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Wear on Earth • Lesson 1 • Earth’s shifting surface

**Lesson 1**

**Launch**

**F-Y10**

**Year 5**

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| To read the most recent version of this task, download associated resources, and view embedded professional learning including classroom videos and work samples, visit: [https://primaryconnections.org.au/teaching-sequences/year-5/wear-on-earth/lesson-1-earths-shifting-surface](https://primaryconnections.org.au/teaching-sequences/year-5/wear-on-earth/lesson-1-earths-shifting-surface?utm_source=docx&utm_medium=lesson1&utm_campaign=WOE) |

# Lesson overview

Students are introduced to the core concepts of weathering and erosion, and look for evidence of weathering and erosion in the local area with the aim of identifying a local issue that needs to be addressed.

## Key learning goals

Students will:

* identify what they think they know about weathering and erosion and how it causes changes to the Earth’s surface.
* recognise that weathering and erosion cause changes to the Earth’s surface, including some that affect humans, animals and the environment.

Students will represent their understanding as they:

* represent their current understanding of weathering and erosion using images, words and labels.

## Assessment advice

In the Launch phase, assessment is diagnostic.

Take note of:

* students’ ideas about weathering and erosion.

See the embedded professional learning *Students’ conceptions and alternative conceptions*in the Elicit step of this lesson.

## List of materials

**Whole class**

* Class science journal (digital or hard-copy)
* Materials to create a word wall or class glossary
* Demonstration copy of the **Thinking about landscapes Resource sheet**—See the embedded professional learning *Adapting to your context* in the *Elicit* step of this lesson to find out how you might modify this resource sheet to better suit your context and location.
* Demonstration copy of the **Vulnerable to erosion? Resource sheet**
* Video: [Behind The News segment ‘Dust Storm’](https://www.abc.net.au/btn/classroom/dust-storm/10537872) (3:50)
* Schoolyard or local site for observation walk to introduce the issue of erosion. Alternatively, use Google maps to take a virtual tour of your local area. Some landscapes suitable for this introductory observation walk include:
* school grounds.
* nearby park or garden.
* bushland/forest/desert/sand dunes.
* local creek/river/beach.
* cave/gorge/rocky outcrop.

**Each student**

* Individual science journal (digital or hard-copy)
* **Thinking about landscapes Resource sheet**

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| **Lesson Routine** | **Estimated time** | **Task type** |
| Elicit | 25 minutes | Collaborative teams, Individual |
| Anchor | Variable | Whole class |
| Experience and empathise | Variable | Whole class |
| Connect | 15 minutes | Whole class |
| Question | 15 minutes | Whole class, Individual |

# Launch

## Elicit • What do we think we know

**Note for teachers**

The terms ‘weathering’ and ‘erosion’ are deliberately not used in this step, as they have not appeared in the curriculum prior to this sequence and are unlikely to be known and/or understood by students. If students offer and show an understanding of these terms then it is perfectly acceptable to use them.

Explain to students that, over the course of this sequence, they will undertake investigations to learn about how Earth’s surface changes over time, and that, before they begin, they’ll have an opportunity to consider and show what they currently think they know, through words, drawings and discussion.

Individually, students complete the **Thinking about landscapes Resource sheet**.

Students then cut along the dotted lines on any pages where there is more than one question, so that each question is on its own slip of paper. Responses can be anonymous or students can put their name on the back of each slip. Determine which approach is most suitable for your students.

* Remaining anonymous is a good way to elicit prior knowledge in a non-judgmental way. It can encourage students to answer in more detail as it removes the anxiety of being incorrect.
* Identifying students’ responses allows students the opportunity to compare their responses at the end of the sequence and consider how their ideas have changed.

Organise the slips into piles based on their question. Set aside all of the slips for Question 6 (these will be tallied later).

Using the responses to Question 1, *Where does soil come from?,* demonstrate how to compare and find similarities between responses by, for example, looking for matching key words or phrases used by students, and how to summarise the response. Repeat this for Question 2, *Where does sand come from?,* if required.

Distribute the rest of the piles of responses out to teams, dividing piles as necessary but ensuring each team gets at least 10 responses to a question.

Teams examine the responses they have been assigned and collate the information.

Teams report back to the class on what they found. Record this in the class science journal. Where students have given different responses discuss each idea and why students might think different things.

Tally up the responses for Question 6 as a class and make generalisations where possible. For example: *Most students think Uluru will look the same in five thousand years as it does now.*If appropriate invite students to share their thinking.Or, if some have voted that Uluru will remain the same because it is a hard rock and others voted that it will not be the same, discuss each idea and why students might think different things.

Students might revisit this task at the end of the teaching sequence, comparing their responses and explaining their ideas.

## Anchor • What is weathering/erosion?

Introduce the term **‘weathering’** to the students: the process by which wind and water break up and wear away rocks and minerals into smaller rocks and rock particles. Students will have learned about rocks, minerals and soils in Year 3, so using this terminology with students is appropriate at the start of this sequence.

Discuss the different uses of the term ‘wear/worn’ as students may be more familiar with it in terms of clothing items.

Look at an example of weathering by viewing the sample images of the London Bridge Arch from the **Thinking about landscapes Resource sheet**. Review the ideas students had about the differences between the two images and how they occurred.

Ask students if they think it takes a long time or a short time for wind or water to wear down a rock, why they think that, and where they think the small rocks/rock particles end up.

Confirm for students that the constant pounding of waves against the rock causes it to wear away and disappear. Ask students if they think it took a long time or a short time for the ‘arch’ to fall into the ocean.

Introduce the term **‘erosion’** to the students: the process by which wind, water, gravity etc. move rocks and sediments from one place to another.

Also, clarify the term ‘sediments’ as including any material that sinks to the bottom of water, including small rocks, soil, sand, remains of plants (such as mulch and bark), and animal remains. These can be left behind when the water evaporates or flows away.   
  
Show students two contrasting images, one where the land is exposed and vulnerable to erosion, and one where the land is less vulnerable. Examples are included in the **Vulnerable to erosion? Resource sheet**(a recently harvested field versus a planted field, and sand dunes with no vegetation versus sand dunes with vegetation cover). You might also use images of local examples if more appropriate.

Ask students to determine which 'place' they think is more vulnerable to erosion—that is wind or water blowing or washing away the soil/sand—and why they think that. Make a list of factors that students think might make a place more vulnerable to erosion caused by wind or water. Some examples might include sloping land, land exposed to high winds, of changing tides/water flows, exposed soil etc.

Ask students if they think it takes a long time or a short time for wind/water to blow/wash away sediments, and why they think that.

Explain that weathering and erosion are important natural processes that change the Earth's surface over time, however, human activities can contribute to increased erosion, leading to negative effects on the environment. Explain that during this sequence students will be using models and simulations to learn about the processes of weathering and erosion, how they change the Earth's surface, and what humans can do to minimise their impact.

## Experience and Empathise • Identifying local issues

Take students on an observation walk of the school grounds or local area to look for examples of weathering and erosion. Alternatively use Google Maps to take a virtual tour of your local area. See the embedded professional learning *Using Google Maps to undertake a virtual tour* for more information.

**Before the walk/virtual tour**

Ask students if they can identify any school/local examples where weathering and erosion might have taken/be taking place. Discuss what kinds of places in the local community are likely to be more vulnerable to weathering/erosion and the factors that make them so.

Allow students the opportunity to share ideas of how they might identify sites of weathering and erosion before offering any ideas. See the embedded professional learning *Identifying local examples of weathering and/or erosion* for information that will support you to support your students.

Some examples you might use as prompts, if required, include:

* in coastal communities, exposed sand dunes are vulnerable to high winds and tides, particularly during and after heavy rainfall.
* in rural communities, fields and paddocks are vulnerable after harvesting or due to grazing livestock.
* river and lake shorelines are vulnerable after heavy rainfall events.
* local parks and bushlands might have pathways worn by heavy pedestrian traffic, both human and animal.
* buildings can also show signs of weathering including peeling paint, cracking materials, or worn-down stones, pavers or bricks.

**During the walk/virtual tour**

* Stop at student-identified sites of potential weathering and/or erosion.
* Discuss what made the student/s want to stop and explore/discuss this particular site.
* Identify the factors they think are present that indicate weathering and/or erosion.
* Take photographs/videos of sites of interest.
* Mark sites of interest on a map of the local area.
* If you have already identified a weathering/erosion issue in your schoolyard or local area that your students will design a solution for, ensure this area is visited on the walk/virtual tour and discussed in depth after the walk.

**After the walk/virtual tour**

* Review the photographs/video and location of sites of interest and why students wanted to observe them more closely.
* Identify the features that made this site susceptible to weathering/erosion.
* Discuss how the environment, including the who (people) or what (plants and animal) might have been changed by the weathering/erosion.
* Discuss if students think that human activity has contributed to the weathering/erosion and how.
* Discuss if students think these changes are problematic and potentially need to be controlled.
* Discuss what might happen if the erosion is not controlled.

Explain to students that at the end of the sequence, they will have an opportunity to design (and possibly test) a strategy to address a problem caused by weathering or erosion in the community.

Note: As part of preparing for this sequence you may have already identified a weathering/erosion issue in your schoolyard or local area that your students will design a solution for. If so, also include a targeted discussion of this issue after the walk/virtual tour. If you are allowing students to determine the issue to be addressed, the discussion can be more general in nature, with a focus on the issue students believe is causing the most negative impacts on the environment.

## Connect • How does weathering and erosion affect us?

Invite students to share their own experiences of erosion such as: sand blowing in their eyes at the beach/schoolyard/outback, dust devils, dust storms, heavy rain washing away a garden/sandpit/favourite beach etc.

View and discuss the [Behind the News segment ‘Dust Storm’](https://www.abc.net.au/btn/classroom/dust-storm/10537872) (3:50) This will:

* connect students’ own experiences to the topic of erosion.
* create a sense of agency on the issue.
* introduce the [DustWatch program](https://www.environment.nsw.gov.au/topics/land-and-soil/soil-degradation/wind-erosion/community-dustwatch) which you may choose to get involved in.

**Potential discussion prompts**

* *Has anyone experienced a dust storm before? How was it similar or different to this one?*
* *What problems do dust storms cause?*
  + Health issues, visibility issues and dangers on the road, removal of soil etc.
* *What effect do dust storms have on farm soil?*
  + Soil is blown away and deposited somewhere else making it difficult to grow crops.

**Optional:**

* Explain that many jobs involve working with soil and rocks, such as mining, farming, construction, landscaping, earthworks and town planning. Ask students if they know someone who works in one of those fields, and if they would like to come and talk to the class about: how their job changes the landscape, why their job is important, what they do to reduce erosion (where relevant).
* Explore and potentially get involved in the [DustWatch Citizen Science](https://www.environment.nsw.gov.au/topics/land-and-soil/soil-degradation/wind-erosion/community-dustwatch) program.

