board and explain to students that rabbits are an introduced species. This means that rabbits are not indigenous to Australia but were introduced at some point during colonisation. Ask students to consider some of the ways that rabbits may have impacted the ecosystem. 2. Students watch the documentary *Keeping Pakulyarra Safe – A 40 year success story*, about an endangered species of rock wallaby in Western Australia. During the viewing, they take note of strategies employed by the Martu rangers and ecologists to help the rock wallaby populations. 3. After watching the documentary, place students into small groups and ask them to consider the following questions:

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
		• What threats are there to the rock wallabies? (foxes, dingos, feral cats) • How did the Jigalong rangers help sustain the rock wallaby population? (microchips, relocation, DNA sequencing, baiting predators) • How is Aboriginal knowledge vital in the rock wallaby project? (the Martu people have knowledge of rock wallaby populations in a healthy ecosystem, and knowledge of the country, how to traverse it, and where to release the rock wallabies. The Martu people have in-depth knowledge when it comes to tracking predators.) 4. Ask each group to share their thoughts and draw out any discussion points. Students share any questions they might still have about the black-flanked rock wallabies (pakulyarra). 5. Check the KJ website at http://www.kj.org.au/ for updates about the continued project and highlight to students which strategies have proven the most successful.

Term 2 Week 4

Western Australian Curriculum content

Science understanding

Biological sciences
Producers, consumers and decomposers have roles within an ecosystem and interact in ways that can be represented by food chains

Science inquiry

Processing, modelling and analysing
Organise and represent data using tables, column graphs and models to identify patterns

Communicating
Communicate ideas using scientific vocabulary

Collaborating and applying
Use science knowledge to propose explanations for observed phenomena and solutions to problems

Teaching and learning intentions

Focus questions

- What are indigenous species?
- What are introduced species?
- How can a food chain be interrupted?
- How can this interruption impact the rest of the ecosystem?
- Where does fruit come from?
- How do bees and flowers rely on each other?

Support notes
Pollinators, particularly bees, help transfer pollen from flower to flower. When the pollen from another flower is deposited onto a new flower's stigma, it can fall into the ovary where the plant can start developing seeds and fruit. The stamens are the part of the flower where pollen can be found.

Bees use nectar and pollen from the flowers as a food source for their hive, and incidentally also deposit pollen from one flower to another. They are two living things that depend on each other in an ecosystem, and so do humans. Bees and other pollinators are responsible for most of our food.

Connected learning
In the first learning experience, there are the continued connections to the Cross-curriculum Priorities of Sustainability and Aboriginal and Torres Strait Islander histories and cultures. This activity can also be

Learning experiences

Learning experience 1

1. Review introduced and indigenous species from the last lesson.
2. Students create a T-chart with indigenous species on one side and introduced species on the other side. Using their prior knowledge and information shown in the documentary from the previous lesson, students fill in their chart. Discuss their findings as a class. Possible examples are shown below.

Indigenous species	Introduced species
Black-flanked wallabies	Cats
Emus	Foxes
Numbats	Rabbits
Kangaroos	Cane toads
Dingos	Sheep
Quenda	Cows
Bobtail lizard	Camels

3. On the board, write a simple rock wallaby food chain. Grass (producer) > rock wallaby (primary consumer) > wedge-tailed eagle (secondary consumer). Ask students to think about ways this food chain could be broken, and the impacts on the rest of the food chain. For example, weeds taking over the grasses which means less food for the rock wallabies. If the rock wallabies die out, there will be less food for the wedge-tailed eagles.

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	connected to the Humanities and Social Sciences learning area, in the Geography and History sub-strands. The bees section of the unit fits in with the context Food and Fibre Production from Design and Technologies. **Safety considerations** When observing the bees, remind students to keep their distance so as not to make them feel threatened. Teachers should be aware of and consider any allergies or other health needs of their students. **Suggested assessment points** **Diagnostic assessment** • Students make some connections between the role of bees and flowers. **Formative assessment** Observe if students can: • identify indigenous and introduced species • develop a simple food chain • identify interruptions to the food chain and describe the wider implications.	4. In pairs, students choose an indigenous species to put into a simple food chain and look at ways that food chain could be interrupted. Encourage students to think about the wider impacts this could have on the ecosystem. 5. Students communicate their ideas in an appropriate way, whether recording in a science journal, on paper or creating a bigger visual display. 6. Once complete, students identify what is missing from the food chains. Once identified, add decomposers to all parts of the food chain. **Learning experience 2** 1. Display an image of a flower that is found on or near school grounds. Point out the petals, leaves, stems, stamen, stigma and ovaries and discuss the role of each (see support notes). 2. Discuss the role of diagrams in showing science understanding and ask students to draw and label a picture of a flower. Alternatively, students can use a digital picture and type in labels. 3. Display an image of a bee and ask students to share everything they know about bees using sticky notes or a digital message board. Review the students' answers as class. 4. Ask students why they think bees are important. Introduce the terms 'pollen' and 'pollinator'. Bees are not the only pollinators, but they are the most visible to us. 5. Walk around the school and look for areas where bees are present. On some of the bees, the pollen baskets on

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
		their back legs may be yellow or orange showing they have been collecting pollen. 6. Encourage students to look at the flowers the bees are visiting and identify any parts of the flower they can. 7. Back in class, draw and label a diagram of a bee or use a digital picture.

Term 2 Week 5

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Biological sciences** Producers, consumers and decomposers have roles within an ecosystem and interact in ways that can be represented by food chains **Science inquiry** **Questioning and predicting** Pose questions and make predictions based on planned observations of phenomena that include variables to be measured and changed **Planning and conducting** Plan and conduct investigations, including elements of fair tests, and consider the material and equipment risks Make and record observations, including formal measurements using familiar scaled instruments **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns **Evaluating** Compare findings with those of others, and to predictions; consider if investigations were fair; and identify questions for further investigation **Communicating**	**Focus questions** • What role do bees play in food production? • What flower do you think bees will enjoy the most and why? • What does your data tell you? • How can you represent this data? • Was this a fair investigation? How do you know? **Support notes** Identifying the role of bees in food production helps students see the real-life context for needing to understand bees and their behaviours. To complete the investigation, at least five different flowers are needed. These can usually be obtained from florists as surplus to need, or from the school garden or other local areas where it is appropriate to pick flowers. The more variation between the flowers' shape, size and colour the easier it will be to draw results. It is possible that the flowers will have very little or no bees visit, which is still an important result. This shows the bees are not interested in cut flowers, or those particular flowers. This provides an opportunity to look at what plants the bees are visiting and what about them that may be enticing to the bees if no data is available to create a column graph.	**Learning experiences** 1. Students share what they had in their lunchboxes. For example, bread, butter, tomatoes, apple, cake. Make a master list on the board. Cross out any foods that would be affected by the lack of bee pollination. Many guides and videos can be found online. 2. Pose a question to students: What kind of flowers do the bees in our school prefer to pollinate? Explain to students that this kind of information is important to apiarists, ecologists, botanists, farmers so that food production can continue. 3. Show students the array of flowers and identify any interesting aspects, such as large stamen or stigma, colours, smells or shape of petals. Explain that they are going to place these flowers in areas where bees were observed in the last lesson, or in pot plants, to see which one is visited by the most bees. 4. Lead students through the process of planning the investigation using the template, including: • what will we change? (the type of flower) • what will we measure? (the number of bees that visit) • what will we keep the same? (the location of the flowers, the time they are left outside) 5. Each group writes a question for their investigation, such as 'Will changing the type of flower have an effect on the number of bees that attempt to pollinate?' and a

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Communicate ideas using scientific vocabulary	**Resources** • Five flowers of a different variety and shape • *Fair test investigation template* (Appendix A) **Suggested assessment points** **Formative assessment** Observe if students can: • create a reasonable question and prediction that suits the investigation • conduct the investigation in a safe and sensible manner • record and represent data • compare their results to their predictions • identify reasons the investigation was fair or not.	prediction such as, 'The lily will get the most bees because the stamen is so big.' 6. Once the students have filled in the questioning and predicting and planning and conducting sections of the *Fair test investigation* template, set up the investigation in the chosen area of the school. Negotiate a suitable amount of time to watch the flowers and set a timer. 7. Students observe the flowers and make a tally mark in a chart until the timer goes off. 8. In class, compare the results. If there were no or very few bees visiting the flowers, discuss with students why this may have happened. 9. Guide students through using their data to create a column graph. Draw attention to features of the graph such as: • the X axis (type of flower) and Y axis (number of bees) • title • axis-labels. 10. Fill out the processing, modelling and analysing sections of the *Fair test investigation* template and use the evaluating section to compare the results to their predictions and indicate whether it was a fair investigation.

Term 2 Week 6

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Biological sciences** Producers, consumers and decomposers have roles within an ecosystem and interact in ways that can be represented by food chains **Science inquiry** **Communicating** Communicate ideas using scientific vocabulary **Collaborating and applying** Use science knowledge to propose explanations for observed phenomena and solutions to problems	**Focus questions** • What plants did the bees prefer? • What plants would you choose for a garden to attract more pollinators? • Why would you choose those plants? • How could you communicate your ideas to someone else? **Support notes** This activity provides an opportunity for students to use their science knowledge to solve problems. Choose a staff member that the students would know, such as the principal, gardener or a teacher who runs a gardening program for the students, to design their garden for. Ideally this staff member can come in when the students have finished their plan so they can communicate their ideas. The teacher is best placed to decide whether students complete this individually, and the level of explanation required for each plant. **Suggested assessment points** **Summative assessment** Observe if students can: • apply their scientific knowledge in a reasonable manner to choose plants for their garden	**Learning experiences** 1. Place signs that say producer, consumer, decomposer in three of the corners of the room. Call out some living things and ask students to move to the corner they think matches. Some examples include grasses, fungi, earthworms, algae, moss, wombats, echidnas, humans. 2. Classify bees as consumers and review their importance to our food production and ecosystem. Review what flowers the bees were most interested in during the last lesson. 3. Explain that someone at the school (principal, gardener) is thinking of making a garden to attract more pollinators. This means bees, but also butterflies, Brown Honeyeaters and other pollinators. However, they don't know what kind of plants to put in their garden that will attract the most pollinators. 4. Students need to use their prior knowledge from the investigation, and research from other sources to decide what kind of plants should be included. Remind students that these plants need to be able to: • survive in their school environment • attract pollinators • be safe to have in a school • be planted alongside other plants to increase biodiversity.

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	• provide explanations for their choice that make sense • communicate their ideas to another.	5. Give students time to research and decide what plants they would include in their garden. 6. Students draw their garden, using specific dimensions. For example, a rectangle that is 3 metres by 4 metres. They draw in their plants and label them. 7. Once the garden has been drawn and labelled, students explain why each plant was chosen. Students might have chosen fruiting plants that can also provide food for the school community, or indigenous plants. 8. Students review what might be missing from their gardens. There needs to be decomposers to keep the garden healthy long term. Give students time to add appropriate decomposers. 9. Invite the principal, gardener or staff member who runs the gardening program to come into the class for students to present their ideas and justifications.

