

Science & Literacy Activity

GRADES 3-5

OVERVIEW

This activity, which is aligned to the Common Core State Standards (CCSS) for English Language Arts, introduces students to scientific knowledge and language related to the rock cycle. Students will read content-rich texts, visit the David S. and Ruth L. Gottesman Hall of Planet Earth, and use what they have learned to complete a CCSS-aligned writing task, creating an illustrated text about the rock cycle.

Materials in this packet include:

- Teacher instructions for:
 - Pre-visit student reading
 - Visit to the Gottesman Hall of Planet Earth and Student Worksheet
 - Post-visit writing task
- Text for student reading: "The Rock Cycle"
- Student Worksheet for the Gottesman Hall of Planet Earth visit
- Student Writing Guidelines
- Teacher rubric for writing assessment

Common Core State Standards:

W.3-5.2, W.3-5.8, W.3-5.9
 RI.3-5.1, RI.3-5.2, RI.3-5.4, RI.3-5.7, RI.3-5.10

New York State Science Core Curriculum:

PS 2.2g

Next Generation Science Standards:

PE 4-ESS1-1
 DCI ESS1.C: The History of Planet Earth
 Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe.

SUPPORTS FOR DIVERSE LEARNERS: An Overview

This resource has been designed to engage all learners with the principles of Universal Design for Learning in mind. It represents information in multiple ways and offers multiple ways for your students to engage with content as they read about, discuss, view, and write about scientific concepts. Different parts of the experience (e.g. reading texts, or locating information in the hall) may challenge individual students. However, the arc of learning is designed to offer varied opportunities to learn. We suggest that all learners experience each activity, even if challenging. We have provided ways to adapt each step of the activities for students with different skill-levels. If any students have an Individualized Education Program (IEP), consult it for additional accommodations or modifications.

1. BEFORE YOUR VISIT

This part of the activity engages students in reading a non-fiction text about the rock cycle. The reading will prepare students for their visit by introducing them to the topic and framing their investigation.

Student Reading

Have students read "The Rock Cycle." Have them write notes in the large right-hand margin. For example, they could underline key passages, paraphrase important information, or write down questions that they have. They may also use this space for drawings or diagrams that show the rock cycle.

Ask:

- What are the three major rock types, and how do they form?
(Answers may include: The three major rock types are igneous, sedimentary, and metamorphic. Sedimentary rocks form when small particles, such as sand grains, accumulate and combine to form a single rock. Igneous rocks form from the cooling of molten rock, usually magma deep within Earth. Metamorphic rocks form when igneous or sedimentary rocks are exposed to heat and pressure, resulting in fundamental changes to their properties.)
- Why is the process discussed in this reading called a "cycle?"
(Answers may include: A cycle is any process that continues without a beginning or end. The water cycle is another example of a cycle. Rocks continue to pass through the rock cycle going from one kind to another.)

- What does the author of this text mean when he says that “Earth is always recycling rocks?”
(Answers may include: This means that rocks are constantly changing, and that the rock cycle has no beginning or end. Sedimentary rocks today may become igneous rocks in millions of years, and igneous rocks today may eventually form sedimentary rocks. Each rock in this story started out as a different kind of rock, and changed over time. For example, the “Old Red Sandstone” contains sand grains. These sand grains were once part of an igneous rock. Over time, that igneous rock was weathered into tiny pieces – sand grains – that are a kind of sediment. Sediments collect and form sedimentary rocks. In this way, new rocks are formed from older rocks.)

Students can work in pairs, small groups, or as a class. During discussion, remind students to use evidence from the text to explain their thinking, and to use specific examples, such as the story of specific rocks.

SUPPORTS FOR DIVERSE LEARNERS: Student Reading

- “Chunking” the reading can help keep them from becoming overwhelmed by the length of the text. Present them with only a few sentences or a single paragraph to read and discuss before moving on to the next “chunk.”
- Provide “wait-time” for students after you ask a question. This will allow time for students to search for textual evidence or to more clearly formulate their thinking before they speak.