## Question • What do we want to know?

Use the [Question Formulation Technique](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/question-formulation-technique?utm_source=docx&utm_medium=lesson1&utm_campaign=WOE) with the responses to the Thinking about landscapes Resource sheet (from earlier this lesson) to support students to generate questions they might want/need the answers to in order to design an erosion strategy at the end of the sequence.

## Reflect on the lesson

You might:

* begin a [word wall](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/using-word-wall?utm_source=docx&utm_medium=lesson1&utm_campaign=WOE%20) or [glossary](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/using-glossary?utm_source=docx&utm_medium=lesson1&utm_campaign=WOE) of relevant words and images that students will likely use throughout the sequence.
* begin a [TWLH chart](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/using-twlh-chart?utm_source=docx&utm_medium=lesson1&utm_campaign=WOE%20) about weathering and erosion. Use the questions generated using the QFT as the W section of the chart.
* look back at some of the images students have encountered during the lesson and discuss if students think they are examples of weathering or erosion and why they think that.

**Year 5**

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Where on Earth • Lesson 2 • Physical weathering of rocks

**lesson 2**

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| To read the most recent version of this task, download associated resources, and view embedded professional learning including classroom videos and work samples, visit:  [https://primaryconnections.org.au/teaching-sequences/year-5/wear-on-earth/lesson-2-physical-weathering-rocks](https://primaryconnections.org.au/teaching-sequences/year-5/wear-on-earth/lesson-2-physical-weathering-rocks?utm_source=docx&utm_medium=lesson2&utm_campaign=WOE) |

# Lesson overview

Students use models to investigate the physical weathering of rocks, including a simulation of what happens when rocks are tumbled around in a river.

## Key learning goals

Students will:

* follow procedures to investigate the physical weathering of rocks.
* use models to represent changes that occur over long time scales and in large environments.
* observe and explain how weathering causes river rocks to become rounded and smooth.

Students will represent their understanding as they:

* contribute to discussion to explain physical weathering observations.
* explain the science of physical weathering of rocks.

## Assessment advice

In this lesson, assessment is formative.

Feedback might focus on:

* students’ identification that physical weathering (including abrasion) breaks rocks into smaller pieces. Are they able to identify that scraping and shaking the rocks are both breaking the rocks and therefor both physical weathering processes?
* students’ explanation of physical weathering in rivers. Can they explain how physical weathering rounds the shape of river rocks by slowly breaking away sharp edges?

## List of materials

**Whole class**

* Class science journal (digital or hard-copy)
* 2 small rocks that are easy to hold
* Demonstration copy of the **Scrape it, shake it Resource sheet**
* Chalk or sugar cubes
* Small piece of sandpaper (course grit)
* Glass jar with a lid
* 1 teaspoon of salt
* Optional video: [Tumbling rocks](https://www.youtube.com/shorts/OGQusNS1kcU) (0:57)

**Each group**

* 3 x chalk pieces or sugar cubes
* 1 x small piece of sandpaper (coarse grit)
* 1 x jar with lid
* 1 teaspoon of salt
* Timing device (alternatively you can use a single timer for the whole class, asking all teams to start and stop scraping/shaking at the same time)
* Damp paper towel to clean up chalk dust/sugar

**Each student**

* Individual science journal (digital or hard-copy)
* **Scrape it, shake it Resource sheet**
* Optional: dust mask

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| **Lesson Routine** | **Estimated time** | **Task type** |
| Re-orient | 5 minutes | Whole class |
| Question | 10 minutes | Whole class |
| Investigate | 30 minutes | Collaborative teams, Whole class |
| Integrate | 20 minutes | Whole class |

# Inquire

## Re-orient

Review the meaning of the term ‘weathering’, the changes to London Bridge Arch rock formation, and any examples of weathering students identified during their observation walk/virtual tour.

## Question • Can we change the shape of rocks?

Ask students if they think all rocks are the same level of hardness, or if some rocks are harder/softer than others, and why they think that.

Discuss how they might investigate to find the answer.

Note: In Year 3, students may have undertaken a rock scratch test when learning about rocks and minerals. See [Lesson 5 of the Year 3 teaching sequence *Dig deep*](https://primaryconnections.org.au/teaching-sequences/year-3/dig-deep/lesson-5-scratch-test?utm_source=docx&utm_medium=lesson2&utm_campaign=WOE%20) for details of this lesson. You might choose to include that lesson in this sequence if students demonstrate alternative conceptions about rock hardness.

Model attempting to scratch one rock with another rock and observe and discuss any changes to the surface of the rocks (the harder rock will leave a scratch or a dent on the softer rock). Ask students how rocks might end up scratching/rubbing together in nature or with the help of humans.

**Potential discussion prompts**

* *How will we know which of these rocks is harder?*
  + It will create a small dent/line in the softer rock which we can feel when we run our finger across it.
* *In nature, how could rocks scratch against each other?*
  + Tumbling down a hill with gravity, tumbling down a river, etc.
* *What human activities might cause rocks to scratch/rub together, or might scratch rocks in other ways?*
  + Mining, bush walking on very soft rocks, grinding seeds between rocks, etc.

**Pose the question:***If rocks scratched against each other for long enough, would it change their observable features such as size, shape, pointiness?*

## Investigate • Scrape ‘n’ shake

There are two short investigations in this lesson: Scrape it and Shake it. Similar materials are required for each investigation and it is recommended that students complete both to build a solid understanding of the physical weathering of rocks.

Discuss the importance and limitations of models in scientific investigations. Show students the equipment they will be using to simulate rocks for the investigation and discuss why these are being used in place of real rocks.

**Potential discussion prompts**

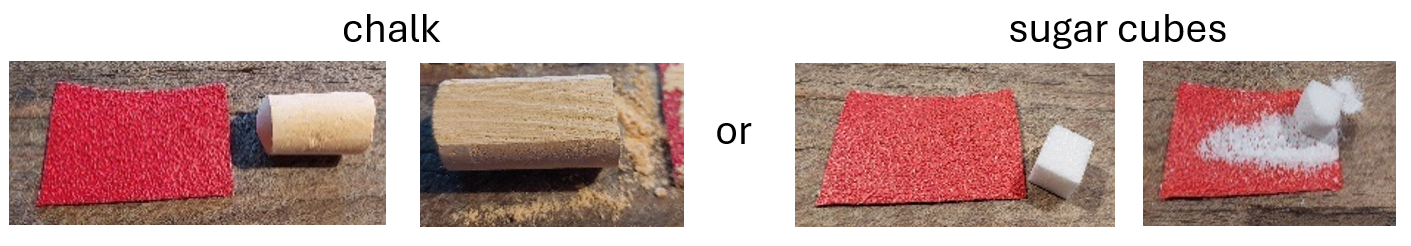
* *Why and when is it helpful to create models in science?*
  + Sometimes, the things being investigated are too large to see as a whole, or the processes are too slow. Scientists use models instead in these cases.
* *What limitations or problems could we face by using models?*
  + The materials used may be different, other factors may not be considered and excluded from the modelling etc.
* *Why are we using sugar, chalk and sandpaper in these models, instead of real rocks?*
  + Real rocks would take a very long time to break down—much longer than we have to give. Using something to represent the rocks help us see what happens in a much shorter timeframe.

**Scrape it**

Use a demonstration copy of the first page of the **Scrape it, shake it Resource sheet** to explain/model the investigation.

Using chalk/a sugar cube to represent one rock, and sandpaper to represent the other, students will:

1. Draw a labelled diagram to represent what they observe before scraping the 'rocks' against each other.
2. They will then scrape the 'rocks' against one another for 30 seconds to see what happens.
3. Draw a labelled diagram to represent what they observe after scraping the 'rocks' against each other.



**Shake it**

Use a demonstration copy of the second page of the **Scrape it, shake it Resource sheet** to explain/model the investigation.

Using 2 pieces of chalk/sugar cubes to represent large rocks, salt to represent small rocks, and a glass jar to shake them in, students will:

1. Draw a labelled diagram to make observations about the rocks before they shake them.
2. Predict what they think will happen when they shake the rocks inside the glass jar.
3. Shake the rocks in the jar for 2 minutes.
4. Write/draw their observations after shaking.
5. Explain what happened, why they think it happened, and compare their predictions with the results.



Distribute equipment (chalk or sugar cubes, salt, jar with lid) and allow time for students to complete the investigations, recording their results on the **Scrape it, shake it Resource sheet**.

## Integrate • Rounding out the rocks

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| In this integrate step, guide students to link their experiences in the investigation to the processes of weathering in real-life.  Through questioning and discussion, students should come to a consensus that:   * physical weathering occurs when rocks rub against each other or other things in nature. * this typically happens with smaller rocks as they tumble down cliffs and rivers/streams. * this rubbing/tumbling wears away the edges of a rock, creating smaller rocks, rock particles and smooth/er edges. |

Share and discuss findings from the investigations as a class to form conclusions and common understandings.

**Potential discussion prompts**

* *What happened when you scraped the chalk/sugar cube against the sandpaper?*
* *Is that what you expected to happen? Why? Why not?*
* *Were you able to scratch/ break away any of the chalk/sugar? How can you tell?*
* *Has the shape of your chalk/sugar changed? How?*
* *How were the 'rocks' moving against one another during the Scrape it investigation?*
* *When might rocks move against each other like this in a real situation?*
* *What did you predict would happen when you shook the chalk pieces/sugar cubes in the jar?*
* *Did your predictions match your observations after you shook the jar?*
* *What actually happened when you shook the jar?*
* *How were the 'rocks' moving against each other in the Shake it investigation?*
* *When might rocks move together like this in a real life situation?*
* *Did the scraping create sharp or rounded edges? What about the shaking?*

Ask students if they have ever seen rocks in a river, and what might cause them to move. Discuss, and potentially view using Google Maps, any specific locations where students may have viewed river rocks, for example the [Buckland River](https://www.google.com.au/maps/@-36.6931747,146.8976222,3a,75y,146.76h,70.15t/data=!3m8!1e1!3m6!1sAF1QipOjXdsl8i4I80rggeVNcC4mDV6cXUOyi5CGp-CI!2e10!3e12!6shttps:%2F%2Flh3.googleusercontent.com%2Fp%2FAF1QipOjXdsl8i4I80rggeVNcC4mDV6cXUOyi5CGp-CI%3Dw900-h600-k-no-pi19.849999999999994-ya153.76-ro0-fo100!7i5376!8i2688?entry=ttu&g_ep=EgoyMDI1MDIwOS4wIKXMDSoJLDEwMjExMjMzSAFQAw%3D%3D) in Victoria.