Term 2 Week 7

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Biological sciences** Producers, consumers and decomposers have roles within an ecosystem and interact in ways that can be represented by food chains **Science inquiry** **Questioning and predicting** Pose questions and make predictions based on planned observations of phenomena that include variables to be changed and measured **Communicating** Communicates ideas using scientific vocabulary **Collaborating and applying** Use science knowledge to propose explanations for observed phenomena and solutions to problems	**Focus questions** • What is the difference between indigenous and introduced species? • Why were cane toads first introduced into Australia? • What impacts could cane toads be having on indigenous ecosystems? • What can be done to minimise these impacts? • How can you communicate these strategies to others? **Support notes** Prior to the first learning experience, teachers will need to consider indigenous species local to the school and print photos of these. Consider the use of plants and animals. Pre-made cards can be found on the Department of Biodiversity, Conservation and Attractions Cane toad management resources site https://library.dbca.wa.gov.au/FullTextFiles/925827-02.pdf. Teachers should consider whether the organisms represented here are relevant and familiar to the students. If the school is situated in an area that is not yet affected by cane toads, mitigation strategies are still relevant as cane toads move approximately 50 kilometres every	**Learning experience 1** 1. Write the words 'indigenous' and 'introduced' on the board and remind students of this concept that was covered earlier in the term. 2. Explain to students that introduced species are sometimes also referred to as invasive species. This denotes the destructive impact they can have on the indigenous species and ecosystem. A well-known invasive species in Australia is the cane toad. 3. Allow students time to investigate the introduction of cane toads, through books or internet searches. Once students have had time to find information, they share their findings with the class. Highlight that cane toads were introduced as a solution to the white grubs eating the sugar cane. A lot of invasive species were introduced with good intentions to help solve problems or benefit Australia in some way. However, once introduced, they upset the indigenous ecosystem. 4. In a think-pair-share, ask students to brainstorm ways that cane toads may interrupt the ecosystem and then share their ideas. Some examples could be: • eating indigenous species • killing animals that try to eat them • taking over habitats • leeching toxins into waterways. 5. In small groups, give students animal pictures from the local area (see support notes) and ask them to construct

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	year. The areas currently inhabited by cane toads in Western Australia are in the far north-east Kimberley region. Students in these areas may focus more on preventative rather than mitigation strategies. **Resources** • Pictures of animals from the local area, and one of cane toads (see Support notes) • A3 or poster paper • Books on cane toads • Food webs from the last lesson • Books and brochures on cane toads **Suggested assessment points** **Summative assessment** Observe if students can: • identify impacts invasive species can have on a local ecosystem • demonstrate understanding of a food web and the main relationships present • identify some mitigation strategies for dealing with invasive species • communicate their ideas in a clear manner.	a food web. Remind them that arrows point to the living thing that does the eating. 6. Students walk around and look at each group's food web to see if there are any connections they missed, then they edit their own food web. 7. Introduce the cane toad card to the food webs. Students use a different colour to demonstrate any disruptions to their food web as the result of the cane toad being introduced. 8. Remind students to consider further disruptions to living things that don't directly consume the cane toad. For example, habitat loss or predators that lose their food source. 9. Save the food webs for the next lesson. **Learning experience 2** 1. Show students the food webs from the previous lesson and ask them to identify what is missing from their food web (decomposers). 2. Using a third colour, ask students to draw in decomposers and possible impacts from the cane toad. Some examples: • Cane toads eat some insects that are decomposers, removing them from the food web. • Decomposers may be killed by toxins when attempting to decompose dead cane toads, or other animals that have been killed by cane toads.

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
		3. Students investigate the steps already being taken to help sustain the ecosystems disrupted by the cane toads and limit their continued destruction. 4. Students choose one of these methods to investigate. They could use books, internet searches and brochures. 5. Some of the methods students may choose to investigate include: • relocating threatened species, e.g. northern quolls • toad busting • community education • toad sausages – microdosing toad toxins to key species to teach them to avoid cane toads • fences. 6. Students create a 'fact sheet' or brochure to inform the public about their mitigation strategy. This could include diagrams, infographics and any useful statistics. Remind students to consider the audience and how that might influence their vocabulary choices. 7. Complete a gallery walk so students can see others' ideas.

Term 2 Week 8

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Biological sciences** Producers, consumers and decomposers have roles within an ecosystem and interact in ways that can be represented by food chains **Science inquiry** **Planning and conducting** Make and record observations, including formal measurements using familiar scaled instruments **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns **Evaluating** Compare findings with those of others, and to predictions; consider if investigations were fair; and identify questions for further investigation **Communicating** Communicate ideas using scientific vocabulary	**Focus questions** • What materials did decompose? • What patterns can you see in the results? • How did your prediction compare to the results? • Was this a fair investigation? Why? • What does an ecosystem need? • What ecological relationships can you see? **Support notes** Students should find that only organic materials, such as food and paper have started to decompose or have entirely decomposed. Other organic materials like fabric (if made from natural fibres) or wood may have started to change and break down, but not completely. Inorganic materials like metal, plastic and glass will not have changed at all. Students should deduce that decomposers can only decompose organic materials. In the second learning experience, students think about what kind of food chains would exist in a simulated ecosystem and make sure they have a mix of consumers, producers and decomposers. Their answers to the questions could be written down or digitally recorded and used as assessment.	**Learning experience 1** 1. Watch a small excerpt of a nature documentary and highlight living things and any ecological relationships students observe. 2. Display a picture of what the decomposer experiment looked like at the beginning and ask students to share their predictions of which materials have decomposed and which haven't. 3. Take out the decomposer soils set up earlier in the term and allow students time to observe what has changed. Take a photo of the results and display them side by side. 4. Ask students to verbally describe what has changed and look for any patterns in the results. 5. Students record their observations and results in the processing, modelling and analysing section of their *Fair test investigation template*. *6.* Ask students to compare their predictions with their results. Add their thoughts in the evaluating section of the *Fair test investigation* template. 7. Discuss if it was a fair test. Only the material should have changed. Evaluate as a class whether anything else was changed and finish filling out the investigation template. 8. Decide as a class whether to keep the investigation going to further observe the materials over the year or dispose of the soil in a garden bed. Take care to remove the undecomposed materials before returning the soil to a garden bed.

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	Resources • Blank paper or tree outline (photocopied) **Suggested assessment points** **Summative assessment** Observe if students can: • identify and explain patterns in their results • compare their prediction to their results • give a reason why a test was fair or not • represent and explain ecological relationships within an ecosystem.	**Learning experience 2** 1. Students draw a tree, or use a template given to them, then add organisms to complete an ecosystem. Students think about ecological relationships, and producers, consumers and decomposers. For example, they have bees living in their tree. The bees need a way to get pollen or nectar, so they need to add flowers to their ecosystem, and they need a decomposer to deal with the waste and dead leaves. 2. Students think about the relationships they have learned about. These can extend from what an organism eats to other beneficial relationships, like the tree providing a habitat, the flowers being pollinated. 3. Remind students that all energy on Earth originates from the Sun and that producers use a process called photosynthesis to turn this into their own energy. 4. Once complete, students walk around the room and look at each others' ecosystem. They must ask one of four questions before moving to the next person: • What would your ecosystem be like if there were no producers? (the consumers that eat plants would die out. Then the consumers that eat those animals would die out) • What would your ecosystem be like if there were no consumers? (the producers would grow in population) • What would your ecosystem be like if there were no decomposers? (waste would build up and it would become unliveable). What would happen to the ecosystem if (choose an organism from their drawing) disappeared? (answer depends on the organism chosen).

Term 3

Weeks 1–8: Earth and space sciences

Term 3 Overview

Earth and space sciences Weathering, erosion, transportation and deposition cause slow or rapid change to Earth's surface							
Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**	**Week 8**
Changes to the Earth's surface: introduction	Investigation: mechanical weathering freeze and thaw	Practical: chemical weathering acid rain	Summative assessment *Investigation: Waste rock stockpile* (Appendix C)	Investigation: mechanical weathering river rocks	Practical: erosion, transportation and deposition	Investigation: erosion, transportation and deposition	Practical: Uluṟu
Fieldwork: weathering	Investigation: mechanical weathering freeze and thaw	Practical: chemical weathering acid mine run-off	Fieldwork: biological weathering	Investigation: mechanical weathering river rocks	Investigation: erosion, transportation and deposition	Practical: finding solutions to the impacts of erosion	Weathering and erosion in the local area
Resources							
Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**	**Week 8**
• *The Rainbow Serpent*, book by Dick Roughsey • weathering vocabulary and definitions match-up	• clear containers • resealable bags	• cups • vinegar • limestone • variety of living and non-living items • tray • sand • dyed salt	• sand • dyed salt • trays • materials, such as rocks, twigs and plastic wrap	• modelling clay • jars with lids • cornflour	• sandpit • watering can • straws • ice cubes • trays with soil or sand • timers	• trays with soil or sand • leaves, toy plants, small seedlings	• large rocks • watering can • straws • sandpit

Term 3 Week 1

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Earth and space sciences** Weathering, erosion, transportation and deposition cause slow or rapid change to Earth's surface **Science inquiry** **Planning and conducting** Make and record observations, including formal measurements using familiar scaled instruments **Communicating** Communicate ideas using scientific vocabulary	**Focus questions** • What is the Earth's surface? • How has time changed the Earth's surface? • How have humans changed the Earth's surface? • What types of weathering are there? How would you know the type of weathering? • What examples of weathering can you find around the school? **Support notes** Chemical weathering: changing or breaking down rocks and minerals because of a chemical reaction, e.g. rust. Biological weathering: weathering that occurs as the result of living things, including humans, e.g. mining. Mechanical weathering: the physical breaking down of rocks and minerals that doesn't change their chemical composition, e.g. freeze and thaw, river rocks (also referred to as physical weathering). **Resources** • *The Rainbow Serpent* by Dick Roughsey • Large sheets of paper • Weathering vocabulary and definitions match-up (Appendix A)	**Learning experience 1** 1. Remind students of the word 'ecosystem' from the biological sciences unit, and the definition. Ecosystems include the living and non-living elements of an area. 2. Students brainstorm what makes up the non-living parts of an ecosystem, e.g. water, soil, rocks. Ask students to consider whether these non-living parts can change over time like living things do. (Yes, on a much longer timescale than living things) 3. Use an online map to look at the school from overhead. If it has a timeline feature, look at the site of the school over different years and discuss what has changed and how. 4. Read or watch an online video of *The Rainbow Serpent* by Dick Roughsey. While listening, ask the students to make note of the changes that happened, such as rivers and creeks being made by Goorialla. 5. At the end of the book, a large mountain has been turned into a small hill. Ask the students if that has happened on the Earth's surface, e.g. 'Where has a large mountain or rock been made smaller by something?' 6. Look at pictures or videos of riverbanks before and after floods. Highlight the changes that have been made. 7. In small groups, give students two large sheets of paper with the words erosion and weathering on them. Students write down anything they think they know about the words, any examples, or any questions.

