Distance Learning at the Cleveland Museum of Art

The Rock Cycle
Grades 4–7

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Teacher Note:
Please bring the following materials to the videoconference - scissors, glue (or gluesticks),
pencils, copies of The Rock Cycle Diagram and The Rock Cycle Diagram Images (pages 8 & 9 in
this packet.)
How to Prepare Your Class for the Distance Learning Presentation

Teacher Information will be sent or made available to you prior to the program.

Please familiarize yourself with the materials and discuss them with your class.

Have the Teacher Information Packet (T.I.P.) materials on hand in the classroom, ready for the program. These materials may be used during the videoconference.

Be prepared to facilitate by calling on students yourself during the lesson. Students are sometimes initially shy about responding to questions during a distance learning lesson.

Explain to students that this is an interactive medium and encourage them to ask questions.

Reinforce topics discussed in the program by asking students to complete some of the suggested pre- and post-conference activities in the Teacher Information Packet.

We ask teachers, after the program, to please fill out the Evaluation Form and return it to:

Dale Hilton/Distance Learning
The Cleveland Museum of Art
11150 East Boulevard
Cleveland, OH 44106

Thank You!
Distance Learning at the Cleveland Museum of Art

Geology Rocks!
Grades 4–7

Teacher Information Packet:

Program Objectives:
Students will learn or understand...

- The Rock Cycle

- Artists have been picking up rocks for thousands of years, using beautifully colored stones for jewelry, carving rock sculptures small and large, drawing with chalk or painting with pigments made from ground-up colored stones, and all of these rocks and minerals were formed in some stage of the Rock Cycle.

- Many of the properties of rocks prized by artists—their hardness or softness, the way they reflect light, their ability to draw or make a streak—are used by geologists to identify rocks and understand the geological processes that formed them in the earth.

- Looking at works of art from geological materials can also reveal a good deal about rocks and minerals—and even processes within earth itself.

Common Core State Standards Applicable:

_English Language Art & Literacy in History/Social Studies, Science, and Technical Subjects-4th Grade_

CCSS.ELA-Literacy.W.4.4
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CCSS.ELA-Literacy.SL.4.1
Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 4 topics and texts, building on others’ ideas and expressing their own clearly.

CCSS.ELA-Literacy.SL.4.4
Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
5th Grade:
CCSS.ELA-Literacy.W.5.4
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CCSS.ELA-Literacy.SL.5.1
Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 5 topics and texts, building on others’ ideas and expressing their own clearly.

CCSS.ELA-Literacy.SL.5.4
Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

6th Grade
CCSS.ELA-Literacy.SL.6.1
Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 76 topics, texts, and issues, building on others’ ideas and expressing their own clearly.

CCSS.ELA-Literacy.SL.6.4
Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.

CCSS.ELA-Literacy.W.6.4
CCSS.ELA-Literacy.WHST.6.4
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CCSS.ELA-Literacy.RST.6.3
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

7th Grade
CCSS.ELA-Literacy.SL.7.1
Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 76 topics, texts, and issues, building on others’ ideas and expressing their own clearly.

CCSS.ELA-Literacy.SL.7.4
Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.

CCSS.ELA-Literacy.W.7.4
CCSS.ELA-Literacy.WHST.7.4
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CCSS.ELA-Literacy.RST.7.3
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
National Education Standards:

For Fine Arts - Visual Arts (grades K-4, 5-8):
- Understanding the visual arts in relation to history and cultures.
- Making connections between visual arts and other disciplines.
- Choosing and evaluating a range of subject matter, symbols, and ideas

For Science (grades K-4, 5-8):
- Physical science
- History and nature of science

Ohio Department of Education Academic Content Science Standards by benchmark

By the end of the 3-5 program:
- Summarize the processes that shape Earth's surface and describe evidence of those processes.
- Describe Earth's resources including rocks, soil, water, air, animals and plants and the ways in which they can be conserved.