**Potential discussion prompts**

* *How do you think rocks in a river feel? Why do you think they might feel that way?*
* *How would rocks in a river be affected by physical weathering?*
  + Rocks scratch and bump against each other, the force of the water breaks off small pieces.
* *What things might affect how smooth river rocks become over time?*
  + How fast the river flows, the hardness of the rocks, the size of the rocks, how long the rocks have been in the river, what the rocks are made of, the temperature of the water.
* *What did we learn about what happens to rocks tumbling down a river?*
* *What do you think this simulation might help explain about real-life weathering?*
* *Why do you think scientists use models to gather information?*
* *Can you think of any jobs in the workforce where models or simulations are used?*
  + Environmental scientists use modelling to predict effects on animal populations and develop conservation strategies, city planners use models to simulate traffic patterns and design efficient transport systems, architects use building models to test design ideas.

**Optional:**View the video [Tumbling Rocks](https://www.youtube.com/shorts/OGQusNS1kcU) (0:55) to observe how rock/mineral tumbling mimics the natural process of rocks being rounded in a river.

Introduce and discuss these following terms with students:

* ‘physical weathering’: when physical forces break down of rock into smaller pieces. Note that this is sometimes also called mechanical weathering.
* ‘abrasion’—the process of scraping or wearing something away.

If students haven't already made the connection, review their understanding of forces (which they have learned about in Year 1 and Year 4), including push-pull forces and friction, identifying their roles in the actions students have modelled in the investigation.

Either as a class, and recorded in the class science journal, or individually in their own journals, students construct a short explanation using these terms to describe what/how physical forces cause the rocks to rub against each other and what happens to them during these processes.

## Reflect on the lesson

You might:

* add to the class word wall any vocabulary related to physical weathering.
* add to the class TWLH chart, completing the H and L sections with what they have learned about mechanical weathering, rivers and rocks.
* re-examine the intended learning goals for the lesson and consider how they were achieved.

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**Year 5**

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Wear on Earth • Lesson 3 • Freeze-thaw weathering

**lesson 3**

**INQUIRE**

# Lesson overview

Students investigate what happens to water when it is frozen, and determine how this might contribute to the weathering of rocks.

## Key learning goals

Students will:

* conduct a fair test to explore changes to water volume as it changes state from a liquid to a solid.
* apply their understanding of increasing water volume (during freezing) to explain how freeze-thaw weathering can split rocks in nature.

Students will represent their understanding as they:

* make a claim about the effect of freezing on water, based on their findings.
* draw a labelled diagram to explain freeze-thaw weathering.
* consider and discuss the conditions in nature required to facilitate freeze-thaw weathering.

## Assessment advice

In this lesson, assessment is formative.

Feedback might focus on:

* students’ line graphs. Have students clearly represented their observations with an increase in water volume (when frozen) on the line graph?
* students’ claims about water volume as a liquid and a solid. Have students identified and provided evidence to support the claim that water expands when it freezes?
* students’ freeze-thaw weathering diagram. Have students identified the repeated freezing and thawing cycle that gradually cracks and breaks rocks?

## List of materials

**Whole class**

* Class science journal (digital or hard-copy)
* Demonstration copy of the **What broke the bottle? Resource sheet**
* Demonstration copy of the **Variables grid Resource sheet**
* Optional: Demonstration copy of the **Freeze-thaw investigation planner Resource sheet**
* 1 x syringe (10ml or 20ml, catheter tip or similar, no needle) with coloured water inside and sealed with blu-tac on end, or another container that can hold water and will be easy for students to see the visible change in the volume. This will be used for demonstration purposes only.
* Video: [Freeze-Thaw Weathering Explained](https://www.youtube.com/watch?v=rsBRVE93hOk) (2:48)

**Each group**

* 1 x syringe (10ml or 20ml, catheter tip or similar, no needle), or another container that can hold water and will be easy for students to see the visible change in the volume
* Small amount of blu tac to seal the end (if using syringes)
* Coloured water
* Optional: a second identical syringe with the same amount of coloured water, pre-frozen—the water will expand (see note below on lesson timing)

**Each student**

* Individual science journal (digital or hard-copy)
* **Freeze-thaw investigation planner Resource sheet**

**Note on lesson timing**

The investigation in this lesson involves freezing water for observation. The water must be frozen before the final steps of the investigation can be completed.

To manage the timing and allow for freezing, it is recommended that the lesson is completed in two stages. See the end of the Investigate step for recommendation on how to split the lesson.

Alternatively, you might pre-freeze the exact amounts of water students are going to use, in the same containers, prior to beginning the lesson. These can them be presented as “some I prepared earlier” before the lesson continues.

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| **Lesson Routine** | **Estimated time** | **Task type** |
| Re-orient | 5 minutes | Whole class |
| Question | 5 minutes | Whole class |
| Investigate | Variable | Collaborative teams, Whole class |
| Integrate | 20 minutes | Whole class, Individual |

# Inquire

## Re-orient

Review the definition of physical weathering introduced in the previous lesson: when physical forces break down rock into smaller pieces.

Discuss the physical forces that break down rocks that students explored in their investigations—abrasion (which occurs when rocks rub and tumble against each other), breaking of particles and smoothing edges of rocks.

**Potential discussion prompts**

* *What is physical weathering?*
* *What type of force did we use to weather our rocks in the last investigation?*
* *Why did our rocks change shape when we shook them?*
* *What process in nature were we replicating when we shook the ‘rocks’ in the jar?*
* *In nature, would all rock types weather and change shape at the same rate? Why/why not?*
  + Harder rocks made of harder minerals take longer to weather.
* *Other than the hardness of rocks, what else might affect how fast they weather?*

## Question • How can water cause weathering?

Ask students to identify how water appears in the environment, prompting them to think about it in all its states. For example:

* Liquid: creek, river, lake, puddle, ocean.
* Solid: ice, snow (loosely held ice crystals).
* Gas: water vapour caused through evaporation.

Note: In Year 3 students would have learned about how adding and removing heat from liquids changes its state. They also will have learned about the water cycle in Year 4, and may have already learned about the three states of matter—solid, liquid and gas—earlier in Year 5. Their level of understanding of these phenomena will impact their responses. The key focus relevant here is water moving between a solid and liquid state through the adding and removal of heat energy.

**Pose the question:***Can freezing and thawing water cause weathering to rocks?*

Discuss the definition of the term ‘thawing’ if required.

## Investigate • What happens to water when it freezes?

Ask students if they have ever seen what happens when a full bottle of water is left in the freezer. View the image on the **What broke the bottle? Resource sheet** telling students that the bottle had been left in the freezer overnight. Students compare this to previous experiences and suggest reasons why the bottle broke.

If not already offered by the students, share your own thinking: *As the water froze, it expanded and broke the bottle.*

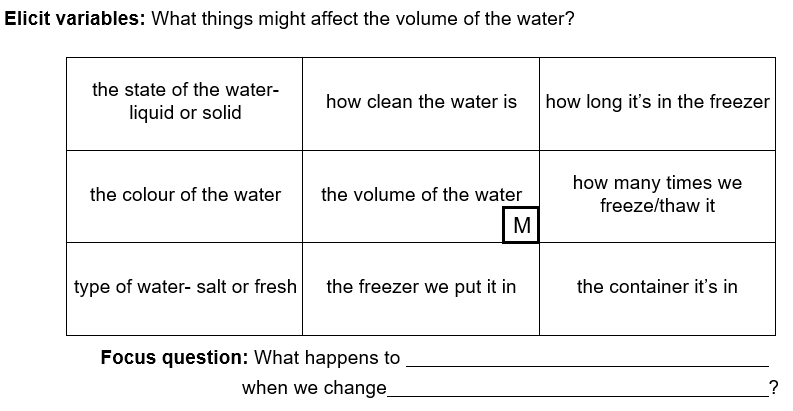
Ask students how they might devise a fair test to investigate if water does indeed expand as it freezes.

If required, prompt students by showing them the equipment available for the investigation. For example, show them a syringe of coloured water (with a small amount of Blu-Tac used to seal the end) and ask them how we might use it to see if water expands when it is frozen.



**Pose the broad question:***What things might affect the volume of water?*

Using a demonstration copy of the **Variables grid Resource sheet**, identify and record the thing to be measured during the investigation—that is, the volume of water in the syringe—and place that in the centre of the grid, marked with (M). Brainstorm other variables in the surrounding columns/rows. Add or remove additional columns/rows as required. For example,



Note: In some investigations it is appropriate to allow teams to select the variable they wish to change, and teams might select different variables. However, in this case, the goal of the investigation is to show that water expands as it freezes. This is achieved by changing the water from a liquid state to a solid state through freezing, so all teams should investigate this same variable.

Model how to use the question stem to write a question for the investigation: *What happens to the volume of water when we change the state of the water from liquid to solid?*

Discuss how the investigation will be conducted and data collected and recorded.

**Potential discussion prompts**

* *How could we measure the volume of water?*
* *How will we record the before and after freezing measurements?*
* *How long will it need to be in the freezer for the water to freeze?*

**Optional:** Discuss fair testing principles, including why it is essential to only change one variable and leave everything else the same: to ensure that we find out the impact changing a specific variable has on the outcome. If multiple variables are changed there is no way of knowing which one made the impact and to what degree.

In collaborative teams, students plan their investigation and record their results using the **Freeze-thaw Investigation Planner Resource Sheet.**

Ideally this investigation should take place over two lessons to allow the water time to freeze. You might organise this by:

* Completing page 1 of the investigation planner and the liquid water observations and measurements on page 2 in one lesson.
* Placing the water-filled syringes into the freezer.
* In a follow-up lesson the next day or week, complete the solid water observations, results and claims (remainder of page 2 and page 3).
* Leave the freeze-thaw weathering diagram to be complete AFTER the integrate step is complete.

## Integrate • Comparing water volume

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| In this integrate step, guide students to link their experiences in the investigation to the processes of freeze-thaw weathering in real life.  Through questioning and discussion, students should come to a consensus that:   * water provides a physical force when it expands as it freezes. * in nature this force can cause rocks to break apart as repeated cycles of freezing and thawing occur. |

Teams share the result of their investigations.

Using the [QCER framework](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/facilitating-evidence-based-discussions?utm_source=docx&utm_medium=lesson3&utm_campaign=WOE) as a guide, each team makes a claim to answer the question they were investigating: *What happens to the volume of water when we change the state of the water from liquid to solid?*For example, *Water expands and takes up more volume when it changes from a liquid to a solid.* Teams support their claim with evidence from their investigation, for example *The water in our syringe increased from 5ml as a liquid to 6ml when it froze solid*.

Compare to see if each team got the same results and made the same/similar claims. Discuss why this happened, any results that differed, and why they might have differed. Ask students if they would now consider the prediction "water expands when it is frozen" to be shown as true, and what they think broke the glass bottle from the **What broke the bottle? Resource sheet**.

Using the Think-Pair-Share strategy, ask students to consider how the force created by water physically expanding when it freezes would contribute to weathering.

Show the video [Freeze-Thaw Weathering Explained](https://www.youtube.com/watch?v=rsBRVE93hOk) (2:48) so students can generalise what they have learned about water expansion and freeze-thaw weathering of rocks.

Students complete their freeze-thaw weathering diagram on the **Freeze-thaw investigation planner Resource sheet**.