Connected learning

When reading *The Rainbow Serpent*, many connections can be made to the Cross-curriculum priority Aboriginal and Torres Strait Islander histories and cultures. The changing of the Earth's surface can also be connected to Humanities and Social Sciences, particularly in the Geography sub-strand.

Suggested assessment points

Diagnostic assessment

Observe if students can

- recognise weathering in the school
- sort examples of weathering correctly.

8. Discuss the sheets as a class and address any misconceptions. Give students the correct definitions to add to the sheet.

Learning experience 2

1. Place students into small groups and give each one a cut up match-up (Appendix A) and ask them to match them.
2. Check answers and get each group to change the matches they made if necessary.
3. Take students into the school grounds and look for examples of weathering. Students record the weathering they see using photos, paper on a clipboard or individual whiteboard.
4. Look for examples of weathering, such as tree roots disturbing the earth and pavement, discoloured bricks, and concrete and grass that has been worn away.
5. Put students into the groups from earlier and sort the examples into biological, chemical and mechanical weathering.
6. Using the students' examples, create a class chart with different type of weathering. A sample can be seen below:

Chemical	Biological	Mechanical
• Discoloured concrete and bricks from bore water	• Paths worn into the grass • Tree roots disturbing the earth • Sand moved from one place to another (sandcastles)	• Parts of rock/soil/ brick that have been worn away from water • Chips off corners

Term 3 Week 2

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Earth and space sciences** Weathering, erosion, transportation and deposition cause slow or rapid change to Earth's surface **Science inquiry** **Questioning and predicting** Pose questions and make predictions based on planned observations of phenomena that include variables to be measured and changed **Planning and conducting** Plan and conduct investigations, including elements of fair tests, and consider the material and equipment risks Make and record observations, including formal measurements using familiar scaled instruments **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns **Evaluating** Compare findings with those of others, and to predictions; consider if investigations were fair; and identify questions for further investigation	**Focus questions** • What is weathering? • What are the types of weathering? • How can you make this a fair investigation? • What caused your results? • How can you communicate these results? • How does your prediction compare to the results? **Support notes** Freeze and thaw, also known as frost wedging, is a form of mechanical weathering where water repeatedly gets into cracks and freezes expanding the cracks in the rocks until it completely cleaves through. Freeze and thaw is known for creating straight, complete cracks. **Resources** • *Fair test investigation* template (Appendix A) • Clear containers • Resealable bags **Safety considerations** Put the container in a resealable bag before freezing it to contain any broken pieces. This investigation can be done with glass or plastic	**Learning experiences** 1. Complete the vocabulary and word match-up from the last lesson in small groups. Students should be able to complete this quicker given their prior knowledge. 2. In the definition for mechanical weathering, changes in temperature and freeze and thaw are mentioned. Ask students to share what they think these terms mean. 3. Find and display freeze and thaw images and show students the results. Highlight the generally straight cracks this type of weathering produces. Reinforce that weathering of rocks and minerals usually happens over many thousands of years. 4. Show students a small clear container with a tight lid. Students imagine that the container is a rock, and they are going to fill it to the top with water and then put in the freezer. Students predict what will happen to their rock when they remove it from the freezer in the next lesson. 5. Lead students through the process of planning the investigation using the template, including: • what will we change? (the temperature) • what will we measure? (how the rock/container changes) • what will we keep the same? (the size of the container, the amount of water, the amount of time in the freezer etc) 6. Place students into groups and instruct them to write a question for their investigation; for example, 'When we change the temperature, what will happen to our rock?' and a prediction, such as, 'The rock will look the same, because the water won't do anything'.

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Communicating Communicate ideas using scientific vocabulary	but warn students to be careful of sharp edges. The containers can be disposed of without opening the bag to prevent any injuries. **Suggested assessment points** **Formative assessment** Observe if students can: • identify the variables that are being changed and measured • create a question and prediction that is reasonable to the investigation • identify the weathering process at work • discuss and demonstrate their results.	7. Once the students have filled in the questioning and predicting and planning and conducting section of the investigation template, give each group a container to fill up and put the lid on firmly. Take a digital picture and put the container in a resealable bag and label with names. Put the container into the freezer. 8. In the next learning experience remove the containers from the freezer and let the students observe them through the resealable bag. Remind students to handle the bag carefully in case sharp bits poke through. 9. Ask students to observe the breaks and cracks in their container, and if the lid stayed on or off. Relate their observations back to the images of freeze and thaw from the previous lesson. 10. Students draw diagrams or annotate a digital picture of their observations. 11. Students think about what caused the cracks in their container and share these ideas. Guide students to the concept that as water freezes, it expands and takes up more space and therefore cracks the container it is in. 12. Compare this to rocks, when water gets into cracks and freezes, it expands the crack. When this happens several times, over hundreds or thousands of years the crack eventually gets so big the rock cracks open. This is why freeze and thaw creates straight cracks in the rock. 13. Students work together to fill out the 'explain your results' section of the *Fair test investigation template* using the previous discussions of freeze and thaw. 14. To fill out the evaluating section of the investigation template, students compare their predictions to the results and discuss whether it was a fair test.

Term 3 Week 3

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Earth and space sciences** Weathering, erosion, transportation and deposition cause slow or rapid change to Earth's surface **Science inquiry** **Communicating** Communicate ideas using scientific vocabulary **Collaborating and applying** Use science knowledge to propose explanations for observed phenomena and solutions to problems	**Focus questions** • What is acid rain? • What impact can acid rain have on Earth's surface and living things? • What type of weathering is acid rain? • How do humans change the Earth's surface? • What impact does mining have on the Earth's surface? **Support notes** Acid rain is caused by the water vapour in the air mixing with other gases, such as carbon dioxide, sulphur dioxide and nitrous oxide to create an acidic compound. When this mixture rains down to Earth, it is called acid rain. A common misconception is that acid rain is pure acid and instantly dissolves anything it encounters. Acid rain is primarily water that has some acidic components. The damage done to buildings, rocks and sculptures from acid rain is through repeated exposure over a long amount of time. In the second learning experience, students examine mining as a form of weathering and erosion. Waste rock stockpile: a mound where rocks and other materials that don't contain the mined mineral are put. Some of these materials are acid-forming	**Learning experience 1** 1. Show students a piece of limestone and let them touch it. Ask them to share their observations of what the limestone looks and feels like. Highlight that limestone is rough and sandy. 2. Put the limestone into a cup of vinegar. Students verbally share their predictions of what might happen to the limestone. 3. Introduce the term acid rain and ask students to complete a think-pair-share activity to discuss what it might mean. 4. Explain acid rain to students (see support notes). 5. View images of the effects of acid rain on buildings and statues using an internet search. 6. Check on the limestone and see how it has changed. Students should observe that the liquid is cloudier and that grains of sand have accumulated at the bottom. The vinegar has dissolved the lime in the limestone and released the grains of sand. Leave the limestone in the vinegar. 7. Show students some organic and non-organic items (leaves, twigs, eggshells, seashells, pebbles, nails, pieces of brick or concrete) and ask them to predict how they might change if exposed to acid. 8. Students sketch what the items look like now. Place them in vinegar and leave them somewhere they won't be disturbed. 9. Ask students to indicate if they think acid rain is chemical, biological or mechanical weathering (it is chemical).

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	and so are sandwiched between other materials to stop water and oxygen getting to them. Acid mine run-off: acids that run off from the stockpile in a liquid form and enter the environment through waterways and plants. Leaching: substances drawn out from a solid and dissolving into a liquid. To mimic a waste rock stockpile, place light-coloured sand at the bottom of a tray and put some of the dyed salt (see instructions below) on top of it. Use more light-coloured sand to cover the salt and make a mound. When water is poured onto the sand, the salt should start to dissolve, and the dye will leach out to mimic acid mine run-off. To make dyed salt, add some drops of food colouring to table salt and mix in. Let the salt dry before using. **Resources** • Vinegar • Cups • Limestone • Variety of organic and non-organic items, e.g. leaves, twigs, eggshells, seashells, pebbles, nails, pieces of brick or concrete • Demonstration waste rock pile (see Support notes)	10. Exit ticket: students write on a sticky note what they think could cause an increase in acid rain. **Learning experience 2** 1. Look at the items left in the vinegar, including the limestone. Students share their observations and sketch what the items look like now. 2. Discuss any patterns they notice in the results. Have the organic or non-organic items changed the most? Were there any items that didn't change at all? 3. Revisit the exit tickets from the last lesson where students shared their thoughts on what can cause an increase in acid rain. Human activity contributes to acid rain as greenhouse gases release more of the gases that mix with water vapour to create acid rain. 4. Humans can cause lots of different types of weathering and erosion. They cause changes to the Earth's surface on a small and large scale. Take students to a sandpit in the school and ask them to pretend it is a mine. Give students five minutes to mine (teachers may want to bury some small toys for the students to find). Take a before and after photo. 5. Once the five minutes are up, ask students to share the actions they took, focussing particularly on moving material from one place to another. Display the images of the before and after and note any changes to landforms in the sandpit. 6. Introduce the idea of mining waste: most of what mines remove from the ground is waste product and must be moved somewhere. These are referred to as waste rock

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	Connected learning These learning experiences address the Sustainability Cross-curriculum Priority by highlighting the role humans play in weathering and erosion. These ideas could be developed further in other learning areas. **Safety considerations** Students should not ingest or put their hands in the vinegar. Teachers should consider medical needs and allergies in their class, such as eggs, when choosing items to put into the vinegar. **Suggested assessment points** **Formative assessment** Observe if students can: • recognise the role humans play in changing the Earth's surface • describe the type of weathering being shown • identify impacts that mining may have on the Earth's surface.	stockpiles and need to be planned for before a mine is ever opened. Images of waste rock stockpiles can be found using an internet search. 7. The waste rock stockpile includes material that can form acid and materials that can't form acids. Discuss issues that acid in the environment may produce, reviewing the results from the acid rain practical. 8. Show students the example waste rock stockpile (see support notes) and explain that there is acid forming material inside the mound, and you have tried to cover it with non-acid forming material to protect the environment. Pour water like rain over the mound and see what comes out. The colour from the dyed salt in the centre should run out. 9. Ask students to imagine what would happen if that were acid being released into the environment. Mines are responsible for maintaining the environment and rehabilitating it when the mine closes. The students think of ways that they could change the waste rock stockpile to stop the acid leaching out, to develop in the next lesson. 10. Look up images of nearby mines and acid mine drainage.