By the end of the 6-8 program:
- Describe the rock cycle and explain that there are sedimentary, igneous and metamorphic rocks that have distinct properties (e.g., color, texture) and are formed in different ways.
- Identify that the lithosphere contains rocks and minerals and that minerals make up rocks.
- Describe how rocks and minerals are formed and/or classified.
- Describe the processes that contribute to the continuous changing of Earth's surface.

Ohio Fine Arts Standards by Benchmark:
- Recognize and describe visual art forms and artworks from various times and places.
- Identify art forms, visual ideas and images and describe how they are influenced by time and culture.
• Identify and describe the different purposes people have for creating works of art.

Prior to the Program:

• Prior to the program, please ask the students to pick up and bring to the program one or maybe two rocks that struck them as being especially beautiful or noteworthy in some way (for example, being a striking color, having crystals or stripes, being able to make a dark or light mark on the sidewalk, being magnetic, etc.).

• Please make a copy of the Classifying Rocks and minerals page for each student to take notes on.

• Please also make a copy of the sheet titled The Rock Diagram as well as the sheet titled The Rock Diagram Images for each student, if you want the students to fill in a blank rock cycle with images from the CMA during the lesson.

After the Program:

• Make copies of the sheet titled Make Your Own Rock Cycle if you would like the students to cut out labeled shapes, and glue them in the correct order at the end of the lesson. Students will need scissors and glue (or gluesticks,) as well. They can also use colored pencil to shade in the shapes if desired.

Teacher Resources:

Recommended Reading


**Websites of Interest**

Kids Love Rocks – activities and lessons for all ages

PBS American Field Guide
http://www.pbs.org/americanfieldguide/teachers/rocks/rocks_sum.html

Exploring the Environment, Earth Floor: Cycles
http://www.cotf.edu/ete/modules/msese/earthsysflr/rock.html

Rock Cycle Song created by a 6th Grade Teacher, sung to the tune of “Life is a Highway” by Rascal Flatts
http://www.youtube.com/watch?v=53IMdHzvGCQ

Rock Cycle Rap for 6th graders "Still Fly" by Page featuring Drake
http://www.youtube.com/watch?v=rkGVE6wNAzo

**Rock Cycle Vocabulary:**

*Geology* – a science that deals with the history of the earth and its life especially as recorded in rocks, and the study of the solid matter of a celestial body (such as the earth or the moon)

*Igneous rocks* – a rock formed by the cooling and solidification (crystallization) of magma

  **Extrusive Igneous Rock** forms when molten rock reaches the earth's surface and cools. Air and moisture cool the lava rapidly. The quick cooling doesn't allow the formation of large crystals so most extrusive rocks have small crystals or none at all.

  **Intrusive Igneous Rock** forms when magma cools slowly beneath the Earth’s surface. This slow cooling allows for the formation of large crystals.

*Lava* – magma that reaches the earth’s surface

*Limestone* – the most abundant chemical sedimentary rock on the Earth, made of a mineral called calcite, much of it from biochemical origin. Limestone is commonly found in underground caves and caverns

*Magma* – a body of molten rock deep inside the earth, including any dissolved gases or crystals
Marble – limestone that has undergone pressure (metamorphism) to produce a dense, smooth rock that can be carved into delicate features and be polished as smooth as glass, and even can be worked so thin it is translucent to light

Metamorphic rocks – rocks formed by the alteration of preexisting rock deep within the earth, but still in the solid state, by heat, pressure, and/or chemically active fluids

Minerals – naturally occurring, inorganic solids with an internal orderly structure and well-defined chemical composition (gold, for example, or minerals that occur as crystals)

Rock – an aggregate of one or more minerals, in which the properties of the individual minerals are retained (for example, granite)

Rock cycle – a model that illustrates the origin of the three basic rock types (igneous, sedimentary, and metamorphic) and the interrelatedness of earth materials and processes

Sedimentary rocks – rocks formed from the weathered products of preexisting rocks that have been transported, deposited, and lithified (compressed or cemented into solid rock); sedimentary rocks are of two types: detrital (formed from fine rock particles eroded away and transported to another location) and chemical (formed from the chemical breakdown of plants, animals, or minerals)

**Classifying Rocks and Materials:**

| Name: ____________________________ |

During the presentation, fill in the table to help you remember the rock cycle, the three different types of rocks, and examples shown.