Discuss the conditions required for freeze-thaw weathering to occur: rain or snow and temperature change that repeatedly goes above and below 0°C. Determine if it is likely for freeze-thaw weathering to occur in your location and why/why not.

**Optional:** Explore summer images of [Blue Lake](https://maps.app.goo.gl/gHXcYLZ1KvTyLTcPA) at Mt Kosciuszko, NSW. Zoom in to see signs of freeze-thaw weathering on the large rock faces and rocky debris on the ground.

**Reflect on the lesson**

You might:

* add new words and images to the [word wall](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/using-word-wall?utm_source=docx&utm_medium=lesson3&utm_campaign=WOE%20) or [glossary](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/using-glossary?utm_source=docx&utm_medium=lesson2&utm_campaign=WOE%20).
* add to the W and H sections of the [TWLH chart](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/using-twlh-chart?utm_source=docx&utm_medium=lesson3&utm_campaign=WOE%20).
* ask students to articulate the forces involved when the water volume expands when it freezes.
* discuss how the learning from this lesson relates to freeze-thaw weathering of rocks.
* discuss how students were thinking and acting like scientists during this lesson. Focus on recording, explaining, evaluating data and using scientific diagrams.

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**Year 5**

Wear on Earth • Lesson 4 • Chemical weathering

**lesson 4**

**inquire**

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| To read the most recent version of this task, download associated resources, and view embedded professional learning including classroom videos and work samples, visit:  [https://primaryconnections.org.au/teaching-sequences/year-5/wear-on-earth/lesson-4-chemical-weathering](https://primaryconnections.org.au/teaching-sequences/year-5/wear-on-earth/lesson-4-chemical-weathering?utm_source=docx&utm_medium=lesson4&utm_campaign=WOE) |

# Lesson overview

Students explore chemical weathering through a series of hands-on investigations.

## Key learning goals

Students will:

* model and observe chemical weathering through hands-on exploration.
* consider how human activities contribute to chemical weathering.

Students will represent their understanding as they:

* discuss the chemical weathering changes observed during modelling.
* draw diagrams of changes observed during chemical weathering investigations.
* compare and discuss the similarities and differences between real-life chemical weathering and classroom modelling.

## Assessment advice

In this lesson, assessment is formative.

Feedback might focus on:

* the claims students are making about the difference between physical and chemical weathering. Are they referring to the definitions and their evidence to make their claims? Can they give an example of where they might see the effects of chemical weathering?
* students’ descriptions of chemical weathering. Have they recognised that chemical weathering is a natural process and that human activities contribute to it?

## List of materials

**Whole class**

* Class science journal (digital or hard-copy)
* Demonstration copy of the **pH scale Resource sheet**
* Demonstration copy of the **Chemical weathering investigations Resource sheet**
* Optional: Demonstration copy of the **PROE Resource sheet**
* Video: [Chemical Weathering](https://www.youtube.com/shorts/kLMHUSpwJGM) (0:56)
* Video: [Cave Formation](https://www.youtube.com/shorts/ErVEfUJX_D8) (0:30)
* Video: [Jenolan Caves](https://www.youtube.com/shorts/juc22fOBooE) (0:23)

**Each group**

Four investigations are presented in this lesson. Complete any or all of them as appropriate for your students. See the *Investigate* lesson step for details of each investigation. See the [*Preparing for this sequence*tab in the sequence overview](https://primaryconnections.org.au/teaching-sequences/year-5/wear-on-earth?tabIndex=3) for more information on sourcing limestone or cement for the **Reaction time** investigation.

* **Chemical weathering investigations Resource sheet** (modified to include instructions of chosen investigations only). Alternatively, display an enlarged version for the whole class.

**Reaction time**

* 2 clear cups/jars
* 2 pieces of either limestone or cement
* White vinegar
* Water
* Texta or label to indicate which substance in each cup

**Drip drip**

* 2 sugar cubes
* Clear cup/jar
* Vinegar diluted in water, using a 1:1 or 1:2 vinegar to water ratio
* Dripper (syringe/eye-dropper/straw) to drip the diluted vinegar

**Altered sculptures**

* 2-5 sugar cubes or toffee (commercially available or homemade), to represent rock
* Sculpting tools (popsticks/nail files/toothpicks/butter knife)
* Dripper (syringe/eye-dropper/straw)
* Vinegar diluted in water, using a 1:1 or 1:2 vinegar to water ratio
* Optional: icing to glue together sugar cubes

**Caves and sinkholes**

* Sugar cubes
* Clay or biscuit/cracker
* Clear cup/jar
* Dripper (syringe/eye-dropper/straw)
* Vinegar diluted in water, using a 1:1 or 1:2 vinegar to water ratio

**Each student**

* Individual science journal (digital or hard-copy)
* Optional: Demonstration copy of the **PROE Resource sheet**(printed as many times as needed, or students can make their own in the science journals)

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| **Lesson Routine** | **Estimated time** | **Task type** |
| Re-orient | 5 minutes | Whole class |
| Question | 10 minutes | Whole class |
| Investigate | Variable | Collaborative teams, Individual |
| Integrate | 20 minutes | Collaborative teams, Whole class, |

# Inquire

## Re-orient

## Recall the previous lessons, focusing on how physical weathering changes rocks and sometimes breaks them apart.

## Question • What is chemical weathering?

**Note for teachers**

The concept and potential consequences of chemicals in the environment affecting rocks, including in the form of acid rain, are explored in this lesson. This is modelled using vinegar as a substitute for naturally occurring acids in the environment. The idea of acid rain can be alarming to students, and it is worth noting that vinegar is a stronger acid than naturally occurring acid rain. See the embedded professional learning The pH scale for more information.

Discuss if students think that rocks can wear away without a physical force, and how that might happen.

**Potential discussion prompts**

* *Are there any other ways a rock can break down?*
* *What are chemicals? How might they change a rock?*
  + Everything is made of chemicals (even water). Some chemicals can cause changes in materials, including the weathering of rocks.
  + Students’ responses will depend upon their prior knowledge, but it is likely most have been exposed to terminology that describes chemicals as dangerous liquids or other substances. Examples might include cleaning products, batteries and drugs, and alcohol.
* *Have you heard the words ‘acidic’ or ‘acid’ before? What do you know about them?*
* *What natural things are acidic?*
* *Have you heard the terms ‘alkaline’, ‘neutral’ or ‘pH level’? What do you know about them?*
* *Looking at this visual image of a pH scale, what substances are you familiar with? How do you encounter them in everyday life?*
  + The **pH scale Resource sheet**provides a visual image to reference during the discussion.
* *How acidic is water? Rainwater? Lemon juice? Vinegar? Soft drink?*
* *Is this what you expected?*
* *What do you think would happen if we poured something acidic over rocks?*
* *What about if we left a rock submerged in something acidic?*
* *What if we diluted the acidic substance with water? Do you think the same things would happen?*
* *Have you ever seen natural rocks with stripes of colour running through them? What do you think might cause those colours to appear?*
* *Have you seen stalactites and stalagmites inside a cave? How do you think they might form?*

**Pose the questions:** *What is chemical weathering, and how does it change rocks?*

## Investigate • A chemical reaction

Four different investigations exploring chemical weathering are outlined below. Select the investigation(s) that best suit the needs and context of your students. You may choose to do all of these investigations if adequate time and supplies are available. The instructions for each are provided on the Chemical weathering investigations Resource sheet. Modify the resource sheet to include the instructions required for the investigations you will undertake, and print or display them for teams as necessary.

**Before undertaking any investigations**

Introduce a formal definition of ‘chemical weathering’—the breakdown of rocks and minerals caused by non-physical changes (chemical reactions).

View and discuss the materials students will use, and how/why they are being used to model the chemical weathering process. For example:

* vinegar has a high pH level, and so exaggerates the effects of what happens when rocks/minerals are exposed to acid.
* sugar cubes can be used as a substitute for rock because breaking up the hard, compressed particles can show what happens to rocks when they come into contact with acidic substances.

Discuss/model the PROE strategy, as students will use it to record what is happening in their investigations.

* First, students make a Prediction about what they think will happen and give Reasons for why they think that, based on their prior knowledge and experiences.
* Next they undertake the investigation, discussing it with their team and writing about, drawing, or taking photos of their Observations in their science journal.
* Finally, they Explain what they think happened and why.

Allow teams time to undertake the selected investigations. The **PROE template Resource sheet** can be printed as many times as will be required, or students can create as many as they need in their individual science journal.

**REACTION TIME**

Students conduct an investigation into what happens to rocks when they are exposed to neutral and acidic substances (water and vinegar).

Students complete the **P** and **R** sections of a PROE, then submerge one piece of limestone/cement in a cup of water and the other piece in a cup of undiluted white vinegar. They record observations during the course of the day in the O section of their PROE, before leaving the limestone or cement submerged overnight. They make a final observation the following day finalise the **O**bservations and **E**xplanations of their PROE in their science journals.

Watch the video [Chemical Weathering: Acid Rain](https://www.youtube.com/watch?v=JpRS9N-NWsY) (2:00). Discuss if students’ observations matched those in the video. Discuss the chemical reaction where carbon dioxide is produced as the acidic vinegar reacts with the limestone. Allow students time to add to or amend their explanations as needed.

**Two glasses with water and rocks in them

AI-generated content may be incorrect.**

Students conduct an investigation comparing physical weathering to non-physical (chemical) weathering, using sugar cubes and diluted vinegar.

Students ‘physically’ weather their ‘rocks’ (sugar cubes) by, for example, pressing down on the cubes with their hand or a book, or scraping two cubes against each other.

Students consider the questions: *Are these smaller pieces you have created still ‘rock’ (sugar)?*and *What will happen when we drip acid onto the ‘rock’?*They complete the **P** and **R** sections of a PROE, before dripping diluted vinegar onto the rock using a dropper or syringe. They record their **O**bservations and **E**xplanations in their science journals, including a response to the question *How has the rock changed?*

**A knife and a pile of powder

AI-generated content may be incorrect.** ****

**ALTERED SCULPTURES**

Students make a sugar cube/toffee sculpture then observe the effects of acid rain (vinegar) dripping on their sculpture.

Supply teams with sugar cubes/toffee and sculpting tools (popsticks, nail files, toothpicks etc.) and allow time for them to create a sculpture.

If using sugar, single cube sculptures work fine or cubes can be glued together with icing if required. Encourage students to include fine details and sharp edges on their sculpture.

Once sculptures are complete, students complete the **P** and **R** sections of a PROE, before modelling the effects of acid dripped on rock by dripping diluted vinegar onto their sculpture. They record their **O**bservations and **E**xplanations in their science journals.

**CAVES AND SINKHOLES**

Teams explore the creation of a cave or sinkhole by making a model of the Earth's surface.

Teams place a layer of ‘rock’ (sugar cubes) in a clear glass/jar and cover it with ‘topsoil’ (clay or a biscuit/cracker). They make a few holes or cracks in the ‘topsoil’ so rainwater can seep into the ‘rock’ layer.

