# *The rock cycle* Teaching and learning plan

## Learning intentions

Students will be able to:

* describe the formation and characteristics of igneous, sedimentary and metamorphic rocks and identify examples;
* identify the different rock types based on common features;
* identify and describe the processes in the rock cycle that result in new rocks being formed;
* construct a model of the rock cycle.

## Suggested time for this CLE

The time needed to complete The rock cycle CLE will depend on the depth of the prior knowledge of students, the time to perform the four investigations—‘The formation of sedimentary rocks’, ‘The formation of metamorphic rocks’, ‘The formation of igneous rocks’ and ‘Classifying rocks’—and follow up with any further extension activities. Allow 6–12 hours.

## [Planning ahead and equipment list](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Planning_and_equipment_list_yr8_The_rock_cycle.docx)

## Safety considerations

When you and your class are completing your Risk Assessment, consider the following safety points and add any other relevant ones to the list:

* Make students aware of the risk of grating fingers when grating crayons.
* Care should be taken when handling hot water and hot glassware.

## \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Introduction

This CLE focuses on the rock cycle and links to Year 8 Earth and space sciences in the Australian Curriculum: Science.

### Equipment needed

Per student:

* rock sample
* hand lens
* A4 sheet of paper (plus extra sheet for group)
* plastic wobbly eyes and glue (optional)

### What to do

1. Explain to students that, just like biologists, who describe and classify living things, and chemists, who describe and classify chemicals, geologists describe rocks so they can classify them. Provide each student with a rock sample and a sheet of A4 paper and explain that in this activity they will write down some observations about their rock, which will be used later to classify it.
2. Ask students to write a description of their rock on their A4 sheet. They could ask the following questions as they make their observations.

* What colour is it?
* Is it shiny or dull?
* Is it rough or smooth?
* Is it striped?
* Can I see separate grains? If so, how many different grains and what shape are they?
* Can I see crystals? If so, how many different crystals and what shape are they?

1. Place students into groups and ask them to share the descriptions of their rocks with the group.
2. Provide each group with a sheet of A4 paper. Students divide the sheet in two and write the headings *Compare* and *Contrast* at the top. Students record the similarities and differences between their rocks.

|  |  |  |
| --- | --- | --- |
| Whose rock? | Compare (similarities) | Contrast (differences) |
|  |  |  |

1. Share some of the descriptions, similarities and differences.
2. Keep this document for later.

**Optional activity:** Pet rock

If students brought in their own rocks, you could provide them with wobbly eyes to glue on their rock. Rocks can be kept in the class and used in *Investigation 4: Classifying rocks*.

## Core

Ask students if they know the names of the three types of rocks—sedimentary, igneous, metamorphic.

Inform students that, over the next few lessons, they are going to investigate: how each of these types of rock are formed, the properties of each type of rock, and some examples of each rock type.

### Investigation 1: The formation of sedimentary rocks

### Equipment needed

Per class:

* [PowerPoint presentation, The rock cycle](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/The_rock_cycle.pptx). Slides 2–11

Per group:

* sample of sand and sandstone
* hand lens
* two different coloured wax crayons
* grater
* 15 cm square of aluminium foil
* sheet of paper towel
* bench protector
* safety glasses
* iPhone/iPad/digital camera (optional)
* [rock pictures](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Rock_pictures_yr8_The_rock_cycle.docx) (optional)

Per student:

* [Student worksheet 1: Think/Pair/Share](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_1_Think_Pair_Share_Yr8_The_rock_cycle.docx)
* [Student worksheet 2: Formation of sedimentary rocks](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_2_Formation_of_sedimentary_rocks_yr8_The_rock_cycle.docx)

### What to do

1. Think/Pair/Share

Provide students with a sample, or images, of sand and sandstone (PowerPoint slide 2)

Students could record their answers in their notebook or you could use [Student worksheet 1: Think/Pair/Share](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_1_Think_Pair_Share_Yr8_The_rock_cycle.docx)

* Question: How could you create sandstone out of sand?
* Think: Each student has ~ 2 minutes to record his or her answer to the question.
* Pair: Students pair up and have ~ 5 minutes to share their answers to the question and develop an answer to the question to share with the class.
* Share: Pairs of students share answers with the class. Record ideas from class discussion to refer back to at the end of the investigation.

1. Explain to students that sandstone is an example of a sedimentary rock and they are now going to model the formation of sandstone. In science, we use models to help explain what is happening in the real world. You might like to introduce the concept of scientific models and their limitations at this point. During the activity you could discuss the limitations as they arise.
2. Ask students to follow the instructions on PowerPoint slides 3–11 together as a class. After each step, discuss what actually happens to form sand and sandstone.
3. Refer back to the student answers from the Think/Pair/Share activity at the start of this investigation. Identify those answers that were close to what happens. Identify where students have described the processes of weathering, erosion, deposition, compaction and cementation. They probably won’t have used the correct terminology.
4. Students complete [Student worksheet 2: Formation of sedimentary rocks](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_2_Formation_of_sedimentary_rocks_yr8_The_rock_cycle.docx).