<table>
<thead>
<tr>
<th>Type of Rock</th>
<th>How this type of rock forms (describe or draw)</th>
<th>Example rocks from video and what they look like</th>
<th>Example artworks shown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Igneous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedimentary 1—detrital 2—chemical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metamorphic</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rocks shown: basalt, granite, clay, chlorite, sandstone, limestone, marble, gold, precious gemstones, amethyst, jade (nephrite, jadeite), lapis lazuli, chalk, graphite
The Rock Cycle Diagram:

The squares are to be filled in with examples of igneous (both extrusive and intrusive), sedimentary, and metamorphic rocks from the Cleveland Museum of Art. The larger box is for the artwork, and the smaller box is for the name of the rock type. The sunbursts represent the intermediaries between these kinds of rocks: Lava, Magma, and Sediments.
Rock Cycle Diagram Images:

Directions – Cut out these objects from the Cleveland Museum of Art collection and the terms and fill in the rock cycle above
The squares are to be filled in with examples of igneous (both extrusive and intrusive), sedimentary, and metamorphic rocks from the Cleveland Museum of Art. The larger box is for the artwork, and the smaller box is for the name of the rock type. The sunbursts represent the intermediaries between these kinds of rocks: Lava, Magma, and Sediments.
Make Your Own Rock Cycle:

Test your memory! Cut out all of the shapes to create your own rock cycle – make sure to check your arrangement before gluing all of the pieces down.
The Crayon Rock Cycle Activity:

Name: ____________________

Materials:
- Wax paper
- Small pencil sharpener
- Crayons
- Newspaper
- Aluminum foil
- Tuna can
- Hot plate
- Ice cubes

(You can also use another piece of aluminum foil to create a “boat” instead of a tuna can, and use a candle to heat, instead of a hot plate, holding the “boat” with tongs)

PART 1: WEATHERING
1. Cover your lab area with newspaper like a table cloth

2. Obtain two squares of wax paper, a small pencil sharpener, and four crayons the same color as your lab partner’s. The crayons are the parent rock material and the pencil sharpener is the disintegration weathering agent. Shave each crayon color into a small pile with your partner’s on the waxed paper. Keep each color separate.
   - Are all of your “rock fragments” the same size? Why or why not? How is this similar to minerals?
   - What are some of nature’s weathering forces?

PART 2: EROSION & SEDIMENTATION
3. Obtain a piece of aluminum foil 18 in x 18 in (45 cm x 45 cm). Fold it in half (9 in x 9 in/22.5 cm x 22.5 cm). You are now the erosion force. Carefully “erode” (move) one color of your “rock fragments” and put them in the center of the foil making a 3 in x 3 in (8 cm x 8 cm) layer of “sediment.” Now the other partner should add a second color of “rock fragments” to the “sediment.” Continue adding the “rock fragments” to the “sediment.”

4. When finished, fold each side of the foil over the “rock fragments.” Allow for a 1 cm distance between the shavings and each fold as room for expansion.

PART 3: COMPACTION, CEMENTATION AND LITHIFICATION
5. Place your “rock fragment” sandwich on the floor. Mildly compress your package by carefully applying pressure with your foot. Carefully open your package.

6. Break the compressed central region, look at the broken edges and describe the layers.
   - How do they compare to the original layers?
   - What happened to the spaces between the fragments?
PART 4: METAMORPHISM
7. Replace the fragments and rewrap your package. Your rocks are now going to be buried deep within the earth or be subjected to mountain building when you add as much pressure as you can by standing with one foot on your package and applying all of your body weight to it. You may even carefully stomp on it.