Term 3 Week 4

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Earth and space sciences** Weathering, erosion, transportation and deposition cause slow or rapid change to Earth's surface **Science inquiry** **Questioning and predicting** Pose questions and make predictions based on planned observations of phenomena and include variables to be measured and changed **Planning and conducting** Plan and conduct investigations, including elements of fair tests, and consider the material and equipment risks **Communicating** Communicate ideas using scientific vocabulary **Collaborating and applying** Use science knowledge to propose explanations for observed phenomena and solutions to problems	**Focus questions** • What is chemical weathering? • How could you prevent acid mine run-off? • How could you improve your design for limiting acid mine run-off? • What is biological weathering? • What examples of biological weathering can you see in the school? **Support notes** In the first learning experience, the students apply their knowledge from the last lesson to solve the problem of acid mine run-off. Students might choose to cover their pile in larger rocks, twigs, vegetation or a material like clingwrap. Encourage students to think about how they could improve their design, acknowledging that scientists and engineers often need to try many different iterations before they solve the problem. **Resources** • Sand • Dyed salt • Trays • Materials for students to use in their investigation, e.g. rocks, twigs, leaves, plastic wrap	**Learning experience 1** 1. Review the vocabulary: waste rock stockpile, leaching and acid mine drainage. 2. Students design a solution to prevent acid leaching out of the waste rock stockpile and test the solution. They complete this activity in small groups, pairs or individually depending on student and assessment needs. 3. Give students the templates and ask them to devise a question that they are trying to answer with their investigation. Have them describe their plan and what materials they need. 4. Give students their example waste rock stockpiles, or, if appropriate, construct them together. Provide students time to execute their ideas and then test them by pouring water. 5. Students either draw or take an image using a digital tool. They evaluate the success of their idea and describe any changes they would make. Note: students shouldn't expect there to be no colour leaching, but rather significantly less leaching from the demonstration in the last lesson. 6. Students share their findings with each other, including what they think went well with their plan and what they would change. **Learning experience 2** 1. Display a picture of a nearby park, or other community place that has both natural and manmade elements. Ask students to share changes that could happen there. For example, a flood could kill the plants and wash away soil and sand,

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	• *Mine waste rock stockpile* template (Appendix C) **Safety considerations** When disposing of the sand from the investigation, only use a sandpit. The salt content may damage plants if returned to a garden bed. **Connected learning** The first learning experience where students design and implement a solution to acid mine run-off has connections to Design and Technologies. It also addresses the Sustainability Cross-curriculum Priority. **Suggested assessment points** **Formative assessment** • Students can identify biological weathering and its causes. **Summative assessment** Observe if students can: • identify investigable questions • make and execute a plan, explaining their reasoning • evaluate the success of their plan and identify areas for improvement.	wind could blow away the sandpit or people could come and take out the playground. Classify these ideas as weathering or erosion. 2. Remind students of biological weathering; weathering caused by any living thing, such as trees, humans and other animals. 3. Instruct students to walk around the school looking for signs of biological weathering and take photos of them. Some examples that could be found around the school are: • paths worn into the grass • limestone or other rocks that have been cut into block shapes to make walls • sandcastles or holes in the sandpit • moss or lichen on rocks • ground being disturbed by tree roots. 4. In the classroom, students display and explain their images. 5. Students choose one example of biological weathering that they or other students found and draw a diagram. They label the parts of the diagram and the biological weathering taking place.

Term 3 Week 5

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Earth and space sciences** Weathering, erosion, transportation and deposition cause slow or rapid change to Earth's surface **Science inquiry** **Questioning and predicting** Pose questions and make predictions based on planned observations of phenomena that include variables to be measured and changed **Planning and conducting** Plan and conduct investigations, including elements of fair tests, and consider the material and equipment risks Make and record observations, including formal measurements using familiar scaled instruments **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns **Evaluating** Compare findings with those of others, and to predictions; consider if investigations were fair; and identify questions for further investigation	**Focus questions** • What could have caused the differences between the rough and smooth rock? • What will happen when you shake your clay rocks? • How can you make the test fair? **Support notes** Abrasion is a mechanical type of weathering, where rocks rub against each other and other surfaces to wear away parts of the rock. River rocks are rocks that have been tumbled in water for many years and so have abraded to a smooth and polished surface, usually oval. **Resources** • Modelling clay • Jars with lids • Cornflour • Timers • *Fair test investigation* template (Appendix A) **Safety considerations** When shaking the jar, students should move away from furniture and others to avoid injury.	**Learning experiences** 1. Show students a rock with rough, irregular edges and a rock that is smooth and rounded. Ask students to share their ideas of what may have happened to make the rocks so different. 2. After hearing ideas, share with students that the smooth rocks are sometimes referred to as river rocks. Does that give a clue of what made the rock so smooth? What would happen to a rock that is in a river? 3. Students should deduce that a rock in a river is tumbled and moved around a lot by the water, and it would bang and rub against other rocks and hard materials in the river. Reinforce that this weathering process would occur over many hundreds of years. 4. Pose question: 'What would happen if we made some rocks out of modelling clay and tumbled them around in a jar, like rocks in a river?' Take some verbal predictions. 5. Lead students through the process of planning the investigation using the template including: • what will we change? (the shape of the rock) • what will we measure? (how the rock changes) • what will we keep the same? (the material the rocks are made from, the amount of shaking) 6. Put students into groups and instruct students to write a question for their investigation, such as, 'When we change the shape of the rock what will happen when I shake them?' and a prediction, such as, 'The rocks will become smoother like the river rock.'

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	Suggested assessment points **Formative assessment** Observe if students can: • make a reasonable question and prediction • conduct the investigation in a safe and sensible manner • explain results using clear language • identify the mechanical weathering at work.	7. Once the students have filled in the questioning and predicting and planning and conducting section of the investigation template, give each group/student some modelling clay so they can make five rocks. Students make the rocks different shapes, take a digital image and put them in a jar. Note: if the modelling clay is sticky or soft it may need a pinch of cornflour to stop the rocks sticking to each other. 8. Students use a timer to make sure they are shaking for an adequate time (five minutes) and then tip the rocks out. Take a second image and compare it to the first. 9. Record the results by sketching the before and after or printing the images to add to their template. 10. Discuss any patterns the students noticed. All the rocks should have smoothed out. Relate their findings to river rocks, and how the tumbling and rubbing against each other over many years may have smoothed them out. This process is called abrasion. 11. Ask students to summarise their ideas and fill out the 'explain your results' section of the investigation template. 12. Compare their predictions to the result and discuss whether it was a fair test. Consider things that were hard to control, such as keeping the force of shaking consistent, or the amount of clay in each rock. Fill out the evaluating section of the investigation template. 13. Watch a mechanical rock tumbling video online and ask students to decide whether abrasion and rock tumbling is mechanical, chemical or biological weathering.

Term 3 Week 6

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Earth and space sciences** Weathering, erosion, transportation and deposition cause slow or rapid change to Earth's surface **Science inquiry** **Questioning and predicting** Pose questions and make predictions based on planned observations of phenomena that include variables to be measured and changed **Planning and conducting** Plan and conduct investigations, including elements of fair tests, and consider the material and equipment risks Make and record observations, including formal measurements using familiar scaled instruments **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns	**Focus questions** • What is erosion, transportation and deposition? • How do wind, water and ice erode the Earth's surface? • What patterns can you see in the deposition? • What kind of factors impact erosion? **Support notes** Erosion is the movement of the broken-down pieces of rock or sand. A good way to remember weathering and erosion is the phrase 'weathering breaks, erosion takes'. As those pieces are being moved, it is called transportation. Deposition is where those particles are laid down, for example, at the bottom of a river, to eventually turn into sedimentary rock. Deposition is where the eroded material is deposited. Erosion naturally occurs in three main ways: wind, water and ice. Humans can also cause erosion; for example, through mining and construction. **Resources** • Sandpit (or sand in trays) • Watering can • Straws	**Learning experience 1** 1. Display a picture of a beach, local to the school if possible, and talk about what changes could happen there. Could the coast change shape? Do the dunes change? 2. Ask students if they have ever been to the beach or park or somewhere similar when it has been windy and to describe what happened. Did they see or feel sand flying around? 3. Explain to students that the movement of the sand or small pieces of broken-down rock is called erosion. This can happen with wind, water and ice. Deposition is when those pieces are laid down somewhere, such as the bottom of the river or in sand dunes. 4. Set up stations in the sandpit or sand trays for students to observe erosion at work: • Push ice down mounds of sand. Observe what happens to the path where the ice travelled and where the sand ends up. • Build up hills and valleys in the sand and then pour water at the top of a hill. Observe any movement of the sand and where the sand ends up. • Use a straw to blow wind onto a patch of dry sand. Observe what the sand looked like before and after, and where the sand ended up. 5. In the classroom, display pictures of the various stations or draw diagrams with the students' input.

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	• Ice cubes • Timers • *Fair test investigation* template (Appendix A) **Safety considerations** When blowing on the sand or soil, students need to wear safety glasses to prevent any particles blowing into their eyes. **Suggested assessment point** **Formative assessment** Observe if students can: • define erosion, transportation and deposition • identify changes to the Earth's surface because of erosion. **Summative assessment** Observe if students can: • devise a question and prediction that is reasonable for the investigation • conduct the investigation in a safe and sensible manner • devise efficient ways to record results.	6. Discuss the terms erosion, transportation and deposition and label the deposition on the diagrams. Discuss how the deposition was different for each method of erosion. **Learning experience 2** 1. Show pictures of notable land formations in the local area that students would be familiar with. Discuss what might have happened to form these landscapes. 2. Explain that students are going to look at factors that affect wind erosion by having a tray of dry soil and a tray of damp soil. They are going to blow on both trays with a straw and see the difference in the erosion, transportation and deposition. 3. Lead students through the process of planning the investigation using the template, including: • what will we change? (the moisture in the soil) • what will we measure? (the amount of erosion) • what will we keep the same? (the amount of soil, the method of blowing, the time of blowing) 4. Put students into groups and instruct them to write a question for their investigation, such as, 'When we change the moisture of the soil, will it change the amount of erosion?' and a prediction, such as, 'The wet soil will not move as much as the dry soil.' 5. Once the students have filled in the questioning and predicting and planning and conducting section of the investigation template, put students into groups and give them two trays of soil, straws and a timer. Students should wear safety glasses to prevent soil blowing into their eyes. 6. Give students time to conduct their investigation. Record results with photographs, videos or diagrams.

Term 3 Week 7

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Earth and space sciences** Weathering, erosion, transportation and deposition cause slow or rapid change to Earth's surface **Science inquiry** **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns **Evaluating** Compare findings with those of others, and to predictions; consider if investigations were fair; and identify questions for further investigation **Communicating** Communicate ideas using scientific vocabulary **Collaborating and applying** Use science knowledge to propose explanations for observed phenomena and solutions to problems	**Focus questions** • What patterns can you see from your results? • Was this a fair investigation? • What impact does erosion have on the soil? • How could that impact be minimised? **Support notes** When the topsoil gets washed or blown away, crops cannot be grown, and livestock is not able to be fed. This affects the food supply chain. It is difficult and costly to replace topsoil, as it only exists in a finite amount. Ways to limit the erosion of topsoil is planting more trees and using boulders. **Resources** • Trays • Soil or sand • Straws • Rocks • Leaves, toy plants etc.	**Learning experience 1** 1. Review the results from the investigation from the previous lesson, looking at any images, videos or diagrams that were collected. 2. Students devise a general statement to explain the results. For example, 'The dry soil moved more and was transported much farther. The deposition from the dry soil was spread out far from the tray. The wet soil barely had any erosion occur.' 3. Students add their statements to the investigation templates. 4. Compare their predictions to their results and check whether it was a fair test. Fill out the evaluating section of the investigation template. 5. On sticky notes, students write one idea for how they could improve the investigation if they were to run it again. For example, measuring the amount of water added to the soil or using another container to catch and measure the amount of deposition. 6. In small groups, lead students through a discussion of the possible impacts of erosion using guiding questions such as: • What could happen if a lot of the soil from an area blew away? • How else could the soil be moved away from the area? (water) • How might different people be affected by soil erosion? (farmers, consumers, fishermen, homeowners) • Would other living things be impacted? • Are there any ways to stop erosion?