### Extension:

* Students could take photos of each step to use later when they construct their own model of the rock cycle.
* Students could conduct some experiments on weathering, erosion, compaction and cementation.

Some sources of experiments include:

* ‘Year 8 Rocks and Minerals’, Woodside Australian Science Project (WASP) website, <http://www.wasp.edu.au/mod/page/view.php?id=87>
* ‘Experiments and demonstrations’, The Rock Cycle, The Geological Society of London website <https://www.geolsoc.org.uk/ks3/gsl/education/resources/rockcycle/page3652.html>

### Expected results and explanations

There are photographs of what happens in each step of the model as you work through the PowerPoint slides. These can be shown to students as they complete each step and during discussions.

Answers to the worksheet are available as a separate document.

### Investigation 2: The formation of metamorphic rocks

### Equipment needed

Per class:

* [PowerPoint presentation, The rock cycle](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/The_rock_cycle.pptx). Slides 12–19
* kettle or urn

Per group:

* sample of sandstone and quartzite
* hand lens
* ‘sedimentary’ crayons wrapped in foil from Investigation 1
* crucible tongs
* small aluminium tart pan
* 250 mL beaker of hot water
* toothpick
* bench protector
* safety glasses
* iPhone/iPad/digital camera (optional)
* [rock pictures](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Rock_pictures_yr8_The_rock_cycle.docx) (optional)

Per student:

* [Student worksheet 1: Think/Pair/Share](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_1_Think_Pair_Share_Yr8_The_rock_cycle.docx)
* [Student worksheet 3: Formation of metamorphic rocks](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_3_Formation_of_metamorphic_rocks_yr8_The_rock_cycle.docx)

### What to do

1. Think/Pair/Share

Provide students with a sample, or images, of sandstone and quartzite (PowerPoint slide 12)

Students could record their answers in their notebook or you could use [Student worksheet 1: Think/Pair/Share](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_1_Think_Pair_Share_Yr8_The_rock_cycle.docx)

* Question: How could you create quartzite out of sandstone?
* Think: Each student has ~ 2 minutes to record his or her answer to the question.
* Pair: Students pair up and have ~ 5 minutes to share their answers to the question and develop an answer to the question to share with the class.
* Share: Pairs of students share answers with the class. Record ideas from class discussion to refer back to at the end of the investigation.

1. Explain to students that quartzite is an example of a metamorphic rock and that they are now going to model the formation of quartzite.
2. Ask students to follow the instructions on PowerPoint slides 13–19 together as a class. After each step, discuss what actually happens to form quartzite.
3. Refer back to the student answers from the Think/Pair/Share activity at the start of this investigation. Identify those answers that were close to what happens.
4. Students complete the [Student worksheet 3: Formation of metamorphic rocks](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_3_Formation_of_metamorphic_rocks_yr8_The_rock_cycle.docx).

### Extension:

* Students could take photos of each step to use later when they construct their own model of the rock cycle.
* Students could conduct some experiments on deformation and metamorphism. Some sources of experiments include:
* ‘Year 8 Rocks and Minerals’, Woodside Australian Science Project (WASP) website, <http://www.wasp.edu.au/mod/page/view.php?id=87>
* ‘Experiments and demonstrations’, The Rock Cycle, The Geological Society of London website <https://www.geolsoc.org.uk/ks3/gsl/education/resources/rockcycle/page3652.html>

### Expected results and explanations

There are photographs of what happens in each step of the model as you work through the PowerPoint slides. These can be shown to students as they complete each step and during discussions.

Answers to the worksheet are available as a separate document.

### Investigation 3: The formation of igneous rocks

### Equipment needed

Per class:

* [PowerPoint presentation, The rock cycle](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/The_rock_cycle.pptx). Slides 20–25
* kettle or urn

Per group:

* sample of quartzite and granite
* hand lens
* metamorphic crayons in aluminium foil tray from Investigation 2
* crucible tongs
* 250 mL beaker of hot water
* 250 mL beaker of ice or ice water or warm water
* bench protector
* safety glasses
* iPhone/iPad/digital camera (optional)
* [rock pictures](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Rock_pictures_yr8_The_rock_cycle.docx) (optional)

Per student:

* [Student worksheet 1: Think/Pair/Share](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_1_Think_Pair_Share_Yr8_The_rock_cycle.docx)
* [Student worksheet 4: Formation of igneous rocks](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_4_The_formation_of_igneous_rocks_yr8_The_rock_cycle.docx)

### What to do

1. Think/Pair/Share

Provide students with a sample, or images, of quartzite and granite (PowerPoint slide 20)

Students could record their answers in their notebook, or you could use [Student worksheet 1: Think/Pair/Share](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_1_Think_Pair_Share_Yr8_The_rock_cycle.docx).