2. DURING YOUR VISIT

This part of the activity engages students in exploring the hall.

Museum Visit & Student Worksheet

Explain to students that they will be studying different rock specimens and using worksheets to gather all the necessary information about the rock cycle. Tell students that back in the classroom they will refer to these notes when completing the writing assignment. Students in small teams may complete only one sheet, and later share their observations with others, or if time allows, student teams may complete all three sheets.

SUPPORTS FOR DIVERSE LEARNERS: Museum Visit

- Review the Student Worksheet with students, clarifying what information they should collect during the visit.
- Have students explore the hall in pairs, with each student completing their own Student Worksheet.
- Encourage student pairs to ask you or their peers for help locating sources of information. Tell students they may not share answers with other pairs, but they may point each other to places in the hall where answers may be found.

3. BACK IN THE CLASSROOM

This part of the activity engages students in an informational writing task that draws on the pre-visit reading and on observations made at the Museum.

Writing Task

Distribute the Student Writing Guidelines handout, which includes the following prompt for the writing task:

Based on the article “The Rock Cycle,” your visit to the Gottesman Hall of Planet Earth, and your discussions, write an illustrated text in which you:

- explain the rock cycle.

Be sure to include:

- a summary of the rock cycle
- the story of at least one rock that shows one part of the rock cycle
- a diagram that shows the rock cycle

Support your discussion with evidence from the reading and the Gottesman Hall of Planet Earth.

Go over the handout with students. Tell them that they will use it while writing, and afterwards, to evaluate and revise their essays.

Before they begin to write, have students use the prompt and guidelines to frame a discussion around the information that they gathered in the Gottesman Hall of Planet Earth, and compare their findings. They can work in pairs, small groups, or as a class. Referring to the writing prompt, have students underline or highlight all relevant passages and information from the reading and their notes from the hall that can be used in their response to the prompt. Instruct each student to take notes on useful information that their peers gathered as they compare findings. Students should write their essays individually.

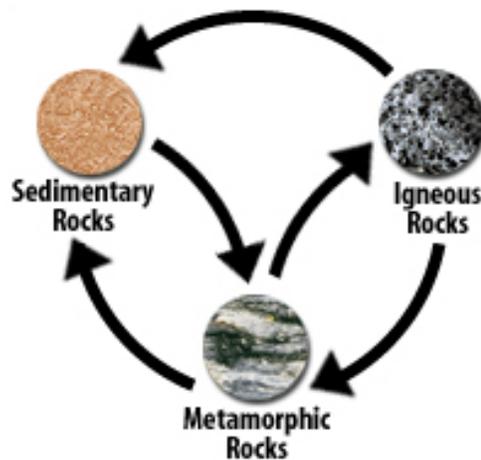
SUPPORTS FOR DIVERSE LEARNERS: Writing Task

- Re-read the “Before Your Visit” assignment with students. Ask what they saw in the hall that helps them understand the rock cycle.
- Allow time for students to read their essay drafts to a peer and receive feedback based on the Student Writing Guidelines.

Student Reading

The Rock Cycle

The rock cycle is a natural process that occurs in and on Earth. It describes how Earth is always recycling rocks and how rocks continue to change from one type to another.



Magma is melted rock that is under the ground. It forms *igneous rocks* when it cools and hardens into a solid form. When magma erupts from volcanoes it is called lava. This is another type of igneous rock.

Sometimes rock from deep inside Earth gets pushed upwards to the surface. There, rain, wind, and ice break rocks into smaller pieces like sand and dust. These pieces are called sediments. They are moved by bodies of water such as rivers and build up in low-lying areas on Earth's surface such as lakes and oceans. Over time, sediments build up layers and layers, and the weight of all the layers puts pressure on the bottom ones. This pressure squeezes the particles of sediment together, forming *sedimentary rock*.

Other times both sedimentary and igneous rocks get buried deep in Earth. High heat and pressure change the rocks into a new type of rock called *metamorphic rock*. If the heat gets too intense the new rock will melt and become magma again.