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	Suggested assessment points **Summative assessment** Observe if students can: • identify patterns in results • compare predictions to their results • evaluate whether they conducted a fair investigation • identify that ground coverings reduce the impact of erosion • communicate their ideas in an effective manner.	7. Look at some online images of erosion in Australia and discuss the possible impacts on living things in the area. **Learning experience 2** 1. Review the discussion from the previous lesson. Students call out ideas for ways to stop or slow erosion from either wind or water. For example, putting something on top of the soil to keep it in place. 2. Ask students to think about things that may occur naturally to help keep soil in place, e.g. rocks and vegetation. 3. In groups, give students two trays. One will be the control that is dry soil with nothing added, the other tray can have one change. For example, adding rocks or leaf coverings to the second tray. 4. Ask the groups to devise their own way to measure their results, such as photos, video, diagrams. 5. Allow students time to complete their investigation and compile their results. 6. The groups then devise a way to communicate their results to others who may be worried about erosion in their area. For example, farmers. They could create a digital collage, a digital presentation, a poster or a brochure. 6. Give students time to execute their ideas and show others what they devised.

Term 3 Week 8

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Earth and space sciences** Weathering, erosion, transportation and deposition cause slow or rapid change to Earth's surface **Science inquiry** **Communicating** Communicate ideas using scientific vocabulary **Collaborating and applying** Use science knowledge to propose explanations for observed phenomena and solutions to problems	**Focus questions** • What do you think caused these rock formations? • How did erosion help form Uluru as you see it today? • What changes to the Earth's surface could occur over a million years? **Support notes** Uluru is an inselberg, which is also known as a rock island. They are characterised by rock formations that jut out of the ground of flat landscapes with the rest of the rock eroded away from the site. The nearby Kata Tjuṯa rock formations are also inselbergs. **Resources** • Resource sheet 5 – *Beneath our Feet*, Primary Connections • Large rocks • Sandpit • Watering cans • Straws **Connected learning** The traditional owners of Uluru and its surrounds are the Aṉangu people, who have a deep history and culture. This culture, and the history surrounding the ownership of Uluru can be	**Learning experience 1** 1. Revisit the images of local rock formations from the second learning experience in Week 6. Show the students a picture of Uluru and note important features, such as its colour, size, shape and the way it protrudes from the ground. 2. Students share their ideas of how these features may have developed using their science knowledge from the term. 3. Share with students that Aṉangu (the traditional owners) and geologists have noticed, from observations in the caves around Uluru, that it was originally a greyish rock. What weathering might have occurred to make it the red-orange colour it is now (chemical weathering; the high iron content of the rock has rusted)? 4. In groups, students create a graffiti or scribble page to answer the following questions: • What might have caused the different shapes and paths around Uluru? (weathering and erosion by water and wind) • Would Uluru have formed the way it is now as a slow or quick process? (slow; geologists believe that Uluru started to form around 550 million years ago) • Why is the sand around Uluru the same colour as the rock? (the rock has eroded over time and the sand is the deposition) 5. Explain that Uluru is known as an inselberg, like a rock island; most of the rock is still under the surface of the Earth. Show students Resource sheet 5 – *Red Rock Uncovered*, from the

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	explored further through Humanities and Social Sciences. It addresses the Aboriginal and Torres Strait Islander histories and cultures Cross-curriculum Priority **Suggested assessment points** **Summative assessment** Observe if students can: • use their science knowledge to explain changes that can occur to the Earth's surface • use scientific vocabulary.	*Beneath our Feet* Primary Connections unit. Look at the diagram of how Uluru was revealed from beneath layers of soft rock over millions of years of weathering and erosion. 6. To mimic this process, students choose a large rock from the school grounds or a collection of rocks and bury it in the sandpit. They erode the sand away either by pouring water into the sandpit or using a straw to produce wind until the top of their rock is exposed like Uluru. 7. As students conduct the investigation, ask them to stop a couple of times in the process to photograph or draw what is happening. In their images, the rock should slowly become exposed. Remind students that most of the rock should remain buried. 8. Back in the classroom, students collate their drawings or photos to show a timeline of their rock being exposed. **Learning experience 2** 1. Students take a photo of an area of the school that has lots of natural features. Alternatively, teachers can supply a picture of a familiar local area. 2. Students annotate the picture digitally or print it out to explain what the area might look like in a million years. 3. Students should use their knowledge of erosion and weathering and be as specific as possible using terms, such as transportation, deposition, chemical, biological and mechanical weathering.

Term 4

Weeks 1–8: Chemical sciences

Term 4 Overview

Chemical sciences Processed materials, including fibres, metals, glass and plastics, are made from raw materials, such as wool, ores, sand and oil, and have a range of physical properties that influence their use							
Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**	**Week 8**
Physical properties introduction	Practical: properties of materials	Plastic packaging	Investigation: absorbency	Investigation: sponge absorbency	Material properties and uses review	Inquiry: fibre production	Egg-drop design challenge
Raw and processed materials introduction	Developing processed materials	Investigation: absorbency	Investigation: absorbency	Investigation: sponge absorbency	Inquiry: clay to bricks	Classroom materials, properties and uses	Egg-drop design challenge
Resources							
Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**	**Week 8**
• *Mr Tuggle's Troubles*, book by LeeAnne Blankenship • raw and processed materials cards (see lesson notes)	• A variety of familiar objects (see lesson notes) • *What If Rain Boots Were Made of Paper?,* book by Kevin Beals and P. David Pearson	• cups • water • samples of different materials, e.g. paper towel, plastic wrap, foil		• cups • water • variety of brands of sponges	• raw clay • bricks	• strips of different fabrics • pipettes • small weights • books on fabric production	• eggs • variety of construction materials (see lesson notes)

Term 4 Week 1

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Chemical sciences** Processed materials, including fibres, metals, glass and plastics, are made from raw materials, such as wool, ores, sand and oil, and have a range of physical properties that influence their use **Science inquiry** **Communicating** Communicate ideas using scientific vocabulary	**Focus questions** • What are physical properties? • What are the properties of common materials? • What are raw materials? • What are processed materials? • What are some products that raw materials are processed into? **Support notes** Physical properties are the characteristics of matter that can be observed and measured without changing a substance. Raw materials are extracted, harvested or collected from the environment and are transformed into more complex products through industrial processes. Any processing by humans means that the material is processed. **Resources** • *Mr Tuggle's Troubles* by LeeAnn Blankenship • raw and processed material cards produced	**Learning experience 1** 1. Read or watch an online video of *Mr Tuggle's Troubles* by LeeAnn Blankenship. Discuss the objects Mr Tuggle chose to replace his clothing, and why the materials were not fit for purpose. 2. Explain the term physical properties as the characteristics that can be observed and measured without changing a substance. In simple terms, it is what we can observe with the senses. 3. Create a list of physical properties on the board to equip students with suitable vocabulary. Terms to include are hardness, elasticity, brittleness, strength, flexibility, transparency, absorbency, density, plasticity and absorptivity. 4. Some terms may be unfamiliar but can be illustrated with examples. Students can write these terms in books or contribute to a word wall. 5. Discuss how purpose and function influence the way materials are chosen using everyday examples in the classroom, e.g. windows are glass because they are transparent but not absorptive or flexible; chairs are made from plastic because it is strong, has moderate density and is flexible when it is heated. 6. Choose a common classroom item, such as a stapler or a pencil case, to illustrate an example of a labelled diagram. Provide clear legible labels, state the material/s used and identify the physical properties of the item. 7. Students draw three familiar items: provide labels, state the material/s used and identify the physical properties or those materials. They may write a description of why those materials were chosen.

<table>
<tr><th>Western Australian Curriculum content</th><th>Teaching and learning intentions</th><th>Learning experiences</th></tr>
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Suggested assessment points
Diagnostic assessment
• Students begin to identify and use scientific vocabulary to describe properties of materials.

Formative assessment
Observe if students can
• define raw and processed materials
• identify raw and processed materials and match them to each other.
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Learning experience 2
1. Give students the definition of raw and processed materials.
2. Provide students with a set of raw and processed materials cards. These may have images, words or both on them. Suggested materials:
<table>
<tr><th>Raw materials</th><th>Processed materials</th></tr>
<tr><td>Cotton</td><td>T-shirt</td></tr>
<tr><td>Iron ore</td><td>Saucepan</td></tr>
<tr><td>Crude oil</td><td>Plastic bottle</td></tr>
<tr><td>Trees</td><td>Wooden furniture</td></tr>
<tr><td>Cocoa beans</td><td>Chocolate bar</td></tr>
<tr><td>Rubber tree sap</td><td>Tyres</td></tr>
<tr><td>Bauxite</td><td>Aluminium can</td></tr>
<tr><td>Silica sand</td><td>Glass window</td></tr>
<tr><td>Sheep’s wool</td><td>Sweater</td></tr>
<tr><td>Gold ore</td><td>Electronic components</td></tr>
<tr><td>Wheat</td><td>Bread or pasta</td></tr>
<tr><td>Clay</td><td>Bricks</td></tr>
<tr><td>Milk</td><td>Cheese</td></tr>
</table>
3. In pairs or small groups, students sort these into two groups: raw and processed. Clarify any unknown words.
4. Ask students to match the raw material with its processed material once the match-up has been discussed and the cards have been moved to the right group.
</td>
</tr>
</table>

Term 4 Week 2

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Chemical sciences** Processed materials, including fibres, metals, glass and plastics, are made from raw materials, such as wool, ores, sand and oil, and have a range of physical properties that influence their use **Science inquiry** **Planning and conducting** Make and record observations, including formal measurements using familiar scaled instruments **Communicating** Communicate ideas using scientific vocabulary **Collaborating and applying** Use science knowledge to propose explanations for phenomena and solutions to problems	**Focus questions** • What are properties of materials? • How do these properties make a material fit for use? • How do raw materials get turned into processed materials? **Support notes** In the first learning experience, a variety of everyday objects are needed for students to examine the materials and their properties. If it is not possible to collect the physical objects, images of the objects will also be suitable. **Resources** • a variety of familiar objects, e.g. drinking glass, pencil, writing paper, mixing bowls, clothing, shoes or toys • *What If Rain Boots Were Made of Paper?* by Kevin Beals and P. David Pearson **Suggested assessment points** **Formative assessment** Observe if students can: • identify physical properties of a material • explain how those properties make a material fit for use or not • use a flowchart to model a material being processed.	**Learning experience 1** 1. Ask students to share properties of materials that they can remember from the last lesson and record them on the board. 2. Show students the variety of objects that have been collected and give them a short amount of time to touch and look at each item. Discuss any objects that students might not be familiar with. 3. Give out the items so that each student or pair has one. The students need to examine their object and think about: • the object's use • what properties it needs to have • what material it is made from • what properties that material has that makes it fit for purpose. 4. Students share their ideas with the class, so each object is discussed. 5. Name some familiar objects, such as books and clothing and ask students to describe what would happen if they were made from a different material. For example, 'What would happen if shirts were made out of glass?'. 6. Read or watch an online video of *What If Rain Boots Were Made of Paper?* by Kevin Beals and P. David Pearson. Discuss the questions at the end of the book.