Students complete the **P** and **R** sections of a PROE before dripping diluted vinegar onto their model of the Earth's surface. The sugar cubes (rocks) will begin to chemically weather beneath the surface layer, in a similar way to how caves and sinkholes are created. Students record their **O**bservations and **E**xplanations in their science journals.

 A cracker in a glass of water

AI-generated content may be incorrect.

## Integrate • What did you observe?

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| In this Integrate step, guide students to link their experiences in the investigation to the processes of chemical weathering in real-life.  Through questioning and discussion, students should come to a consensus that:   * not all changes to rocks are physical changes. * some changes are caused by the mixing of chemicals in the environment. * human actions can sometimes speed up the process of these changes. |

Students share their observations and explanations from the investigation/s they undertook.

**Potential discussion prompts**

* *What is the difference between physical/mechanical weathering and chemical weathering?*
* *How does acid in the environment cause rocks to weather?*
* *Do you think the flatter faces of rock or the sharper, pointier areas of rock weather the quickest? Why do you think that?*
  + Sharp/pointed/narrow sections of weather faster than large flat areas, because they are smaller and provide a greater exposure (surface area) for the acidic substances to react easily.

Further consolidate student understanding of chemical weathering by viewing videos of weathering and discussing brief explanations to suit your context. Examples include:

* [Chemical weathering](https://www.youtube.com/shorts/kLMHUSpwJGM) (0:56) – the importance of chemical weathering
* [Cave formation](https://www.youtube.com/shorts/ErVEfUJX_D8) (0:30) – limestone cave formation explanation
* [Jenolan Caves](https://www.youtube.com/shorts/juc22fOBooE) (0:23) – footage to music without explanation

Discuss how students’ observations from their investigations were similar or different from what they had just viewed.

**Potential discussion prompts**

* *How is this similar to our modelling? How is it different?*
* *Do you think chemical weathering is a rapid or slow weathering process? Why do you think that?*
  + Chemical weathering is usually very slow, but it can be sped up by human activities such as the burning of fossil fuels.
* *How does the modelling we have seen in today’s lesson help us to learn about the Earth’s surface, and why it looks the way it does?*

**Optional:**Use Google Maps to explore some famous Australian landscapes that are the result of chemical weathering, such as [Wave Rock, WA](https://maps.app.goo.gl/pwj8322RihCTtznb9). Wave Rock is 14m high and 110m long, and is formed by water dissolving and re-depositing chemicals in the granite as it runs down the cliff face.

## Reflect on this lesson

You might:

* add new words and images to the [word wall](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/using-word-wall?utm_source=docx&utm_medium=lesson4&utm_campaign=WOE%20) or [glossary](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/using-glossary?utm_source=docx&utm_medium=lesson4&utm_campaign=WOE).
* add to the W and H sections of the [TWLH chart](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/using-twlh-chart?utm_source=docx&utm_medium=lesson4&utm_campaign=WOE%20).
* consider how students were thinking and working like scientists during the lesson by discussing the use of models to develop their understanding of chemical weathering. Weathering, particularly of large rocks, takes place over millions of years. Modelling helps us to view the process in a reasonable timeframe. Landforms can be large and difficult to view, so modelling makes a smaller version for us to study.

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**Year 5**

Wear on Earth • Lesson 5 • Erosion caused by wind

**lesson 5**

**inquire**

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| To read the most recent version of this task, download associated resources, and view embedded professional learning including classroom videos and work samples, visit:  [https://primaryconnections.org.au/teaching-sequences/year-5/wear-on-earth/lesson-5-erosion-caused-wind](https://primaryconnections.org.au/teaching-sequences/year-5/wear-on-earth/lesson-5-erosion-caused-wind?utm_source=docx&utm_medium=lesson5&utm_campaign=WOE) |

# Lesson overview

Students explore how wind transports sediment from one place to another.

## Key learning goals

Students will:

* model and observe wind erosion on exposed soil.
* consider how different wind speeds impact erosion.
* identify how soil particles move as a result of wind.

Students will represent their understanding as they:

* draw annotated diagrams showing the movement of soil at different wind speeds.
* explain how they think dust storms occur.

## Assessment advice

In this lesson assessment is formative.

Feedback might focus on:

* students’ observations about wind erosion. Have they made careful observations of each particle type in their soil sample, and represented this with appropriate diagrams and or/photographs?
* students’ explanations of how a dust storm might occur. Have they identified the types of particles that are transported in a dust storm and how far away they might be deposited? Have they used accurate scientific terminology?

## List of materials

**Whole class**

* Class science journal (digital or hard-copy)
* Optional video: [What's the difference between weathering and erosion](https://www.youtube.com/watch?v=96sD3bWdtgQ) (1:26)
* Video: [Wind erosion](https://youtu.be/PQmon7Rj6ns?si=GllpM-t1zPf4xCQD&t=100) (3:03)
* Video: [Behind The News segment ‘Dust Storm’](https://www.abc.net.au/btn/classroom/dust-storm/10537872) (3:50)

**Each group**

* A small sample of ‘soil’, made of food stuffs of varying sizes and weights, for example: flour, salt or sugar (fine and/or coarse), lentils, rice grains, breadcrumbs.
* Note: In this activity students blow on piles of soil. Food is used to simulate the different components of soil to avoid the potential hazards caused by students inadvertently inhaling soil during the investigation.
* A paper plate or other flat surface
* Optional: A device for taking photos and/or recording video

**Each student**

* Individual Science journal

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| **Lesson Routine** | **Estimated time** | **Task type** |
| Re-orient | 5 minutes | Whole class |
| Question | 10 minutes | Whole class |
| Investigate | 15 minutes | Collaborative teams, Individual |
| Integrate | 20 minutes | Whole class |

# Inquire

## Re-orient

Revise what students have learned about weathering and erosion. Focus on any discussions students may offer about sediment being moved from one place to another (transportation) by glaciers, water, wind and gravity.

## Question • How does wind move soil?

Revise the difference between weathering and erosion.

Optional: Show the video [What’s the difference between weathering and erosion](https://www.youtube.com/watch?v=96sD3bWdtgQ) (1:26) to view examples in situ and prompt discussion.

**Potential discussion prompts**

* *How are weathering and erosion different?*
  + Weathering changes the rock, erosion transports pieces to another place.
* *What are some ways rocks can be weathered and how do they occur?*
  + Students might describe the scraping and tumbling of mechanical weathering, freeze-thaw weathering, or chemical weathering.

**Pose the question:***How easily does wind move soil?*

## Investigate • Modelling wind erosion

Students simulate the effects of wind on exposed soil using a model.

**Before the investigation**

Discuss what students know about wind and its different ‘strengths’ or speeds.

**Potential discussion prompts**

* *What is wind?*
* *Can wind have different levels of ‘strength’?*
* *What words could you use to describe different levels of wind?*
  + Some response students might offer include: light/gentle/moderate/fresh/strong breezes, gusts, gale-force winds, storm, hurricane or southerly buster (a specific wind event that occurs in New South Wales and Victoria) etc.
* *Do you think a light wind could move soil? Why/why not?*
* *Do you think a strong wind could move soil? Why/why not?*

Discuss what students know about soil and its composition. Examine each of the components of the ‘soil’ sample that teams will be testing and discuss what it might represent in a sample of real soil.   
Note: Students should have learned about soils, rocks and minerals in Year 3. This may have included learning about the features of soil, different soil types—sand, silt and clay— and their components.

**Undertaking the investigation**

Explain/model the investigation—teams will pour their ‘soil’ onto a plate or other flat surface, piling up the soil at one side of the surface, and blow on it with three different ‘strengths’ to represent how bare soil might move in a light wind, a medium wind, and a strong wind.

Discuss how they could make the test fair by, for example, ensuring that the same person simulates the wind each time, and bringing the soil back into a pile before the next test.

As a class design a table that students can use to record their observations.

One example could be:

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| Describe and draw the soil particles in your sample.  Are they big, small, heavy, light? | Observe and describe, using words and drawing, how the soil moves in a ***light wind***.  Which particles moved?  How far did they travel?  How spread out were they? | Observe and describe, using words and drawing, how the soil moves in a ***medium wind***.  Which particles moved?  How far did they travel?  How spread out were they? | Observe and describe, using words and drawing, how the soil moves in a ***strong wind***.  Which particles moved?  How far did they travel?  How spread out were they? |
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Allow teams time to carry out their investigation and record their observations using the table.

Optional: Teams take photos and videos during their investigation.

## Integrate • How did the wind move the soil?

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| In this Integrate step, guide students to link their experiences in the investigation to the processes of erosion caused by wind in real-life.  Through questioning and discussion, students should come to a consensus that:   * wind can cause particles of soil to be transported across the landscape. * stronger winds can transport particles further. * the size of the particles also affects how far and high they are transported. * the particles themselves can be broken down in the process. |

Students share their observations from the investigation. They consider similarities and differences between groups and why these may have occurred. They also consider the fairness and accuracy of the investigation and how this could be improved.

**Potential discussion prompts**

* *Which particles did the light wind move? How far did they move? How spread out were they?*
* *What about the medium and strong winds?*
* *What words would you use to describe how the particles moved?*
  + Students should be given the opportunity to generate terms themselves before prompting.
  + Prompts might include terms like floating, sliding, rolling, bouncing etc.
* *What does this tell you about wind erosion?*
* *How far do you think a strong wind might be able to spread light, fine particles of soil? Why do you think that?*
* *What do you think would happen if the soil was wet? Do you think the results would be the same? Why do you think that?*
* *What measures do you think might help stop or control wind erosion?*

Introduce and discuss the terms **‘transportation’**, the movement of weathered material away from its source location, and **‘deposition’**, the laying down of this material in a new location.

Introduce the terms ‘surface creep’, ‘saltation’, and ‘suspension’ as different ways that the wind transports and deposits weathered material. Explain that students will watch some animations to support them to define these terms for themselves.

Watch the [Wind erosion](https://youtu.be/PQmon7Rj6ns?si=GllpM-t1zPf4xCQD&t=100) video without sound, from 1:40 until 2:40. Pause the video at appropriate times, taking note of the size of the soil particles and how they are moving as each term appears on screen.

Compose student-led definitions of the terms surface creep, saltation, and suspension, using the movement terms students offer and including reference to particle size.

Finally, rewatch the [Behind the News segment ‘Dust Storm'](https://www.abc.net.au/btn/classroom/dust-storm/10537872) (3:50) first viewed in Lesson 1. In their science journal, students use words and diagrams to explain how they think a dust storm may occur, the type of soil particles they transport, and how far the particles are transported before being deposited in another location.

## Reflect on this lesson

You might:

* add new words and images to the [word wall](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/using-word-wall?utm_source=docx&utm_medium=lesson5&utm_campaign=WOE%20) or [glossary](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/using-glossary).
* add to the W and H sections of the [TWLH chart](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/using-twlh-chart?utm_source=docx&utm_medium=lesson5&utm_campaign=WOE%20).
* consider the positive and negative impacts of wind erosion on humans, animals and the environment.