The Museum has examples of all of these rocks. Let's take a closer look at these three types.

Sedimentary Rock: Sandstone

One piece of sandstone in the Museum is a beautiful, red rock. Geologists collected it in New York's Catskill Mountains.



This sandstone, a sedimentary rock that was formed from the sediment sand, is from a layer of rock called the Old Red Sandstone formation. It has been around for 400 million years! Back when it formed there weren't any people, there were not even any dinosaurs! And all the continents, including North America, were just one single landmass called Pangaea.

Mountains formed on Pangaea. Some of the mountains formed what is now called the Appalachian Mountains. Other mountains became the Caledonian Mountains in Europe.

Sand and silt washed into the space between these two mountain ranges. Over time, these sediments formed layers. The layers grew thicker and pressure increased, causing the sand grains to cement together, forming a sedimentary rock. They became the Old Red Sandstone formation. The Old Red Sandstone is red because its cement contains a small amount of iron that turns a rusty color when it is exposed to water and air.

Two hundred million years ago, as Earth's surface continued to change, Pangaea broke apart into the smaller continents we see today. The Old Red Sandstone layer broke into two sections that were moved apart along with the continents and separated by the Atlantic Ocean. One section ended up in Europe. The other section ended up in North America. Geologists collected the pieces from each section and reunited them at the American Museum of Natural History. Now, they are on display in the Gottesman Hall of Planet Earth.

Igneous Rock: Granite

Granite is a type of strong, sturdy rock often used in buildings. The one in the Museum also has a special story and gives us clues about Earth's history.



Two billion years ago, this granite started as molten rock called magma. Over thousands of years and deep within Earth, the magma cooled into a solid. In fact it cooled so slowly that large crystals had time to grow in it.

Over millions of years the slow movement of Earth's crust brought the granite near the surface. Wind and water wore away the rocks above it. About 20,000 years ago, during the last ice age, a giant glacier, moving across the land, picked up a boulder of the granite along with a lot of other pieces of rock, and carried it out over the middle of the Atlantic Ocean. The glacier then melted and all of the rocks it contained, including the granite boulder fell out, and sunk to the deep-sea floor.

The sea floor is covered in layers of sediment. This igneous boulder slowly became covered by a thin layer of black sediment. Even so, it looks nothing like the rock around it because it formed from magma deep within Earth.

Geologists on a ship in the Atlantic Ocean were collecting rock samples from the ocean floor. They were surprised to find a piece of granite that far from land! They collected it and brought it back to the Museum to show us its long and fascinating story.

Metamorphic Rock: Deformed Conglomerate

This rock has been through it all. Like many rocks, this metamorphic rock has changed from one form to another over millions of years. This rock is called a *deformed conglomerate*.



A conglomerate is a sedimentary rock made up of large round pebbles that were cemented together with smaller sediments. But this “deformed conglomerate” is no normal conglomerate. To find out more about this rock’s history, geologists examine it closely to investigate how the rocks that make up the pebbles formed, and what happened to them after they came together to become a conglomerate.

Like the granite, the pebbles within the deformed conglomerate began as igneous rocks formed from magma deep within our planet. Over time, these rocks traveled to Earth’s surface and broke up into small pieces. Some pieces, about the size of an egg, ended up in a stream with other sediments like sand and silt. They were rounded by the moving water and became smooth. These pebbles built up into thick layers, along with smaller sediments. They cemented together to form a new kind of rock, a conglomerate.

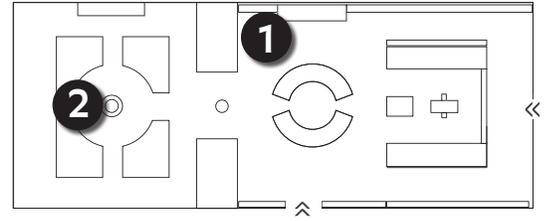
But the story doesn’t end there. After many more years the conglomerate rock became buried deep within Earth again. (This happened when part of Earth’s crust collided with another part, which caused mountains to form.) Exposed to high temperatures and pressure deep underground, the rock was squeezed and stretched in different directions, causing the wavy patterns. Even the harder igneous pebbles were crushed and stretched out. This is how the conglomerate rock became “deformed” – a metamorphic rock called deformed conglomerate.