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
		Learning experience 2 1. Name some everyday objects, such as a teapot, a shoe, water bottle or handball and ask students to tell you the materials they are made from and why. 2. Ask students where the materials used in the identified objects come from, e.g. the glass in windows or the fabric in their clothes. 3. Explain that the materials that can be used come from raw materials that must be processed to make them useful to people. Show students how to look at the tag near the inside seam of their clothes to find out what they are made of. 4. Discuss the material cotton and where it comes from. Display an image of a cotton plant and compare that to the cotton clothing. What must happen to turn the cotton plant into a piece of clothing? 5. Watch a suitable video about cotton production. 6. In small groups, ask students to discuss the steps needed to turn cotton plants into a cotton shirt. The video may need to be viewed more than once. 7. Students create a flowchart using the steps they devised as a group.

Term 4 Week 3

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Chemical sciences** Processed materials, including fibres, metals, glass and plastics, are made from raw materials, such as wool, ores, sand and oil, and have a range of physical properties that influence their use **Science inquiry** **Questioning and predicting** Pose questions and make predictions based on planned observations of phenomena that include variables to be measured and changed **Planning and conducting** Plan and conduct investigations, including elements of fair tests, and consider the material and equipment risks. Make and record observations, including formal measurements using familiar scaled instruments **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns	**Focus questions** • Why is plastic used in a lot of packaging? • What alternatives are there to plastic? • What is absorption? • Which materials are the most absorbent and the least absorbent? • What are very absorbent and non-absorbent materials used for? **Support notes** Absorbency relates to the amount of water a material can absorb. If it can absorb water quickly, easily and of a large volume compared to its size, it is referred to as absorbent. If the material doesn't absorb water at all it is called waterproof. **Resources** • cups of water • samples of different materials • *Fair test investigation* template (Appendix A) **Connected learning** Discussing plastic and the impact on the environment links to the Cross-curriculum Priority of Sustainability.	**Learning experience 1** 1. Write a list of familiar materials on the board with the students' help. Ask students to predict what material might be the most used and why. 2. Students take an inventory of their lunchboxes and record how many of them are made from plastic. Ask students to take a tally of what items inside are packaged in plastic. 3. As a class, discuss how many pieces of plastic were used for the lunches in the classroom. 4. Students complete a think-pair-share to discuss why plastic is so often used to make things. They should think about the properties of materials they already know, e.g. plastic can be flexible or rigid, it is waterproof, it can be colourful, transparent or opaque, it is light. 5. Discuss the environmental issues regarding plastic. For example, it doesn't degrade, it breaks down into microplastic which enters the food chain and it requires fossil fuels to make. 6. As a class, devise a list of 10 objects that the students use regularly that are made from plastic, e.g. resealable bags, water bottles. 7. The students research with a partner alternatives for one of these objects and share with the class. 8. Relate these ideas back to students' lunchboxes and discuss alternatives to the packaging.

	Suggested assessment points **Formative assessment** Observe if students can: • devise a question and prediction that are reasonable • investigate in a safe and sensible manner • use tools to measure accurately. **Summative assessment** • Students identify the properties of plastic that make it useful for packaging. • Students identify some of the environmental concerns around plastic.	**Learning experience 2** 1. Review the property absorbent and what might be the opposing property (waterproof). 2. Students brainstorm a short list of absorbent materials and how they are used, e.g. a cloth towel to dry off after swimming or a sponge for cleaning up spills. 3. Show students a range of materials, such as newspaper, tea-towels, towelling, hessian, sponges, paper towel and plastic. 4. Ask students, 'Which of these materials best absorbs liquid?' Students record the question on their investigation template. 5. Discuss how the absorbency can be measured. Suggest that they submerge the same quantity of material in the same volume of water for a given period and measure the difference in water volume after the material is removed. 6. Students record a prediction and complete their planning. Recording what will be: • changed (material) • measured (volume of water absorbed) • kept the same (the size of the material, the amount of water originally in the cup, the time the material is in the cup). 7. Demonstrate different methods of measuring absorbency. This could be done by weighing the cup of water before and after the material has been dipped, or by weighing the material before and after. Highlight to students that 1 gram is equal to 1 millilitre of water. 8. Assist students to complete the remainder of the template and record their data in a table. 9. Discuss the investigation and any issues with the process of measuring and recording the data.

Term 4 Week 4

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Chemical sciences** Processed materials, including fibres, metals, glass and plastics, are made from raw materials, such as wool, ores, sand and oil, and have a range of physical properties that influence their use **Science inquiry** **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns **Evaluating** Compare findings with those of others, and to predictions; consider if investigations were fair; and identify questions for further investigation **Communicating** Communicate ideas using scientific vocabulary	**Focus questions** • How can you display your data in a clear manner? • What is a fair test? • Why is fair testing important? • How could you improve the investigation? **Support notes** Some students may try to change their prediction so as not to be wrong. Stress that it is perfectly acceptable for results and predictions to differ as this leads us to ask further questions. **Suggested assessment points** **Formative assessment** Observe if students can: • construct a column graph that accurately represents their data • evaluate the fairness of the investigation • compare their result to their prediction • create a summary of the investigation that encapsulates their results.	**Learning experiences** 1. Discuss the investigation from the previous lesson. Which material was the most absorbent? Ask how students can present the results of the experiment visually. 2. Provide students with a template for a column graph. This can be scaffolded as per the needs of the class. 3. Discuss: • the X axis (material) and Y axis (amount of water absorbed) • title • axis-labels. 4. Support students to transfer their information to the graph. Alternatively, this may be done using suitable technology. 5. Work with students to evaluate the investigation, including the fairness of the test and how it could be improved. 6. Students compare their predictions to their data. They fill out the evaluating section of the investigation template. 7. Students write a summary of the investigation. 8. Students decide a use for each material tested based on its properties, e.g. the plastic could be used to make a waterproof jacket.

Term 4 Week 5

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Chemical sciences** Processed materials, including fibres, metals, glass and plastics, are made from raw materials, such as wool, ores, sand and oil, and have a range of physical properties that influence their use **Science inquiry** **Questioning and predicting** Pose questions and make predictions based on planned observations of phenomena that include variables to be measured and changed **Planning and conducting** Plan and conduct investigations, including elements of fair tests, and consider the material and equipment risks Make and record observations, including formal measurements using familiar scaled instruments **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns **Evaluating**	**Focus questions** • How could you plan an investigation to test which sponge holds the most water? • How will you keep this investigation fair? • Is the most expensive sponge the best? **Support notes** The first absorbency investigation sets out the structure for students and allows the teacher to model aspects of the investigation. Students participate in a practical activity and follow the method as modelled by the teacher. The students can complete this second absorbency investigation more independently. It could be used as summative or formative assessment to find out what areas of science inquiry students still need to master. **Resources** • Cups of water • Samples of different sponges • *Fair test investigation* template (Appendix A) **Suggested assessment points** **Summative assessment** Observe if students can: • plan and investigate in a safe and sensible manner • produce a question and a prediction that make sense for the investigation • display their results using a table or graph	**Learning experiences** 1. Ask students to recall the previous lesson and the investigation process. In small groups, they revise the steps (up to five) that they took to complete the investigation. Come up with a master list of steps as a class. 2. Explain that they will be following the investigation procedure to test the absorbency of kitchen sponges and that the students will be working in small groups. 3. Discuss the variables from the last investigation and how they will change for this investigation: • changing (brand of sponge) • measuring (volume of water absorbed) • keeping the same (the size of the sponge, the amount of water originally in the cup, the time the material is in the cup). 4. Provide students with planning templates and show them the different kitchen sponges they may use. 5. Students plan their investigations, including question, variables, prediction, procedure, data collection and recording. Provide guidance as appropriate. 6. When planning is complete, students conduct the investigation and record data. They include their data as a table and as a column graph. Students write a section where they recommend the sponge that absorbed the most water.

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Compare findings with those of others and to predictions; consider if investigations were fair; and identify questions for further investigation **Communicating** Communicate ideas using scientific vocabulary	• conclude the most absorbent sponge based on their results • evaluate the fairness of the investigation • compare their predictions to their results.	7. As a class, discuss any issues students may have had in keeping the investigation fair, such as cutting the sponges to the right size, measuring the water. Compare their results with the prediction. 9. Fill out the evaluating sections of the investigation template.

Term 4 Week 6

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Chemical sciences** Processed materials, including fibres, metals, glass and plastics, are made from raw materials, such as wool, ores, sand and oil, and have a range of physical properties that influence their use **Science inquiry** **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns **Evaluating** Compare findings with those of others, and to predictions; consider if investigations were fair; and identify questions for further investigation **Communicating** Communicate ideas using scientific vocabulary **Collaborating and applying** Use science knowledge to propose explanations for observed phenomena and solutions to problems	**Focus questions** • What properties does this object need to have? • What material matches those properties? • What are raw and processed materials? • How can you test the properties of the raw and processed materials? **Support notes** In the second learning experience, the focus is on investigating the different properties of a raw and processed material and how they change. In the example provided it is clay and brick; however, any raw and processed material that is easily available can be used. For example, wool and yarn (or a knitted piece), wheat and bread. Students should have the opportunity to devise their own tests based on what properties they would like to investigate. This may require extra resources, such as weights and water, depending on what the students decide to test. **Resources** • Photocopied worksheet: *Material properties and uses* (Appendix A) • Raw clay • Bricks	**Learning experience 1** 1. Play 'guess the item' for objects around the room by giving clues based on materials and properties, e.g. 'It is made of plastic, it can be reused, and it is waterproof', for a water bottle. 2. Review the science vocabulary for physical properties of materials. 3. Show students the *Material properties and uses* worksheet (Appendix A) and work through the first one together: glass hammer. 4. Place a cross in the second column and then, as a class, devise some reasons why glass isn't an appropriate material for a hammer. Encourage students to use science vocabulary. For example, 'A hammer is used to hit things and glass is fragile. It wouldn't be a good choice because it will break easily.' 5. Students go on to complete the rest of them individually or in pairs. 6. As a class, discuss the answers. For the objects that were the wrong material, consider what the right material may be and why. Highlight that some objects can be made in different materials that still have all the necessary properties. **Learning experience 2** 1. Review the meaning of raw and processed materials. Present examples from earlier in the term and ask

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	Connected learning Depending on the raw and processed materials discussed and used, a link could be made to Food and Fibre Production in Technologies: Design and Technologies. **Suggested assessment points** **Summative assessment** Observe if students can: • use properties of materials to determine their proper use • identify differences between raw and processed materials • devise fair tests to answer questions.	students to indicate with hand gestures whether it is a raw or processed material. 2. Show students the clay and the bricks and decide on which is the raw material and which is the processed. 3. Before touching the materials, give students a sticky note and ask them to write down anything they would like to know about the clay, bricks or both. 4. As a class, use the ideas on the sticky notes to decide which of the properties of the clay and bricks to investigate. Some examples include testing absorbency, flexibility, strength. 5. Put students into small groups and give each group the task of devising one of the tests, and how to execute it fairly. Once the tests are decided, each group will conduct them. 6. Each group should decide how they are going to record their results, e.g. in a diagram, with noted observations, using digital tools to take photos and videos. 7. Complete the tests, providing support where necessary. 8. Go through the results as a class and discuss any discrepancies or ways to make the tests fairer. 9. Watch an online video of how clay bricks are made.

