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 meteorites. Students will read content-rich texts, visit the Arthur Ross Hall of Meteorites, and use what they have learned to complete a CCSS-aligned writing task, creating an illustrated text about meteorites.

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.3-5.10

New York State Science Core Curriculum:
PS 1.1c

Next Generation Science Standards:
PE 5-ESS1-2
DCI ESS1.B: Earth and the Solar System
The orbits of Earth around the Sun and of the Moon around Earth, together with the rotation of Earth about an axis between its North and South Poles, cause observable patterns.

Materials in this packet include:

- Teacher instructions for:
  - o Pre-visit student reading
  - o Visit to Ross Hall of Meteorites and student worksheet
  - o Post-visit writing task
- Text for student reading: "Meteorites: Rocks from Space"
- Student Worksheet for Ross Hall of Meteorites visit
- Student Writing Guidelines
- Teacher rubric for writing assessment

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 exhibit) 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 meteorites. The reading will prepare students for their visit by introducing them to the topic and framing their investigation.

Student Reading

Before reading, introduce students to the topic by having them surface all the associations they have with the word "meteorite." Either individually, in pairs, or in small groups, have students write down as many words as they can that they associate with the word "meteorite." Once they've done this, create a class list as a group, discussing along the way how students think their words relate to meteorites. Keep the list posted to refer back to throughout the pre- and post-visit activity.

Have students read "Meteorites: Rocks from Space." 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.

Ask:

- What is a meteorite? *(A: A meteorite is a rock from space that has fallen through Earth's atmosphere and landed on the ground.)*
- What do meteorites look like on the outside? *(A: Meteorites are usually dark and dull on the outside. They can be as huge as boulders or as small as grains of sand.)* On the inside? *(A: Once scientists cut and polish meteorites they can look shiny and colorful, and sometimes they have criss-crossing patterns on the inside.)*
- Why do scientists study meteorites? *(A: From meteorites, scientists can learn how old the solar system is, what materials exist in the solar system, and what the insides of planets are like.)*

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

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 Ross Hall of Meteorites.

Museum Visit & Student Worksheet
Explain to students that they will be focusing on the "Origins" and "Building Planets" sections (refer to the map in the Educator's Guide) and using worksheets to gather all the necessary information about meteorites. Tell students that back in the classroom they will refer to these notes when completing the writing assignment.

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 is to engage 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 "Meteorites: Rocks from Space," your visit to the Ross Hall of Meteorites, and your discussions, write an essay in which you:
>
> - define "meteorite"
> - explain where meteorites come from, using two meteorite examples from the Ross Hall of Meteorites
> - include labeled illustrations of the two meteorites
>
> Support your discussion with evidence from the reading and the visit to the Ross Hall of Meteorites.

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 Ross Hall of Meteorites and compare their findings. They can work in pairs, small groups, or as a class. In particular, have them compare and contrast the meteorites they found in the "Origins" section with those that they found in the "Building Planets" section. Referring to the writing prompt, have students underline or highlight all relevant passages and information from the reading, the earlier class discussion, 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 meteorites.
- Allow time for students to read their essay drafts to a peer and receive feedback based on the Student Writing Guidelines.

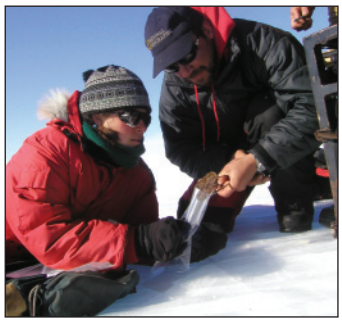
Student Reading

Meteorites: Rocks from Space

Meteorites are rocks from our solar system that have made a fiery passage through our atmosphere to land on Earth. Most of the meteorites that we have collected are parts of asteroids that have orbited the Sun between Mars and Jupiter for millions of years.

The 34-ton Ahniguito meteorite is on display at the American Museum of Natural History.

Meteorites are the oldest material in our solar system. They give us a record of how the solar system formed. Meteorites can be huge. The biggest one ever found weighs around 60 tons – that's about as heavy as six school buses! People have also found meteorites that are quite small. Some are about the size of beach pebbles or even grains of sand.



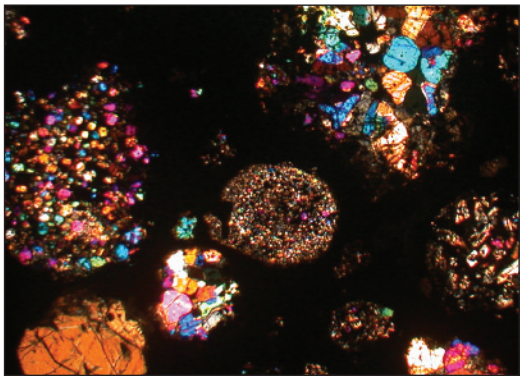
Scientists have been collecting meteorites in Antarctica for over 20 years.

Meteorites are easy to spot against ice or sand, so they are easiest to find in deserts like the ones in Antarctica and Africa. Water causes meteorites to break down and rust, but in dry conditions they can survive for a long time.