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Student Worksheet: TEAM SEDIMENTARY

Stop #1: Three Types of Rocks

Observe the rocks and complete the data table below.



Type of rock	How was it formed?	List characteristics of this rock
Sedimentary		
Igneous		
Metamorphic		

Stop #2: Old Red Sandstone (Specimen #3)

Draw the sandstone.

Where was this rock found?

How did it form?

Imagine you are a geologist telling others about this rock specimen. How would you describe it?

Does the appearance of this rock provide evidence about the way it formed? Explain on the back of this page.

Stop #3: Pick Your Own!

Now find a new sedimentary rock somewhere else in the hall.

Draw this rock and mark its location on the map.

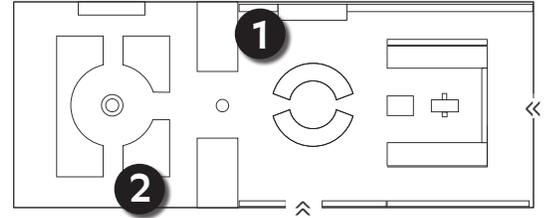
How do you know that this is a sedimentary rock?

Imagine you are a geologist who has just found this specimen in the field. What will you do next? What questions do you have about this rock?

Student Worksheet: TEAM IGNEOUS

Stop #1: Three Types of Rocks

Observe the rocks and complete the data chart below.



Type of rock	How was it formed?	List characteristics of this rock
Sedimentary		
Igneous		
Metamorphic		

Stop #2: Granite (Specimen #2)

Draw the granite.

Where was this rock found?

How did it form?

Imagine you are a geologist telling others about this rock specimen. How would you describe it?

Does the appearance of this rock provide evidence about the way it formed? Explain.

Stop #3: Pick Your Own! Now find a new igneous rock somewhere else in the hall.

Draw this rock and mark its location on the map.

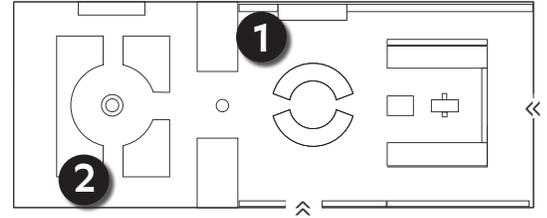
How do you know that this is an igneous rock?

Imagine you are a geologist who has just found this specimen in the field. What will you do next? What questions do you have about this rock?

Student Worksheet: TEAM METAMORPHIC

Stop #1: Three Types of Rocks

Observe the rocks and complete the data table below.



Type of rock	How was it formed?	List characteristics of this rock
Sedimentary		
Igneous		
Metamorphic		

Stop #2: Deformed Conglomerate (Specimen #6)

Draw the deformed conglomerate.

Where was this rock found?

How did it form?

Imagine you are a geologist telling others about this rock specimen. How would you describe it?

Does the appearance of this rock provide evidence about the way it formed? Explain.

Stop #3: Pick Your Own! Now find a new metamorphic rock somewhere else in the hall.

Draw this rock and mark its location on the map.

How do you know that this is a metamorphic rock?

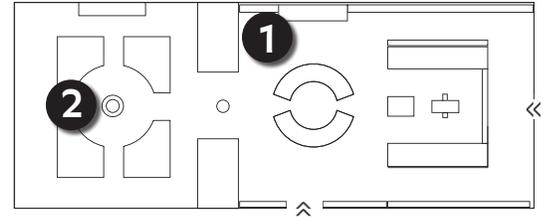
Imagine you are a geologist who has just found this specimen in the field. What will you do next? What questions do you have about this rock?

ANSWER KEY

Student Worksheet: TEAM SEDIMENTARY

Stop #1: Three Types of Rocks

Observe the rocks and complete the data table below.