Term 4 Week 7

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Chemical sciences** Processed materials, including fibres, metals, glass and plastics, are made from raw materials, such as wool, ores, sand and oil, and have a range of physical properties that influence their use **Science inquiry** **Processing, modelling and analysing** Organise and represent data using tables, column graphs and models to identify patterns **Evaluating** Compare findings with those of others, and to predictions; consider if investigations were fair; and identify questions for further investigation **Communicating** Communicate ideas using scientific vocabulary	**Focus questions** • What is the raw material used to make this fabric? • What properties do the different materials have? • How did this fabric turn from a raw material into a processed material? • What properties do these materials have to make them fit for purpose? **Support notes** All fabrics are processed, but some are processed from natural fibres (such as cotton, wool and silk) and some are processed from synthetic fibres (such as nylon, elastane and polyester). In the second learning experience, students are demonstrating their knowledge in a summative assessment activity that looks at materials used in the classroom and the properties that make them fit for use. **Resources** • Strips of different fabrics, both synthetic and natural fibres • Pipettes • Small weights • Books on fibre production • Chemical sciences: Classroom materials, uses and properties (Appendix A)	**Learning experience 1** 1. Write down as many fabric materials that students can think of. Examples include silk, wool, cotton, nylon, polyester, velvet, elastane. 2. Next to each, write the raw material that is used to make the processed material. Silk – silkworm cocoons, wool – sheep's wool. Some of the more unfamiliar materials, such as velvet may require an internet search. 3. In small groups, give students the strips of different fabrics to touch and look at. Magnifying glasses can be used to see the individual fibres. 4. Students complete tests on the fabric strips, such as flexibility by twisting them, strength by putting weights on them, absorbency by dropping water on them. 5. Groups share their observations with the class. 6. Each group must choose one of the types of fabric to investigate how it is processed. 7. Using books or internet searches, students need to determine the steps to process the fabric and turn it into a flowchart. **Learning experience 2** 1. Place some items in an opaque bag so students can't see the objects. Ask one student to come up at a time and put their hand in the bag to feel an item. Instead of trying to guess what the item is, the student needs to try and identify the material it is made from.

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	Connected learning The first learning experience ties in with the Food and Fibre Production sub-strand in Technologies: Design and Technologies. **Suggested assessment points** **Summative assessment** Observe if students can: • explain the process of turning a raw material into a processed material • identify the materials an object is made from and the properties that make it fit for purpose • use appropriate scientific vocabulary.	2. Reveal the item and the material and then move on to the next student. 3. Once all the items in the bag have been discovered, show students the Classroom materials, uses and properties worksheet and read through the questions. Clarify any terms or questions they don't understand. 4. Go through the example together to ensure that students understand what they need to do. 5. Let students walk around the room with clipboards and choose items to add to their sheet. 6. Ask students to point out objects in the room made from metal and describe its properties. Watch an online video about ores being processed into metal; for example, iron ore.

Term 4 Week 8

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
Science understanding **Chemical sciences** Processed materials, including fibres, metals, glass and plastics, are made from raw materials, such as wool, ores, sand and oil, and have a range of physical properties that influence their use **Science inquiry** **Communicating** Communicate ideas using scientific vocabulary **Collaborating and applying** Use science knowledge to propose explanations for observed phenomena and solutions to problems	**Focus question** • What materials would be best for protecting your egg? • What properties do these materials have? • How could you change your idea to improve it? **Support notes** If possible, provide a wide array of materials, including those that may not be suitable so students can make decisions in relation to the type of material they would like to use. **Resources** • Eggs • Variety of construction materials that would or would not be appropriate, such as cotton wool, fabric, egg cartons, popsticks, cardboard, tape, pipe cleaners, bubble wrap. **Safety considerations** Teachers need to be aware of any medical needs or allergies in the class. Assist students where necessary. **Connected learning** This activity has connections to the Technologies curriculum where students are encouraged to solve problems through design.	**Learning experiences** 1. Students use their knowledge of materials and their properties to design and create a contraption that will protect an egg when it is dropped from different heights. 2. The exact heights can be decided on together, for example 60 cm, 120 cm, 180 cm. 3. Students draw and label a plan for their contraption based on the materials available. Their diagram should include explanations for their material choices and whether those materials are raw or processed. 4. Students consider design features like how to get the egg in and out, whether it drops into the contraption or with the contraption. 5. Give students time to work on their contraption, testing and making changes if necessary. These changes should be reflected in their diagrams. 6. Once students have had sufficient time, start the official egg drop. If the egg survives the first drop the contraption moves onto the next round. If it doesn't survive, it is out. 7. Once the surviving contraptions have completed the highest drop, look at them as a class and discuss what features they may have had in common. 8. Ask students to reflect on what they would change about their plan if they had to do it again. Students verbally share a sentence on what they would change, e.g. the material chosen, the shape.

Western Australian Curriculum content	Teaching and learning intentions	Learning experiences
	Suggested assessment points **Summative assessment** Observe if students can: • make a clear design with labels explaining their material choices • make a connection between materials' properties and their use • show that they have tested and refined their design • reflect on possible improvements to their design.	9. Discuss uses for the knowledge used in this activity, e.g. for designing parachutes, transporting fragile items, firemen exiting tall buildings.

Appendix A

Resources

Fair test investigation template Name: _____

Questioning and predicting

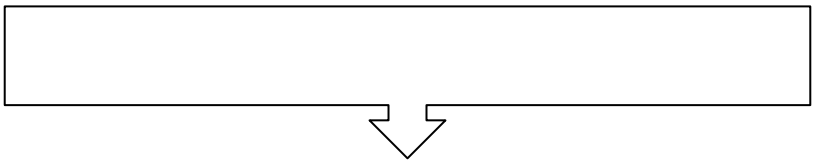
Group members: _____

Task title: _____

What will I change?	What will I measure or observe?

What is the question?

When we change…



…what do you think will happen?

Marking key

Description	✓
Questioning and predicting	✓
Correctly identifies the variable to be changed	
Correctly identifies the variable to be measured and observed	
With guidance, writes a question that can be investigated and is reasonable **OR** Writes a question that can be investigated and is reasonable	
Makes a prediction that is reasonable **OR** Makes a prediction that is reasonable and related to the investigation	
Prediction demonstrates prior knowledge and some science understanding **OR** Prediction demonstrates prior knowledge and correct science understanding	

Fair test investigation template Name: _____

Planning and conducting

Group members: _____

Task title: _____

List the equipment that you used or that you may need.

Explain what you did. Use numbers to order the steps that you followed.

1.

How can we stay safe?

Risks	Solutions

Draw a diagram or provide a digital representation of the equipment set-up.

Marking key

Description	✓
Planning and conducting	✓
Identifies the equipment required for the activity **OR** Correctly lists the equipment required for the activity	
Communicates or writes a sequenced method **OR** Communicates or writes a logically sequenced method	
Method includes detail to ensure investigation could be repeated	
Method includes variables changed	
Method includes variables measured or observed	✓
Identifies reasonable risks	
Identifies reasonable solutions	
Draws a diagram **OR** Draws a suitable and clear diagram	
Diagram includes labels	

Fair test investigation template Name: _____

Processing, modelling and analysing

Group members: _____

Task title: _____

Show your results.

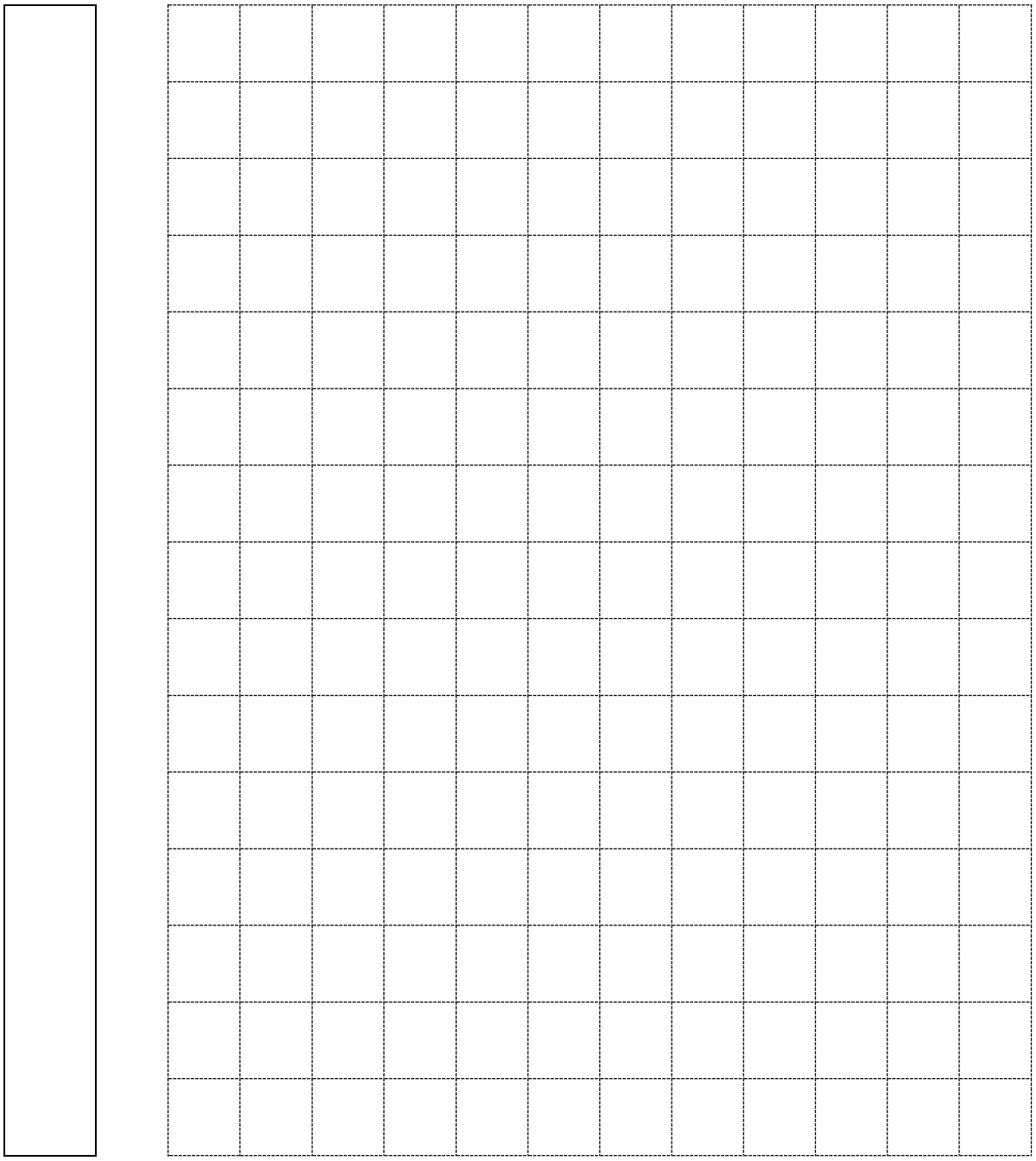
Table title: _____

Explain your results, what happened?