* Question: How could you create granite out of quartzite?
* Think: Each student has ~ 2 minutes to record his or her answer to the question.
* Pair: Students pair up and have ~ 5 minutes to share their answers to the question and develop an answer to the question to share with the class.
* Share: Pairs of students share answers with the class. Record ideas from class discussion to refer back to at the end of the investigation.

1. Explain to students that granite is an example of an igneous rock and that they are now going to model the formation of granite.
2. Ask students to follow the instructions on PowerPoint slides 21–25 together as a class. After each step, discuss what actually happens to form granite.
3. Refer back to the student answers from the Think/Pair/Share activity at the start of this investigation. Identify those answers that were close to what happens.
4. Students complete the [Student worksheet 4: Formation of igneous rocks](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_4_The_formation_of_igneous_rocks_yr8_The_rock_cycle.docx).

### Extension:

* Students could take photos of each step to use later when they construct their own model of the rock cycle.
* Students could conduct an experiment on grain/crystal size and cooling rate.

### Expected results and explanations

There are photographs of what happens in each step of the model as you work through the PowerPoint slides. These can be shown to students as they complete each step and during discussions.

Answers to the worksheet are available as a separate document.

### Investigation 4: Classifying rocks

### Equipment needed

Per class:

* [Rock station cards](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Rock_station_cards_yr8_The_rock_cycle.docx)

Per group:

* rock samples from introduction activity
* hand lens
* additional rock samples (optional)

### What to do

1. Distribute the Rock station cards over three ‘stations’ around the classroom.
2. Students use the description of rock types at the following link to sort their rocks into igneous, sedimentary and metamorphic rocks. ‘What type of rock do I have?’, The Rock Cycle, *Minerology4Kids* website, <http://www.mineralogy4kids.org/rock-cycle/what-type-rock-do-i-have>. Ask each student to place their rocks at the appropriate rock station.
3. Divide the class into three groups and allocate each group to a rock type. Ask each group to look at the rocks at their station and decide whether they agree or disagree with the classification. Ask them to sort them into two piles – ‘Agree’ and ‘Disagree’.
4. As a class, look at each rock type, discuss why the rocks were placed in the agree/disagree piles, and reclassify if necessary. If there are any you can’t classify, put them aside for further clarification.

Note: students don’t need to know the name of the rocks, just the type.

## Conclusion

### Equipment needed

Per class:

* [PowerPoint presentation, The rock cycle](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/The_rock_cycle.pptx). Slides 26–27

Per group:

* [A simple rock cycle card](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/A_simple_rock_cycle_card_yr8_The_rock_cycle.docx)
* samples of the following: sandstone, granite, quartzite
* additional rock samples (optional)

Per student:

* A3 paper or poster paper for rock cycle model

### What to do

1. Provide students with a sample of, or images of, sandstone, granite and quartzite and a copy of the [A simple rock cycle card](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/A_simple_rock_cycle_card_yr8_The_rock_cycle.docx). Ask students to place the rocks in the correct place on the card.
2. Show students PowerPoint slide 26 so students can see if they are correct.
3. Tell students that this is a simple rock cycle and ask them if they can see anything that might be missing.

Explain that any rock (igneous, metamorphic and sedimentary) can be changed into any other type. Demonstrate this on PowerPoint slide 26 to show the complete cycle. For example, sedimentary rock can be:

* subjected to heat and pressure and converted into a metamorphic rock,
* melted then cooled and turned into an igneous rock, or
* weathered and eroded and turned into another sedimentary rock.

1. Explain to students that they are now going to create their own rock cycle model using the information that they have gathered in the activities. Show students PowerPoint slide 27.

Their rock cycle model could take the form of a poster and should contain the following:

* the processes that occur to change the rocks from one type to another,
* a description of each rock type, and
* some examples of each rock type.

Students may also find the following websites useful:

* ‘Interactives Rock Cycle’, Annenberg Learner website, <https://www.learner.org/series/interactive-rock-cycle/>

**Note: This interactive uses Flash and won't work on an Apple iPad.**

* ‘The rock cycle’, *Minerology4Kids* website, <http://www.mineralogy4kids.org/rock-cycle>

## \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

### Additional lessons and activities about the rock cycle:

* ‘Interactives Rock Cycle’, Annenberg Learner website, <https://www.learner.org/series/interactive-rock-cycle/> is a great consolidation activity. It guides students through the different rock types and the rock cycle, gets students to identify rocks and has excellent animations of the rock formation processes.

**Note: This interactive uses Flash and won't work on an Apple iPad.**

### Assessment opportunities

* The concluding activity provides an opportunity to assess student understanding of the concepts related to the formation and properties of rocks.
* To check students’ understanding of the types of rocks and the rock cycle, give the students an invigilated task on the rock cycle. For example,

"On the paper provided, draw a diagram to represent the rock cycle. Include the names of the three types of rocks and describe how they are formed."