**Year 5**

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Wear on Earth • Lesson 6 • Erosion caused by water

**lesson 6**

**inquire**

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| To read the most recent version of this task, download associated resources, and view embedded professional learning including classroom videos and work samples, visit:  [https://primaryconnections.org.au/teaching-sequences/year-5/wear-on-earth/lesson-6-erosion-caused-water](https://primaryconnections.org.au/teaching-sequences/year-5/wear-on-earth/lesson-6-erosion-caused-water?utm_source=docx&utm_medium=lesson6&utm_campaign=WOE) |

# Lesson overview

Students explore how water erosion can change the landscape, transporting sediment from one place to another.

## Key learning goals

Students will:

* construct and observe water erosion using models of different landscapes.
* consider the importance and dangers of erosion and floods.

Students will represent their understanding as they:

* draw annotated diagrams of model landscapes, showing changes caused by water erosion.
* contribute to discussions to identify limitations of modelling and the positive and negative effects of water erosion and flooding.

## Assessment advice

In this lesson, assessment is formative.

Feedback might focus on:

* students’ claims about erosion by water. Are they referring to the definitions of ‘transportation’ and ‘deposition’ along with their evidence to make their claims? Have they recognised that erosion is the process that moves rocks and sediments from one place to another?

## Resources

**Whole class**

* Class science journal (digital or hard-copy)
* Demonstration copies of the relevant pages of the Modelling water erosion Resource sheet
* Optional video: [River erosion: the wrath of nature unveiled](https://www.youtube.com/watch?v=IxlpDWItLPg) (3:09)

**Each group**

In this lesson students have the option of modelling water erosion in three different landscapes. You might test all models across the classroom, select and test one model that is most appropriate for your location and students' experiences, or modify the models to suit your context more closely. See the *Investigate* lesson step or the Modelling water erosion Resource sheet for details of each model.

* Copy of the relevant pages of the Modelling water erosion Resource sheet, as applicable

**WATER EROSION CAUSED BY RAINFALL ON A SLOPING LANDSCAPE**

* 1 x large aluminium or plastic tray
* Sand and/or soil
* A container holding at least 500ml water
* Optional: A spray bottle or cup with holes in the bottom to simulate rainfall
* Book wrapped in plastic, a chunk of wood, or another item to prop up the tray

**WATER EROSION CAUSED BY WAVES**

* 1 x large aluminium/plastic tray
* Sand and/or soil
* A container holding at least 500ml water
* Wide piece of hard plastic to push the water

**WATER EROSION OF RIVERBANKS CAUSED BY HEAVY RAINFALL**

* 1 x large aluminium/plastic tray
* Rocks/block/small containers
* Sand and or soil
* A container holding at least 500ml water

**All teams might also use any of the following materials to build their landscapes, such as:**

* Rocks, plastic containers or building blocks to act as bedrock
* Modelling clay, plaster to build embankments
* Coloured aquarium stones to act as small rocks that appear in the landscape
* Twigs, string, uprooted weeks to model trees and grasses in the landscape
* Access to scissors, glue, sticky-tape, blu-tac to use as required
* Note: Any materials used to build model landscapes, or even the models themselves, should be kept for further use in Lessons 7 and 8 so that students can test their erosion control strategies.

**Per student**

* Individual science journal (digital or hard-copy)

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| **Lesson Routine** | **Estimated time** | **Task type** |
| Re-orient | 5 minutes | Whole class |
| Question | 5 minutes | Whole class |
| Investigate | Variable | Collaborative teams |
| Integrate | 20 minutes | Whole class, Individual |

# Inquire

## Re-orient

Revise what students have learned about erosion so far, with a focus on wind erosion as explored last lesson.

## Question • Water erosion

Revise the ways that water can contribute to weathering, including facilitating the movement of rock down a river, or in freeze-thaw weathering.

Noting the difference between weathering and erosion—as students have already discussed over the course of the sequence—**pose the question:***How does water cause erosion?*

## Investigate • Building landscapes

This step provides three different models for simulating soil erosion on different landscapes (also outlined on the **Modelling water erosion Resource sheet**). You might test all models across the classroom, select and test one model that is most appropriate for your location and students' experiences, or modify the models to suit your context more closely.

Students should work in collaborative teams to build one of the landscapes, test how water moves through it, and observe any erosion that occurs.

Provide students with a variety of materials that they may use to build their landscapes within a defined container in order to hold the water. An aluminium or plastic tray is ideal. The other materials you provide for students to use can be varied, but should include soil and/or sand so that students see how it specifically moves through the landscape. See the *List of materials*above for suggested materials.

You might model this process of building a landscape as a class beforehand, discussing the materials that can be used to mimic the features of that landscape. For example you might use rocks or plaster to build elevated embankments, twigs/sticks and string to mimic trees and tree roots, pop-sticks to build fences or barriers, or uprooted weeds as grasses/plants.

**Optional:**Allow teams time to search for and look at images of examples of their chosen landscape so their models are more accurate.

**Modelling water erosion caused by rainfall on a sloping landscape**

Students build a sloping landscape in an aluminium or plastic tray, then pour water over the landscape.

1. Build a sloping/hillside landscape in the aluminium or plastic tray.
   * Build an elevated section at one end of the tray, making sure that the ‘land’ at the other end is lower.
   * Cover the landscape in things you might find on a hillside. Leave parts of the soil exposed.
2. Cut a small notch at the end of the tray where the land is lower.
3. Draw an annotated diagram of the landscape in your science journal.
4. Prop up the end of the tray opposite the notch to ensure the water flows downwards.
5. Hold the bucket/tub under the notch to catch overflow of water and sand.
6. Using the bottle, pour the water on a specific area of the landscape, at a consistent rate. Alternatively, use a spray bottle or cup with holes in the bottom to simulate rainfall.
7. Observe how the water flowing interacts with features of the landscape.
8. On the annotated diagram mark the areas where water was poured.
9. On the annotated diagram draw how the water has affected the landscape, using a different coloured pen.

**Optional:** Students could collect numerical data by adding coloured aquarium stones to the sloping landscape, then counting the number of stones that end up at the base of the tray after the water has been poured on it. This data could be graphed. This could be built on in the following lesson, if students test erosion control strategies, by calculating the difference between the number of stones that end up at the base of the tray when there are no erosion control strategies in place compared to when there are.

**Modelling water erosion caused by waves**

1. Build a beach landscape in an aluminium or plastic tray.
   * Cover the whole tray with sand to simulate a beach.
   * One section of the ‘land’ should be very low, to simulate the seabed where the water will sit. One section should be higher to simulate the beach, and one section should be higher again to simulate sand dunes.
   * Include other natural features you might find at a beach.
2. Fill the shallow side of the tray with water, making sure you leave some flat area exposed to represent the shoreline.
3. Draw an annotated diagram of the landscape in your science journal.
4. Use a wide piece of hard plastic to push large amounts of water towards the ‘shore’, simulating waves.
5. Observe how the waves interact with features of the landscape, particularly the sand dunes.
6. On the annotated diagram draw how the water has affected the landscape, using a different coloured pen.

**Modelling water erosion of riverbanks caused by heavy rainfall**

1. Build a river landscape in an aluminium or plastic tray.
   * Each side of the landscape should be elevated (but not necessarily completely flat) with a gully/channel running through it.
   * Include bends in your ‘river’ and other features you might see in the landscape.
2. Pour a small amount of water into the river, as would appear in nature.
3. Draw an annotated diagram of the landscape in your science journal.
4. Use a large water bottle or bucket to pour a large amount of water into one end of the ‘river’ all at once.
5. Observe how the sudden increase in water level interacts with features of the landscape, particularly the riverbanks and any bends in the river.
6. On the annotated diagram draw how the water has affected the landscape, using a different coloured pen.

A tray of food on a table

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## Integrate • Water’s sculpting force

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| In this integrate step, guide students to link their experiences in the investigation to the processes of erosion caused by water in real-life.  Through questioning and discussion, students should come to a consensus that:   * water moving over and through the landscape transports soil from one place and deposits it in another. * whilst it is an important natural process, sudden increases in water volume can impact environments negatively. * these impacts can affect humans, animals and plants. |

Invite teams to share their observations, encouraging the use of the terms ‘transportation’ and ‘deposition’.

Discuss the people and animals that will be most affected by erosion in the scenario/s students modelled, and how they would be affected.

**Potential discussion prompts**

* *What have we learned about how water erosion affects landscapes?*
* *Where did the water transport the sand/soil?*
* *Why did the sand deposition occur where it did?*
* *Who might use this information in their work?*
* *What do you think this model helps us understand about real-life landscapes? What other elements does this model not take into account?*
* *Who lives and/or works in the types of environments of environment you modelled?*
  + Farmers, beach goers, people who live on the water’s edge, people who live near rivers, bushwalkers, park rangers.
* *How might they be affected by erosion?*
  + Ask students to name a specific group of people and how they might be affected.
  + For example, people who live near rivers might be affected by flooding in sudden or very heavy rain events. As the riverbanks are eroded, people may need to evacuate home and be displaced. Houses can be lost in floods. Dirty river water can cause people to become sick.
* *What animals live in these environments and how might they be affected?*
* *How might the environment itself change?*
* *Are all the impacts necessarily negative? Are there some positive changes that may occur?*
* *How might water erosions be stopped or controlled?*

**Optional:** Further consolidate understanding of how water erosion causes changes to the landscape and can re-shape rivers by viewing [River Erosion: The Wrath of Nature Unveiled](https://www.youtube.com/watch?v=IxlpDWItLPg) (3:09).

In their science journal, and in reference to their observations of their model, students write a response to answer the question *How does water cause erosion?*

## Reflect on the lesson

You might:

* add new words and images to the [word wall](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/using-word-wall?utm_source=docx&utm_medium=lesson6&utm_campaign=WOE%20) or [glossary](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/using-glossary?utm_source=docx&utm_medium=lesson6&utm_campaign=WOE%20).
* add to the W and H sections of the [TWLH chart](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/using-twlh-chart?utm_source=docx&utm_medium=lesson6&utm_campaign=WOE%20).
* create a table to compare the positive and negative effects of water erosion.
* discuss how students were thinking and working like scientists during the lesson. Focus on the use of modelling to represent changes that occur over long time scales and/or in large environments.

Wear on Earth • Lesson 7 • Time scales and human impact

**Year 5**

**lesson 7**

**inquire**

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| To read the most recent version of this task, download associated resources, and view embedded professional learning including classroom videos and work samples, visit:  [https://primaryconnections.org.au/teaching-sequences/year-5/wear-on-earth/lesson-7-time-scales-and-human-impact](https://primaryconnections.org.au/teaching-sequences/year-5/wear-on-earth/lesson-7-time-scales-and-human-impact?utm_source=docx&utm_medium=lesson7&utm_campaign=WOE) |

# Lesson overview

Students consolidate their understanding of weathering and erosion and consider the impact of humans on the varying time scales involved.