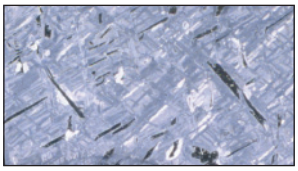
How do scientists study meteorites?

In the lab, scientists often cut meteorites into thin slices and study them under special microscopes. The outside surfaces of meteorites are usually dark and dull, but the insides can be beautiful – especially when they are cut and polished to shine and reflect like mirrors.

Meteorites are not cut into thin slices just to make them beautiful. Scientists study them to figure out what minerals they contain. They also cut small pieces of meteorites to share with other scientists so that many people can study the same meteorite.



Seen under a microscope, the Allende meteorite helps scientists identify different minerals.



This criss-crossing is known as the Widmanstatten pattern.

When a meteorite is cut open and polished people can see patterns inside. The mineral crystals can be both large and small. In iron meteorites the crystal pattern shows how slowly the meteorite cooled. That helps researchers learn the age of the meteorite.

What can scientists learn from meteorites?

The oldest meteorites are about 4.6 billion years old! Since they were the first solid things to form in our solar system and many have not changed since then, scientists use the age of these rocks to determine the age of our solar system. They are clues to what conditions were like when the solar system was young. They also give us hints about the materials that make up our solar system.

Some meteorites teach us about planets, like Earth. These meteorites come from small planets that were smashed apart long ago when they collided with each other. From looking at these meteorites, we can learn what the insides of these former planets were made of. This gives us clues about the planets that are left. No one has ever been to the center of Earth, but we know from meteorites that Earth has a center made of iron and nickel. That center is called a core. Other planets have metal cores too. When planets form, metal sinks to the core because it is heaviest. Lighter materials form a rocky crust and mantle in layers around the core.

An artist's rendering of the early solar system.

Student Worksheet

Choose a meteorite from the "Origins" section of the hall.

Sketch it and label its key features:

What is this meteorite's name?

What is this meteorite made of?

How did this meteorite form?

Choose a meteorite from the "Building Planets" section of the hall.

Sketch it and label its key features:

What is this meteorite's name?

What is this meteorite made of?

How did this meteorite form?

Student Writing Guidelines

Writing Prompt:

Based on the article "Meteorites: Rocks from Space," your visit to the Ross Hall of Meteorites, and your discussions, write an essay in which you:

- define "meteorite"
- explain where meteorites come from, using two meteorite examples from the Ross Hall of Meteorites
- include labeled illustrations of the two meteorites

Support your discussion with evidence from the reading and visit to the Ross Hall of Meteorites.

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

- ☐ I introduced the topic meteorites.
- ☐ I defined the word "meteorite."
- ☐ I described where meteorites come from.
- ☐ I included two meteorites as examples.
- ☐ I included a labeled illustration of the two meteorites.
- ☐ I only included relevant information about meteorites.
- ☐ I used information from "Meteorites: Rocks from Space" to explain meteorites in detail.
- ☐ I used information from the Ross Hall of Meteorites to explain meteorites 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.

Science & Literacy Activity

GRADES 6-8

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 meteorites. Students will read content-rich texts, visit the Arthur Ross Hall of Meteorites and use what they have learned to complete a CCSS-aligned writing task, creating an illustrated text about how meteorites provide clues to planetary formation and the makeup of Earth's interior.

Common Core State Standards:
WST.6-8.2, WST.6-8.8, WST. 6-8.9
RST.6-8.1, RST.6-8.2, RST.6-8.4, RST.6-8.7, RST.6-8.10

New York State Science Core Curriculum:
PS 1.1c

Next Generation Science Standards:
PE MS-ESS1-3
DCI ESS1.B: Earth and the Solar System
The solar system consists of the Sun and a collection of objects, including planets, their Moons, and asteroids that are held in orbit around the Sun by its gravitational pull on them.

Materials in this activity include:

- Teacher instructions for:
    - o Pre-visit student reading
    - o Visit to the Ross Hall of Meteorites and student worksheet
    - o Post-visit writing task
- Text for student reading: "Meteorites: Clues to Planetary Formation"
- Meteorites Classification Charting Exemplar
- Student Worksheet for the Ross Hall of Meteorites visit
- Student Writing Guidelines
- Teacher rubric for writing assessment

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 exhibit) 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 meteorites. The reading will prepare students for their visit by introducing them to the topic and framing their investigation.

Student Reading

Have students read "Meteorites: Clues to Planetary Formation." 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.

Have students complete a classification chart where they list the types of meteorites, their properties and what we learn from them. Types of meteorites should include the three main groups: stony meteorites, iron meteorites, and stony-iron meteorites, as well as the subgroups for stony meteorites (chondrites and achondrites) and stony-iron meteorites (mesosiderites and pallasites).

After completing the chart ask:

- How can studying meteorites from planets, the Moon, and large asteroids help scientists understand Earth's interior? *(Answers may include: Meteorites from planets, the Moon, and large asteroids show evidence of accretion and differentiation. Meteorites from differentiated bodies in particular are useful in helping scientists understand the makeup of Earth's core and mantle.)*