Fair test investigation template Name: _____

Group members: _____

Graph title: _____



Marking key

Description	✓
Processing, modelling and analysing	✓
Displays data in a table **OR** Displays data in a suitable table	
Uses an appropriate title	
Uses accurate data	
Provides an explanation of the results **OR** Provides a reasonable explanation of the results	
Provides a graph title **OR** Provides a suitable graph title	
Labels the X axis (horizontal) appropriately	
Uses correct headings	
Labels the Y axis (vertical) appropriately	
Uses an appropriate scale increment	

Fair test investigation template Name: _____

Evaluating

Group members: _____

Task title: _____

Was it fair?

Explain why.

_____

_____

_____

Could it be better?

Explain how.

_____

_____

_____

Was my prediction correct?

Explain why.

_____

_____

_____

Marking key

Description	✓
Evaluating	✓
Identifies if the investigation was fair	
Explains why it was/was not fair	
Provides appropriate detail as to why the investigation was fair or not	
Identifies if the investigation could be improved	
Explains how the investigation could be improved	
Provides appropriate detail about how the investigation could be improved	
Refers to prediction or expectation of what may have occurred **OR**	
Refers to prediction or expectation of what may have occurred with reference to Science understanding	

Chemical sciences: Materials, properties and uses

Are these items suitable for use?		
Object	✓ or ✗	What is your reason?
Glass hammer		
Cardboard saucepan		
Plastic chair		
Brick pillow		
Metal spoon		
Wooden ruler		
Tissue paper raincoat		

What's in my classroom?

Teacher to import image of the classroom.

Image: Educators.co.uk, 2016.

Choose five items from your classroom or the picture above and complete the table.

Classroom item	Material	Properties	Object use related to the property of the material Can you describe other everyday uses?
Water Bottle	Plastic	Rigid, waterproof	Carries liquids because it is waterproof.

Marking key

Description	✓
Chemical sciences: Materials, properties and uses Are these items suitable for use?	✓
Identifies the suitability or lack of suitability of the material for each of the seven objects	
Provides a reason why the material is suitable or not suitable for each of the seven objects	
Explains what would happen to the material for each of the four objects • The glass hammer would shatter • The cardboard saucepan would burn • The brick pillow would be uncomfortable • The tissue-paper raincoat would get wet	
Chemical sciences: Classroom materials, properties and uses Choose five items from your classroom or the picture above and complete the table	✓
Identify five objects within the classroom, or in the picture	
Names the correct material each of the five items is made of	
Lists one physical property for each of the five items **OR** Lists two physical properties for each of the five items	
States an everyday use for the item **OR** Describes the items use with reason and makes connections to the material choice	

Weathering vocabulary and definition match-up

Cut out the vocabulary and definitions separately. Mix them up for someone to put back together.

Mechanical weathering	Weathering caused by physical processes, such as temperature, wind and water action. This is sometimes also referred to as physical weathering.
Chemical weathering	Weathering where a change occurs due to a chemical rection. The chemical composition of the rock or mineral changes. An example of this is rust.
Biological weathering	Weathering that occurs due to living things, including humans. Some examples of this are mining and lichen growing on a rock.

Appendix B

Assessment task 1

Multistorey car park

Task details

Title	Multistorey car park
Description	Students demonstrate an understanding of forces, including balanced and unbalanced, contact and non-contact, by designing and building a multistorey car park that is three storeys high and can hold some weight.
Type of assessment	Summative
Ways of assessing	To demonstrate knowledge and understanding of the relationship between forces and use that knowledge to solve problems
Evidence to be collected	Multistorey car park planning and evaluation sheet, image of structure
Suggested time	Two 60-minute lessons in class
Differentiation	Teachers should differentiate their teaching and assessment to meet the specific learning needs of their students, based on their level of readiness to learn and their need to be challenged. Where appropriate, teachers may either scaffold or extend the scope of the assessment tasks.

Content descriptions

Science understanding

- Forces are exerted by one object on another through direct contact, such as friction, or from a distance, such as magnetism and gravity

Science inquiry

- Organise and represent data using tables, column graphs and models to identify patterns
- Communicate ideas using scientific vocabulary
- Use science knowledge to propose explanations for observed phenomena and solutions to problems

Task preparation

Prior learning

Students have engaged in hands on investigations and activities to explore forces, and how they can act on an object using contact or non-contact. They have explored balanced and unbalanced forces.

Resources

- Multistorey car park planning sheet
- Construction materials, such as cardboard tubes, old boxes, masking tape
- A method of adding weight to the structure, e.g. toy cars
- Marking key

Instructions for teachers

The teaching and learning sequence is timetabled to start in Week 1. The purpose of the learning experiences is to develop student understanding of how forces can be contact or non-contact and be balanced or unbalanced.

Instructions to students

1. Design a multistorey car park that uses balanced forces to stay up. Your car park needs to be at least three storeys high and carry weight.
2. Consider the following to help you design a successful car park:
    - What forces are at work to keep the car park up?
    - How can you use balanced forces to keep your car park strong?
    - What changes do I need to make to my car park?
    - How could my car park have been even better?

Multistorey car park

Name: _____

Draw a diagram of your multistorey car park design. Include labels and force arrows.

Materials you will need:

Describe the forces at work in a multistorey car park:

_____

_____

Colour the face to show your feelings about the multistorey car park:

How I feel about my multistorey car park

Things that went well

_____

_____

Things I would change

_____

Marking key

Description	✓
Science understanding: Physical sciences Forces are exerted by one object on another through direct contact, such as friction, or from a distance, such as magnetism and gravity	✓
Identifies forces at work on their structure	
Creates a structure that stands up	
Creates a structure that utilises balanced forces to hold weight	
Science inquiry: Processing, modelling and analysing Organise and represent data using tables, column graphs and models to identify patterns Diagram includes:	✓
Neat and clear illustrations	
Appropriate labels	
Arrows to denote forces	
Science inquiry: Communicating Communicate ideas using scientific vocabulary	✓
Uses appropriate scientific vocabulary when describing forces	
Science inquiry: Collaborating and applying Use science knowledge to propose explanations for observed phenomena and solutions to problems	✓
Chooses adequate and appropriate materials	
Explains what went well and what would need to change to improve	

Appendix C

Assessment task 2

Investigation: Waste rock stockpile

Task details

Title	Investigation: Waste rock stockpile
Description	Students demonstrate their understanding of weathering and erosion processes caused by humans, and how to mitigate the effects on the environment
Type of assessment	Summative
Ways of assessing	To demonstrate knowledge and understanding of the planning and conducting of an investigation, and explain the relevant science understanding in relation to the investigation conducted
Evidence to be collected	Completed planning sheets, images of investigation
Suggested time	One 60-minute lesson in class
Differentiation	Teachers should differentiate their teaching and assessment to meet the specific learning needs of their students, based on their level of readiness to learn and their need to be challenged. Where appropriate, teachers may either scaffold or extend the scope of the assessment tasks.

Content descriptions

Science understanding

- Weathering, erosion, transportation and deposition cause slow or rapid change to Earth's surface

Science inquiry

- Pose questions and make predictions based on planned observations of phenomena that include variables to be measured and changed
- Plan and conduct investigations, including elements of fair tests, and consider the material and equipment risks
- Organise and represent data using tables, column graphs and models to identify patterns
- Use science knowledge to propose explanations for observed phenomena and solutions to problems

Task preparation

Prior learning

Students learnt about weathering and erosion in the unit and investigated different types. They explored the effect of humans and mining on these weathering and erosions processes. Students observed a model of acid mine run-off.

Resources

Waste rock stockpile planning templates

- trays
- sand
- dyed salt
- materials for students' plans: rocks, twigs, clingwrap.

Instructions for teacher

The sequence of learning experiences commences in Week 1 of the teaching term. The purpose of the learning experiences is to explore the science understanding and expose students to weathering and erosion processes and their effect on the Earth's surface.

Instructions to students

1. Complete the *Mine waste rock stockpile* planning template with your ideas of how to minimise acid mine runoff.
2. Put your ideas into place on your sample mine waste rock stockpile.
3. Draw or take an image of what your stockpile looks like.
4. Test your ideas by pouring water on your stockpile.
5. Draw or take an image of what your stockpile looks after pouring water on it.
6. Evaluate the success of your stockpile plans.

Waste rock stockpile

Name: _____

The question I am trying to answer:

How I think I can change my waste rock stockpile to stop acid mine run-off (explain your choices):

The materials I will need for my plan:
_____ _____ _____ _____

My waste rock stockpile before adding water:	My waste rock stockpile after adding water:

How I feel about my waste rock stockpile

What went well with your investigation?

_____

_____

_____

_____

_____

What would you change with your investigation?

_____

_____

_____

_____

_____

What could happen if acid mine run-off entered the environment?

_____

_____

_____

_____

_____

Marking key

Description	✓
Science understanding: Earth and space sciences Weathering, erosion, transportation and deposition cause slow or rapid change to Earth's surface	✓
Details what impacts acid mine run-off have on the environment	
Explains reasoning behind choices of what to add to their stockpile **OR** Lists some choices of what to add to their stockpile	
Science inquiry: Questioning and predicting Pose questions and make predictions based on planned observations of phenomena that include variables to be changed and measured	✓
Provides a testable question **OR** Provides a question with elements related to the investigation	
Explains why their changes will work to stop acid mine run-off	
Science inquiry: Planning and conducting Plan and conduct investigations, including elements of fair tests and consider the material and equipment risks	✓
Makes a reasonable plan to change their stockpile	
Identifies reasonable risks	
Identifies reasonable solutions	
Science inquiry: Processing, modelling and analysing Organise and represent data using tables, column graphs and models to identify patters	✓
Draws a diagram **OR** Draws a suitable and clear diagram	
Diagram includes labels	
Science inquiry: Collaborating and applying Use science knowledge to propose explanations for observed phenomena and solutions to problems	✓
Provides a reasonable solution to acid mine run-off	

Acknowledgements

Educators.co.uk. (2016). *School Classroom With Pupil Wall art* [Photograph]. Retrieved December, 2025, from https://www.flickr.com/photos/145029563@N04/30815587220
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