8. Remove your newly formed “metamorphic rock.” Open the foil and break your rocks open. Examine them carefully, noting what happened to the thickness, fragment shape and the texture of the surface against the foil.

PART 5: IGNEOUS ROCK FORMATION & VOLCANIC ACTIVITY
9. Obtain a clean tuna can (or make a “boat” of aluminum foil) and place your “metamorphic rocks” in the can (or “boat”). Carefully heat to melting over a hot plate (or candle, holding “boat” with tongs). If it starts to smoke, you are heating it too strongly.

10. While it is heating, make a bowl shape with another piece of aluminum foil with 5-6 ice cubes in it.

11. When your “magma” has formed (“metamorphic rocks” melted all the way), carefully pour your “volcano” so “lava” flows over the ice cubes. After it has cooled remove your “extrusive igneous rocks.”
   - Do you see any crystals?
   - What kind of texture and shape do you see?

12. Clean up your lab area and return equipment to the supply table.

Lab from:
Mike Barondeau, 8-12 Science Teacher
Edmunds Central School
Roscoe, SD 57471
ROCK CYCLE FREQUENTLY ASKED QUESTIONS

- **What is the difference between a rock and a mineral?**
  - Minerals have set chemical structures, rocks are defined as a mixture of two or more minerals

- **How can we differentiate between magma and lava?**
  - Magma is inside the earth, lava is outside. These two materials form different kinds of rocks. Cooling of magma is slow, resulting in larger crystals. Cooling of lava is faster, creating smaller crystals.

- **What is the difference between a rock and a gemstone?**
  - A gemstone is a mineral that is then cut and polished and used in jewelry and decoration. A rock is a combination of more than one mineral. The term “gemstone” is often applied to other objects used to make jewelry, like lapis lazuli (a rock) and amber (an organic material).

- **How can you tell the difference between older rocks (rocks farther away from the earth’s surface) and newer rocks (rock nearer to the earth’s surface)?**
  - Older rocks will have smaller rock crystals, newer rocks will have larger, more distinct crystals

- **What geological process turns anything to sediment?**
  - Weathering and erosion

- **What objects are found in sedimentary rocks?**
  - Fossils

- **What process changes pieces of rocks, minerals, and other material into sedimentary rock?**
  - Compacting and cementing

- **What characteristic is common to extrusive igneous rocks?**
  - A glassy surface

- **What does “igneous” mean?**
  - Igneous means of or relating to fire, connecting to igneous rock’s formation from magma inside the earth (intrusive igneous rocks) or lava outside (extrusive igneous rocks)

- **What does “metamorphic” mean?**
  - Metamorphic means change, as one rock changes into another type of rock as a result of pressure and heat
**Teacher Rubric:**

### Multimedia Project: The Rock Cycle

Teacher Name: ______________________________________

Student Name: ______________________________________

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Content</strong></td>
<td>Covers topic in-depth with details and examples. Subject knowledge is excellent.</td>
<td>Includes essential knowledge about the topic. Subject knowledge appears to be good.</td>
<td>Includes essential information about the topic but there are 1-2 factual errors.</td>
<td>Content is minimal OR there are several factual errors.</td>
</tr>
<tr>
<td><strong>Mechanics</strong></td>
<td>No misspellings or grammatical errors.</td>
<td>Three or fewer misspellings and/or mechanical errors.</td>
<td>Four misspellings and/or grammatical errors.</td>
<td>More than 4 errors in spelling or grammar.</td>
</tr>
<tr>
<td><strong>Oral Presentation</strong></td>
<td>Interesting, well-rehearsed with smooth delivery that holds audience attention.</td>
<td>Relatively interesting, rehearsed with a fairly smooth delivery that usually holds audience attention.</td>
<td>Delivery not smooth, but able to hold audience attention most of the time.</td>
<td>Delivery not smooth and audience attention lost.</td>
</tr>
</tbody>
</table>
Selected Images:

**Squat Jar with Lug Handles, 2950-2573 BC**
Egypt, Early Dynastic Period, Dynasties 1-3
Pegmatitic hornblende diorite
1914.648

**Statue of Heqat, the Frog Goddess, c. 2950 BC**
Egypt, Predynastic Period, Late Naqada III Period (3100-2950 BC) to Early Dynastic Period, Early Dynasty 1 (2950-2573 BC)
Travertine (Egyptian alabaster)
1976.5
Saluting Protective Spirit, 883-859 BC
Neo-Assyrian, Iraq, Nimrud, Northwest Palace, reign of Ashurnasirpal II, 9th Century BC
Gypsum
1943.246

Eccentric Flint, 600-900
Guatemala, Quirigua, Maya style (250-900)
Chipped flint
1950.161
Magma cools inside crust - **Intrusive**

Lava cools and hardens outside crust - **Extrusive**

- All rock erode and weather to small sediments
- **Erosion** – wearing away of rock
- **Weathering** – breaking down of rock
- **Weathering and erosion**
- **Compaction and cementation**
- **Heat and pressure**
- **Metamorphic Rock**

Melted rock may then find its way to the surface, starting the process again.

Rocks can go back into earth through **subduction and folding**

**Heat and pressure** change rocks to metamorphic rock

Sediments get pressed (pressure) together to form hard sedimentary rock
The Cleveland Museum of Art Distance Learning Evaluation Form

Your Name______________________________________________________________
Your School________________________________________________________________
School Address (with zip code) _____________________________________________
E-mail Address _____________________________________________________
Grade/Class of students (e.g. 10th grade French) ____________________________
Program Title _______________________________                          
Program Date ___________________________________________________________

Thank you so much for your participation in our distance learning program. We would appreciate your response to these questions by circling the appropriate answer and returning the survey.
Please Mail or Fax to Dale Hilton at 216-707-6679

5 = Strongly Agree    4 = Agree    3 = Neither Agree nor Disagree
2 = Disagree         1 = Strongly Disagree

1. The teacher information packet was helpful for preparing my class and me for the distance learning lesson.
   5  4  3  2  1

2. The teaching style of the on-camera instructor was interesting, engaging and fostered interaction.
   5  4  3  2  1

3. The Teacher Information Packet was helpful in providing interdisciplinary extension activities that I did use or plan to use.
   5  4  3  2  1

4. The distance learning lesson successfully taught its objectives.
   5  4  3  2  1

5. The distance learning lesson was not interrupted by technical difficulties.
   5  4  3  2  1

6. The pre-requisites the distance learning lesson and extensions are aligned with The National Education standards.
   5  4  3  2  1

7. I plan to register for another distance learning lesson.
   (circle one)  Yes       No
   If no, why? ____________________________________________________________

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8. I would like more information about The Cleveland Museum of Art’s Teacher Resource Center.  
(circle one) Yes No

9. Why did you choose The Cleveland Museum of Art Distance Learning?  
(circle one)
   a.) Price Point
   b.) Quality of lessons
   c.) Selection of lessons
   d.) Ease of working with CMA
   e.) Other

10. How did you hear about The Cleveland Museum of Art Distance Learning program?  
(circle all that apply)
   a.) CMA inservice
   b.) CILC
   c.) TWICE
   d.) Conference
   e.) Brochure
   f.) The Cleveland Museum of Art website
   g.) The Teacher Resource Center
   h.) Other

11. Do you have any additional comments about the distance learning lesson?


Please return the completed teacher evaluation form to:

Dale Hilton/Distance Learning
The Cleveland Museum of Art
11150 East Boulevard
Cleveland, OH 44106
Or fax to Dale Hilton at 216-707-6679