## Key learning goals

Students will:

* explore time scales of weathering and erosion.
* determine how humans can influence rates of weathering and erosion.
* further examine wind and water as agents of weathering and erosion.

Students will represent their understanding as they:

* categorise statements about weather and erosion on a time scale from slow to rapid.
* justify the placement of statements on this slow to rapid timescale.
* contribute to discussions about wind and water as agents of weathering and erosion and timescales.
* contribute to the creation of a T chart about weathering and erosion timescales.

## Assessment advice

In this lesson, assessment is summative.

Students working at the achievement standard should be able to:

* explain the processes of weathering and erosion and their impacts on the landscape.
* identify weathering and erosion as natural processes that occur over varying time scales—millions of years or just a few hours.
* name the human activities that can affect rates of weathering and erosion.

Refer to the Australian Curriculum content links on the [*Our design decisions* tab](https://primaryconnections.org.au/teaching-sequences/year-5/wear-earth?tabIndex=2) for further information.

## Resources

**Whole class**

* Class science journal (digital or hard-copy)
* 2 x copies of the **Time scale statements Resource sheet,** printed and cut to separate each statement
* Sticky notes and textas
* Buckets/bottles/containers of water (alternatively, carry out the **Water absorption and runoff** activity while it is raining or just afterwards)
* Video: [Behind the News segment ‘Dust storm’](https://www.abc.net.au/btn/classroom/dust-storm/10537872) (3:50)
* Video: [Weathering by wind](https://www.youtube.com/watch?v=99k6FHvykRk) (1:33)
* Video: [The unique geological anomaly in Central Australia](https://www.youtube.com/watch?v=Rsq8fVhicAk) (3:30)
* Video: [Gully erosion: See how quickly it can happen](https://www.youtube.com/watch?v=5ST5DaBp1OE) (0:16)
* Video: [Gully erosion solutions for your property - Part 4](https://www.youtube.com/watch?v=aM-d0clGcjQ) (6:00)
* Video: [Great natural wonders—the Twelve Apostles](https://www.youtube.com/watch?v=iCe4diTfzRk) (1:50)
* Video: [Lighthouse moved 70m on rails to save it from falling into the sea](https://www.youtube.com/watch?v=jg9TmwPqxQg) (0:49)

**Per student**

* Individual science journal (digital or hard-copy)

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| **Lesson Routine** | **Estimated time** | **Task type** |
| Re-orient | 10 minutes | Whole class |
| Question | 10 minutes | Whole class |
| Investigate | Variable | Collaborative teams, Whole class |
| Integrate | 20 minutes | Collaborative teams, Whole class |

# Inquire

## Re-orient

Recap what students have learned so far over the course of the sequence about weathering, erosion, transportation and deposition.

## Question • Rapid or slow?

**Pose the question:** *Does weathering and erosion occur slowly or rapidly?*

Brainstorm student ideas and record them as a table in the class science journal. One way you might do this is in a T-chart.

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## Investigate • How long does it take?

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AI-generated content may be incorrect.In this investigation students will explore what things can affect the rate of weathering and erosion, and use the information they collect to consider whether humans can change weathering and erosion rates.

On a page in the class science journal, write the words ‘rapid’ and ‘slow’, either on the top and bottom of the page or on the left and right of a double page. Discuss the meanings of the terms slow and rapid, including synonyms for these terms. Build a time scale continuum by recording other time descriptor words and placing

them where students think they would appear between ‘rapid’ and ‘slow’.

Designate one end of the classroom as **slow** and one as **rapid**. Ask students to imagine a line between the two ends of the room that represents the time scale continuum. You might place signs at either end of the classroom to help students remember.

Give pairs of students one statement from the **Time scale statements Resource sheet.**

Pairs discuss their statement, considering:

* the weathering or erosion event described.
* what things are affecting the rate of weathering/erosion in the described event.
  + For example, the speed of water flow, strength of wind, size of waves, stability of riverbanks or sand etc.
* where the weathering or erosion event might sit on the time scale continuum.

They then place themselves along the imaginary line representing the time scale continuum.

Note: Students may need some assistance clarifying some of the terminology used in the statements, particularly in relation to landforms such as gorges, rocky outcrops etc.

Each pair reads their statement aloud and shares their reasoning for why they have selected their place on the continuum. Other students can share their thoughts on whether they agree or disagree and why. As you work your way along the continuum, teams might also consider how they are placed next to teams before or after them, and if they might move themselves along the continuum in either direction.

Collect the statements in order from 'slow' to 'rapid' according to the final placements of students and display them in this order for students to refer to later.

Next, students will undertake a series of short investigations to further explore the time scales at which weathering and erosion events occur. These are described below.

**WIND EROSION**

To examine how rapidly erosion can occur, rewatch the video [Behind the News segment ‘Dust storm’](https://www.abc.net.au/btn/classroom/dust-storm/10537872) (3:50), with a focus on the time scale mentioned in the clip.

Discuss whether erosion and weathering by wind always occurs rapidly or slowly, and add notes to the T chart created at the beginning of the lesson.

**Potential discussion prompts**

* *Would we classify a dust storm as causing rapid or slow erosion? Why?*
* *Can you give an example of slow erosion caused by wind?*
* *What evidence have we collected during the sequence that supports your ideas?*
* *When the wind blows sand against rock, it causes weathering. Would this be slow or rapid? How do you know?*
* *Is erosion by wind a local issue? What things might influence how rapid wind erosion occurs?*

**Optional:** Show the video [Weathering by wind](https://www.youtube.com/watch?v=99k6FHvykRk) (1:33) to further consider slow weathering caused by wind, and/or show the video [The Unique Geological Anomaly in Central Australia](https://www.youtube.com/watch?v=Rsq8fVhicAk) (3:30) to explore the millions of years of weathering and erosion that have shaped Karlu Karlu (Devil’s Marbles).

**WATER ABSORPTION AND RUNOFF IN THE SCHOOL GROUNDS**

It’s ideal to complete this activity whilst it is raining, however if that is not possible, using buckets of water to simulate rain is also acceptable.

Brainstorm a list of places in the school grounds where students would like to view what happens with water runoff during rain events. This might include areas that contain drains or gutters, any sloping land, areas where soil or tree roots are exposed, or areas with good vegetation cover.

Head out into the school grounds to observe what happens near flowing water and determine which surfaces are permeable (absorb water) and which are non-permeable surfaces (such as concrete and paving). Make notes and/or take photos and video of what happens to the water and the surrounding soil.

Upon returning to the classroom, discuss how the amount of water runoff affects flooding and erosion rates, and add notes to the T chart.

**Potential discussion prompts**

* *What differences did you observe?*
* *If we concrete large areas, would the water runoff into creeks and rivers increase or decrease? Why do you think that?*
* *What are the positive and negative effects of concreting areas of school grounds, or places like footpaths and driveways etc.?*

**GULLY EROSION**

Show the video [Gully Erosion: See how quickly it can happen](https://www.youtube.com/watch?v=5ST5DaBp1OE) (0:16). Note that it is a time-lapse video filmed over a 24 hour period. Ask students to name the factors they observed that contributed to the rapid widening of the gully. For example: rate of water flow, soil type, too much water to penetrate the soil, and run-off into the creek, creating the waterfall effect at the side.

Show the video [Gully erosion solutions for your property - Part 4](https://www.youtube.com/watch?v=aM-d0clGcjQ) (6:00), pausing intermittently to discuss the purpose of the erosion control measures being used by the farmers and whether they apply to the local landscape. To support students to build their knowledge for the Act phase, consider allocating 1 sticky note and 1 strategy to each pair, so they can take notes about the purpose of the strategy. Collate their ideas (and sticky notes) in the class science journal.

Discuss the erosion control strategies and their impact on erosion rates, and add further notes to the T chart.

**Potential discussion prompts**

* *What is the goal of this erosion control strategy?*
  + For example, to increase water penetration into the soil, slow down the flow rate of water, spread water out across a larger grassed area, and catch sediment before it is washed too far away.
* *Can this erosion control measure be used or adapted for our schoolyard/local landscape?*
* *Why is it important to slow down the water/increase the amount of water absorbed into the soil?*
* *Which of these strategies would also help to reduce erosion by wind?*

**Optional:** Students can try some of the erosion control strategies using the landscapes they created in a tray in the previous lesson. If those testing a sloping landscape added coloured aquarium stones to their tray, they could now collect, graph, and compare data after erosion control strategies have been put in place.

Add notes to the T chart as required.

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## Integrate • Applying what we’ve learned

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| In this integrate step, guide students to link their experiences in the investigations into timescales within which weathering and erosion take place.  Through questioning and discussion, students should come to a consensus that:   * weathering and erosion are natural processes that cause change in the environment. * weathering is a slower process than erosion, although erosion can be slow and rapid. * understanding the patterns of weathering and erosion allows us to make predictions. * human activities can speed up or slow down the rate of weathering and erosion. |

Show the video [Great natural wonders—the Twelve Apostles](https://www.youtube.com/watch?v=iCe4diTfzRk) (1:50) and **pose the question**: *In what circumstances are humans unable to slow down the rate of weathering and erosion?*

Then show the video [Lighthouse moved 70m on rails to save it from falling into the sea](https://www.youtube.com/watch?v=jg9TmwPqxQg) (0:49) to observe and discuss a huge engineering mission to save a light house from coastal erosion.

**Potential discussion prompts**

* *Why was it necessary to move the lighthouse?*
* *Why couldn’t they stop the coastal erosion instead?*
  + It would be very expensive and likely impossible to build a wall tall enough and strong enough to withstand the force of the coastal winds and ocean waves.
* *Have you observed coastal erosion? Do you think the erosion could have been slowed or stopped in that circumstance?*

Rebuild the time scale continuum in light of students’ new understanding. Distribute a second copy of the statements found on the **Time scale statements Resource sheet** (you may give pairs the same statement as earlier, or distribute them again randomly). Pairs discuss their statement and place themselves along the imaginary continuum as they did earlier in the lesson.

Share and discuss the statements and students’ reasoning for placing themselves in that position on the continuum. Collect and display the statements in order, comparing them to the previous attempt.

**Potential discussion prompts**

* *Is this statement mostly about weathering or erosion?*
* *As humans can we do anything to speed up or slow down the rate of weathering/erosion occurring in this situation?*
* *Could this statement be placed in a different place on the time scale? Describe the circumstances that would affect where we place it.*
  + For example, extreme wind speed could cause erosion to occur more rapidly, humans removing vegetation can make soils more vulnerable to erosion, large ocean swells caused by extreme weather can increase erosion, a quarry that operates 24 hours a day breaks more rocks than a small quarry that only operates 2 days per week.
* *In relation to time scales, why is it important that we try to minimise erosion?*

**Optional:** Ask students to write their own additional statements about weathering or erosion and place them on the time scale. Topics covered through the sequence can be used to prompt the students, such as chemical weathering, freeze-thaw weathering and erosion.