Type of rock	How was it formed?	List characteristics of this rock
Sedimentary	<i>(formed from the accumulation of sediments over time)</i>	<i>(may show layering and contain small particles)</i>
Igneous	<i>(formed from molten rock called magma)</i>	<i>(contains crystals that touch on all sides. Crystals may be large or small)</i>
Metamorphic	<i>(changed by heat and pressure into a new rock type)</i>	<i>(shows signs of physical change, including stretching and folding)</i>

Stop #2: Old Red Sandstone (Specimen #3)

Draw the sandstone.

Where was this rock found?

(Siccar Point, Scotland)

How did it form?

(from sediments (sand) piling up over time

between mountains)

Imagine you are a geologist telling others about this rock specimen. How would you describe it?

(The rock is about two feet on each side. It's red, has layers, and some pieces have broken off.

It feels rough to the touch.)

Does the appearance of this rock provide evidence about the way it formed? Explain on the back of this page.

(The many layers show that this rock was built up slowly over time. The rock has grains of sand in it, so it was formed by the movement and collection of sand.)

Draw this rock and mark its location on the map.

Stop #3: Pick Your Own! Now find a new sedimentary rock somewhere else in the hall. How do you know that this is a sedimentary rock?

(Answers will vary.)

Imagine you are a geologist who has just found this specimen in the field. What will you do next? What questions do you have about this rock?

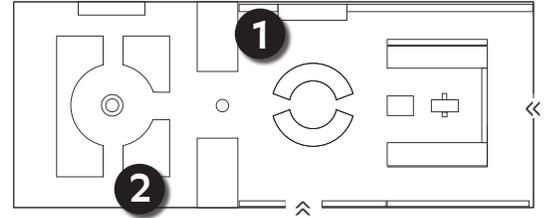
(Answers will vary.)

ANSWER KEY

Student Worksheet: TEAM IGNEOUS

Stop #1: Three Types of Rocks

Observe the rocks and complete the data table below.



Type of rock	How was it formed?	List characteristics of this rock
Sedimentary	<i>(formed from the accumulation of sediments over time)</i>	<i>(may show layering and contain small particles)</i>
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Metamorphic	<i>(changed by heat and pressure into a new rock type)</i>	<i>(shows signs of physical change, including stretching and folding)</i>

Stop #2: Granite (Specimen #2)

Draw the granite.

Where was this rock found?

(Llano, Texas)

How did it form? *(from magma, molten rock)*

Imagine you are a geologist telling others about this rock specimen. How would you describe it?

(This rock has lots of crystals in it, some are light

and others dark.)

Does the appearance of this rock provide evidence about the way it formed? Explain.

(This rock has crystals in it that touch on all sides. It is an igneous rock that formed from magma.

Because the crystals are large, this magma cooled slowly.)

Stop #3: Pick Your Own! Now find a new igneous rock somewhere else in the hall.

Draw this rock and mark its location on the map.

How do you know that this is an igneous rock?

(Answers will vary.)

Imagine you are a geologist who has just found this specimen in the field. What will you do next? What questions do you have about this rock?

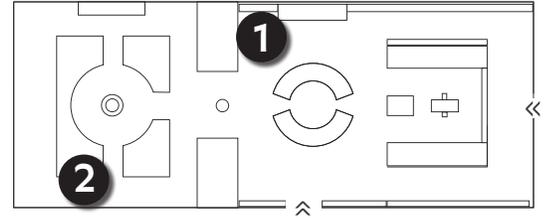
(Answers will vary.)

ANSWER KEY

Student Worksheet: TEAM METAMORPHIC

Stop #1: Three Types of Rocks

Observe the rocks and complete the data table below.



Type of rock	How was it formed?	List characteristics of this rock
Sedimentary	<i>(formed from the accumulation of sediments over time)</i>	<i>(may show layering and contain small particles)</i>
Igneous	<i>(formed from molten rock called magma)</i>	<i>(contains crystals that touch on all sides. Crystals may be large or small)</i>
Metamorphic	<i>(changed by heat and pressure into a new rock type)</i>	<i>(shows signs of physical change, including stretching and folding)</i>

Stop #2: Deformed Conglomerate (Specimen #6)

Draw the deformed conglomerate.

Where was this rock found?

(The Henlow Greenstone Belt, Ontario, Canada.)

How did it form?

(Sedimentary rock formed when pebbles and sediments

accumulated in a stream. Over time, the sedimentary rock

was deformed by pressure and heat.)

Imagine you are a geologist telling others about this rock specimen. How would you describe it?

(This rock is black and white, with wavy white parts in it.)

Does the appearance of this rock provide evidence about the way it formed? Explain.

(The wavy white lines show that pebbles inside this rock have been stretched by heat and pressure.

This is evidence that the rock has changed over time. This means that it is metamorphic.)

Draw this rock and mark its location on the map.

Stop #3: Pick Your Own! Now find a new metamorphic rock somewhere else in the hall. How do you know that this is a metamorphic rock?

(Answers will vary.)

Imagine you are a geologist who has just found this specimen in the field. What will you do next? What questions do you have about this rock?

(Answers will vary.)

Student Writing Guidelines

Based on the article “The Rock Cycle,” your visit to the Gottesman Hall of Planet Earth, and your discussions, write an illustrated text in which you:

- explain the rock cycle

Support your discussion with evidence from your reading and the Gottesman Hall of Planet Earth.

Be sure to include:

- a summary of the rock cycle
- the story of at least one rock that shows one part of the rock cycle
- a diagram that shows the rock cycle

Support your discussion with evidence from the reading and the Gottesman Hall of Planet Earth.

Use this checklist to ensure that you have included all of the required elements in your essay.

- I introduced the rock cycle.
- I defined the rock cycle.
- I included a labeled illustration of the rock cycle.
- All of the information I presented is relevant to the rock cycle.
- I used information from “The Rock Cycle” to explain the rock cycle in detail.
- I used information from the Gottesman Hall of Planet Earth to explain the rock cycle in detail.
- I included a conclusion at the end.
- I proofread my essay for grammar and spelling errors.

Assessment Rubric

Scoring Elements		1 Below Expectations	2 Approaches Expectations	3 Meets Expectations	4 Exceeds Expectations
RESEARCH	Reading	Attempts to include text using examples, quotes, or other references.	Presents some information from reading materials but may lack accuracy or relevance.	Accurately presents information from reading materials relevant to the purpose of the prompt to inform or explain.	Accurately and effectively presents important information from reading materials to inform or explain.
	AMNH Exhibit	Attempts to include Museum exhibit content using examples, quotes, or other references.	Presents some information from Museum exhibit but may lack accuracy or relevance.	Accurately presents information from Museum exhibit relevant to the purpose of the prompt to inform or explain.	Accurately and effectively presents important information from Museum exhibit to inform or explain.
WRITING	Focus	Attempts to address the prompt, but is off-task.	Addresses the prompt, but focus is uneven.	Addresses the prompt with an adequately detailed response; stays on task.	Addresses key aspects of prompt in a detailed response; stays on task.
	Development	Attempts to inform or explain but lacks details.	Informs or explains by presenting some details.	Informs or explains using appropriate details.	Informs or explains by providing detailed and relevant information.
	Conventions	Lacks cohesion and control of grammar, usage, and mechanics appropriate to grade level.	Demonstrates an uneven command of standard English conventions appropriate to grade level.	Demonstrates a command of standard English conventions, with few errors as appropriate to grade level.	Maintains a well-developed command of standard English conventions, with few errors. Response includes language and tone appropriate to the purpose and specific requirements of the prompt.
SCIENCE	Content Understanding	Content is irrelevant, inappropriate, or inaccurate.	Shows uneven understanding of disciplinary content related to the topic.	Presents generally accurate disciplinary content related to the topic.	Presents accurate and relevant disciplinary content to enhance understanding of the topic.