## Reflect on the lesson

You might:

* add to the rapid/slow T chart.
* refer to the list of student questions asked in Lesson 1. Determine which questions have been answered over the course of the teaching sequence, what the ‘answers’ to the questions are, and the evidence that supports these claims. Address questions that have not been answered during the teaching sequence, discuss why they might not have been addressed and potential investigations that might support students to answer them.
* review students’ responses to the **Thinking about landscapes Resource sheet** completed in Lesson 1, comparing students’ initial ideas to what they think now and considering how their thinking has changed.
* consider what students have learnt about weathering, erosion, transportation and deposition.
* ask students to represent their learning in words, symbols and pictures.
* discuss why it’s important to have a good understanding of weathering and erosion: *what kinds of jobs would require you to understand this? What about in your everyday life? What activities might be affected by weathering and erosion?*

**Year 5**

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Wear on Earth • Lesson 8 • Designing an erosion control strategy

**lesson 8**

**ACT**

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| To read the most recent version of this task, download associated resources, and view embedded professional learning including classroom videos and work samples, visit:  [https://primaryconnections.org.au/teaching-sequences/year-5/wear-on-earth/lesson-8-designing-erosion-control-strategy](https://primaryconnections.org.au/teaching-sequences/year-5/wear-on-earth/lesson-8-designing-erosion-control-strategy?utm_source=docx&utm_medium=lesson8&utm_campaign=WOE) |

# Lesson overview

In this lesson students consolidate their learning by designing (and possibly testing) an erosion control strategy for an area of need in their school/local environment. This lesson may need to take place over several sessions.

## Key learning goals

Students will:

* design an erosion control strategy.
* design and carry out an experiment to test the effectiveness of the erosion control strategy (optional).
* share their erosion control strategy with a chosen audience.

Students will represent their understanding as they:

* communicate their understanding of how humans can influence erosion rates.
* use labels on their prototype to identify and explain the erosion and erosion control strategy.
* produce a written or verbal report on erosion and their chosen strategy.

## Assessment advice

In the Act phase, assessment is summative.

Students working at the achievement standard should have:

* demonstrated an understanding of erosion as a local issue. Evidence might include:
  + labelled diagrams or model explaining the erosion control strategy.
  + discussed the effect of erosion on the community.
* collected and represented data to refine their erosion control strategy.
* discussed/described how communities use scientific knowledge.

Refer to the Australian Curriculum content links on the [Our design decisions tab](https://primaryconnections.org.au/teaching-sequences/year-5/wear-earth?tabIndex=2) for further information.

## List of materials

**Whole class**

* Class science journal (digital or hard-copy)
* Optional video: [How do weathering and erosion shape Earth’s surface?](https://www.youtube.com/watch?v=tyPfGs3gbhg) (4:26)
* Optional:Demonstration copy of the**Erosion report Resource sheet**

**Per group**

* Materials are variable dependent on the erosion issue each team tackles, the strategy they design, and whether they actually test their strategy
* Optional: Variables grid Resource sheet
* Erosion control testing investigation planner Resource sheet

**Per student**

* Individual science journals
* Optional: **Erosion report Resource sheet**

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| **Lesson Routine** | **Estimated time** | **Task type** |
| Anchor | 10 minutes | Whole class |
| Connect | 15 minutes | Whole class |
| Design | Variable | Collaborative teams, Individual |
| Communicate | Variable | Collaborative teams, Individual |

# Act

## Anchor • What have we learned so far?

Review the learning that has occurred over the course of the sequence using the class science journal.

**Optional:** View content that summarises weathering and erosion, for example, the video [How do weathering and erosion shape earth’s surface?](https://www.youtube.com/watch?v=tyPfGs3gbhg) (4:26).

## Connect • Our erosion issue

Revisit the weathering and erosion sites identified by students during the school or community walk/virtual tour in Lesson 1. You might take another in-person visit to the site, view photographs and images taken during the first visit, or undertake another virtual tour.

Confirm if these sites are indeed affected by weathering and erosion, and identify how they are affected based on new learning. Identify new potential sites of weathering and erosion.

Discuss the impact the local weathering/erosion issue could have on people, plants and animals, such as:

* loss of soil for growing.
* uneven ground causing injury.
* decrease water quality due to soil runoff.
* less water absorption into the soil for plants and animals.
* dust entering homes or classrooms, causing cleaning and asthma issues.

If, as part of [preparing for this sequence](https://primaryconnections.org.au/teaching-sequences/year-5/wear-earth?tabIndex=3), you identified and discussed an erosion issue that students will be designing a solution for, revisit this site now and discuss the issues it faces and potential solutions.

Otherwise, allow students to consider and select their own site to design an erosion control strategy for.

## Design • Designing an erosion control strategy

In this section, students will design an erosion control strategy for an area of need in their school/local environment. The option to test the strategy is outlined separately in the next section.

Consider if you will require students to design their strategy in teams, and if so, how you will determine these teams. Alternatively students can work independently, however this can require more time and classroom resources and have greater demands on you as the teacher.

**Define**

Students name the site of the erosion issue they would like to address and consider what is causing erosion at the site, how serious the issue is, and how easily it might be controlled.

Students list all the people/animals/plants that are negatively impacted by the erosion issue they have chosen to address, and how they might be impacted.

**Ideate**

Brainstorm ideas related to the design of their erosion control strategy. What strategies, particularly in reference to the ones they learned about in the previous lesson, will be effective at their site and why? What other strategies might they employ?

At this stage, to support creative thinking, every idea offered by students should be recorded in the class science journal. No idea is discounted, as the practicality/possibility of each idea will be considered later.

**Select/Critical thinking**

Revisit each of the ideas offered and ask probing questions (*How will this idea reduce erosion?* or *Will this idea reduce both weathering and erosion?*) to draw out how students are applying their understanding of weathering and erosion.

For example:

* Small, weathered pieces of rock and soil can be eroded by wind and water naturally.
* Slow-flowing water erodes riverbanks at a slower rate than fast-flowing water.
* Soil covered in vegetation erodes more slowly than exposed soil.
* Permeable surfaces absorb water and reduce runoff into rivers.
* Weathering and erosion rates can be increased and decreased by human actions.

**Prototype**

Determine if students are going to draw labelled diagrams, build models as prototypes, or do both for their erosion control strategies.

If students build model prototypes they will need access to materials. They might create a model of the site using similar materials to those used in Lesson 6, and test different erosion control strategies. Building the prototype provides an opportunity to consolidate and refine their understanding.

Designing an erosion control strategy without building it requires fewer materials but can be more challenging, as students are required to express their understanding in an abstract manner. Teacher judgement should be used to determine which approach is best for your students.

Allow teams/students time to design/build their erosion control prototypes.

All works should include labels identifying:

* the main landscape features (hill, slope, river, path…).
* weathering and erosion (soil containing weathered rock, transportation, deposition…).
* measures used to reduce erosion (trees, berms, mulch, ground covers, swales, stick rake lines…).

**Optional:** Students/teams are provided opportunities to share their ideas and receive peer feedback ([download AITSL's guide for more on peer feedback](https://www.aitsl.edu.au/docs/default-source/feedback/aitsl-peer-feedback-stratedy.pdf)).

## Design • Testing the erosion control strategy

This optional design element allows students to design a fair test for their erosion control strategy. See the embedded professional learning *How to design a fair test for erosion control strategies* for more information.

Students consider who and what might be negatively impacted if their erosion control strategies are ineffective. This might take into account considerations such as:

* further detrimental effects on the environment.
* the possibility for increased levels of erosion.
* the potential costs of the control measures, including the cost of removal and replacement.

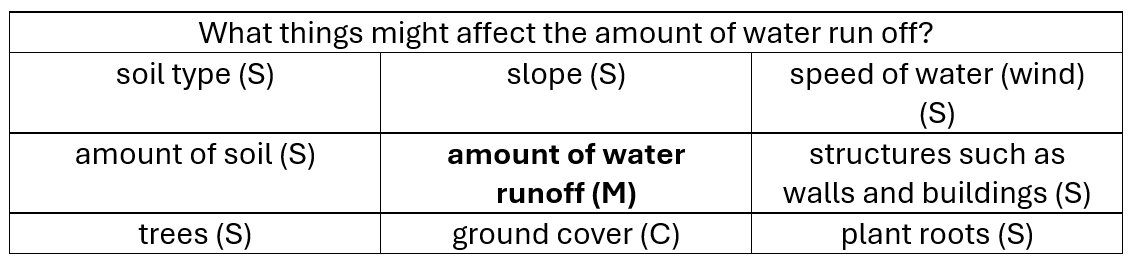
Discuss why testing the strategies is an important way to determine their effectiveness.

Students consider ways they might test their erosion control strategies. The tests they design will depend upon their chosen erosion control strategy.

As students brainstorm ideas for testing, support them by asking probing questions about fair testing. For example:

* *How can we ensure it is a fair test?*
* *How can we measure results?*
* *How will you collect and present the data?*
* *How will the test help you determine if your erosion control strategy might be successful?*

You might provide students/teams with a blank **Variables grid Resource sheet** to support the identification of variables and the creation of a clear investigable question. Teams will also need an **Erosion control testing investigation planner Resource sheet**.



Determine the criteria for how students’ fair testing might demonstrate the science inquiry skills developed during the sequence. For example:

* Change one thing (independent variable).
* Measure/observe the outcome (dependent variable).
* Keep the other things (controlled variables) the same.
* Organise and represent the data.
* Identify any errors that were made during testing and describe what could have been done to correct the errors.

Allow teams/students time to set up and run a fair test on their erosion control prototype.

Time permitting, based on the results, students can make changes to their erosion control strategy then run another fair test to observe/measure improvement.

## Communicate • How can we control erosion?

Students share their erosion control strategy with a chosen audience, including any results from their testing. The audience may include other students, parents at an evening science fair, school council member(s), local paper/newsletter, local council or Landcare member etc.

The communication method will depend on the audience, context and cross-curricula opportunities, some examples include:

* a written field report. You might use the **Erosion report Resource sheet**.
* a verbal presentation (live or recorded) such as an erosion site tour, news report, interview, science quiz, podcast etc.
* a letter of recommendation, accompanied with diagrams, to the local council or school board. It could be presented to the Mayor in person or presented at a local Council forum.

The [CROWN strategy](https://primaryconnections.org.au/pedagogical-tools/learning-through-inquiry-tools/crown?utm_source=docx&utm_medium=lesson8&utm_campaign=WOE%20) can also be used to structure discussions around the erosion control strategies that students have designed (and potentially tested).

**Reflect on the sequence**

You might:

* discuss future plans for the erosion site and student involvement.
* discuss any plans for measuring and documenting change at the erosion site: How will we know if our erosion control measure is successful? What will we see? Is there a way to measure it?