Rocks Rock! Introduction to the Rock Cycle

Aligned Lesson 1
Science Lesson for Unit: Rock Cycle Rocks

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Unit: Rock Cycle Rocks	**Lesson Length:** 3 (45-minute) class periods
Grade Level: 6-8; Piloted at Grade 6	**Related Unit:** • The Rock Cycle; Geologic Change • WHST.6-8.2 - Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (CCSS ELA) • SL.8.1 - Engage effectively in a range of collaborative discussions (one-on-one, in groups, teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly. (CCSS ELA) • RST.6-8.7 - Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (CCSS ELA) • SS.IS.6.6-8.MdC - Construct explanations using reasoning, correct sequence, examples and details, while acknowledging their strengths and weaknesses. (IL SS)
Enduring Understandings	**Essential Questions**
• Models can be used to represent systems and their interactions. • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.	• How does energy contribute to the formation of Earth materials, such as minerals, rocks, and ores? • How can scientists determine what has happened in the past? • How does energy affect Earth's landscapes? • How do processes in the Rock Cycle affect earth's landscapes?

• Rocks and fossils tell the history of Earth and how environmental conditions have changed over time. • The principle of uniformitarianism states that the processes that occurred in the past are the same as the processes occurring presently, and will continue to occur in the future. • The rock cycle is a slow, continuous, never-ending recycling of rocks that changes Earth's surface. • Energy from Earth's interior drives the rock cycle. • Weathering changes rocks on Earth's surface. • Erosion carries rocks away on Earth's surface. • Melting of rocks can occur on or below Earth's surface. • Igneous rocks can form aboveground from quick-cooling lava and underground from slow-cooling magma. • Sedimentary rocks are made from cemented and compacted sediments. • Metamorphic rocks are formed underground when a rock is exposed to intense heat and pressure. • All rocks can weather and erode. • All rocks can melt into magma. • Geologic change on Earth is sudden, the result of catastrophic events (catastrophism), or slow and gradual (uniformitarianism). • Geologic changes that occur today will affect resources and landscapes in the future.	• How does change happen to Earth's landscapes? • How have tectonic plates shaped Earth's landscapes throughout history? • Changing Earth: What has the history of Earth looked like?

Transfer Goals

- Developing and using models
- Constructing explanations (for science)
- Identifying Patterns and Causes/Effects to make future predictions
- Using data and evidence of past events to make statistical predictions for future events
- Citing evidence that stability may be disturbed by sudden events or gradual changes over time

Learning Objectives

- Use reasoning, along with the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future, to connect the evidence and support an explanation for how the geologic time scale is used to construct a timeline of the Earth's history.
- Use evidence and reasoning to construct an explanation for the given phenomenon, which involves changes at Earth's surface.
- Identify and describe* the evidence necessary for constructing an explanation, including:

- The slow and large-scale motion of the Earth's plates and the results of that motion.
- Surface weathering, erosion, movement, and the deposition of sediment ranging from large to microscopic scales (e.g., sediment consisting of boulders and microscopic grains of sand, raindrops dissolving microscopic amounts of minerals).
- Rapid catastrophic events (e.g., earthquakes, volcanoes, meteor impacts).

- Identify the corresponding timescales for each identified geoscience process.
- Use multiple valid and reliable sources, which may include students' own investigations, evidence from data, and observations from conceptual models used to represent changes that occur on very large or small spatial and/or temporal scales (e.g., stream tables to illustrate erosion and deposition, maps and models to show the motion of tectonic plates).
- Use reasoning, along with the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future, to connect the evidence and support an explanation for how geoscience processes have changed the Earth's surface at a variety of temporal and spatial scales.
- Use reasoning, along with the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future, to connect the evidence and support an explanation for how geoscience processes have changed the Earth's surface at a variety of temporal and spatial scales. Students describe the following chain of reasoning for their explanation:
  - Surface processes such as erosion, movement, weathering, and the deposition of sediment can modify surface features, such as mountains, or create new features, such as canyons. These processes can occur at spatial scales ranging from large to microscopic over time periods ranging from years to hundreds of millions of years.
  - Catastrophic changes can modify or create surface features over a very short period of time compared to other geoscience processes, and the results of those catastrophic changes are subject to further changes over time by processes that act on longer time scales (e.g., erosion of a meteor crater).
  - A given surface feature is the result of a broad range of geoscience processes occurring at different temporal and spatial scales.
  - Surface features will continue to change in the future as geoscience processes continue to occur.

Students will be able to:

- Explain the changes that happened in Earth's 4.6 billion-year past are the same changes that occur in the present and will continue to occur in the future.
- Identify weathering and erosion as forces that work together to make and move sediment from one place to another.
- Identify compaction and cementation of sediments as the forces that create Sedimentary Rocks.
- Identify heat and pressure as the agents of metamorphism (Metamorphic Rocks.)
- Identify the cooling and hardening of magma and lava as the forces that create Igneous Rocks.
- Point to melting as the cause of any rock turning back into magma under the Earth's surface, or lava above.
- Identify Earth's internal energy as the driving force for the Rock Cycle.
- Identify the sun, water, and wind as agents of weathering and erosion on Earth's surface.
- Classify the Rock Cycle as a slow and gradual process but identify counterexamples to explain when rocks can be changed suddenly, as seen in natural disasters.
- Explain the Rock Cycle and its processes verbally or in text.

Library of Congress: Primary Sources	**Materials/Supplies/Resources**
• Contents of Abraham Lincoln's Pockets on the Night He Was Assassinated https://www.loc.gov/item/2011646850/	• *Rock Cycle Vocab Guided Notes** • Computer with Internet Access for LOC & Study Jams Video • http://studyjams.scholastic.com/studyjams/jams/science/rocks-minerals-landforms/rock-cycle.htm • Contents Explained:

- Primary Source Analysis Tool

- http://www.americaslibrary.gov/aa/lincoln/aa_lincoln_pocket_1.html
- Whiteboards & Dry Erase Markers (Plastic Sheet Protectors over white paper if whiteboards are not available.)
- Once Upon an Earth Science Book by Jodi Wheeler Toppen by NSTA Press, 2016.
- 1 egg carton containing 6 rock samples (2 Metamorphic, 2 Sedimentary, 2 Igneous)/group of 4 students
- 4 hand lenses/group of 4 students
- 1 Lab Sheet per student
- http://studyjams.scholastic.com/studyjams/jams/science/index.htm

* Template for Guided Notes created by and downloaded from Liz LaRosa www.middleschoolscience.com

Engage: How can I get students interested in this?

- See attached lesson for detailed plans.
- The teacher will engage students with solving a mystery: What are the objects and why are they important? If the teacher is enthusiastic, the kids will get more excited.
- Students will complete the Primary Source Analysis Tool while they view the objects.
- Students will share what they know of Lincoln's assassination. Some students may have been to Ford's Theater, while other students may know the similarities between the Lincoln Assassination and the Kennedy Assassination. Some students may have been to Springfield, Illinois to see Lincoln's Tomb and can add some historical context.
- The students will sing a new song to help them with the 3 types of rocks. The song is catchy, and students tend to use the song to apply their knowledge.
- As the lesson progresses, students will utilize clues and prior knowledge to "solve" the identification of the mixed-up rocks.

Explore: What tasks/questions can I offer to help students puzzle through this?

- See attached lesson for detailed plans.
- Teacher will show Study Jams video to engage students.
- Teacher will use whiteboards and NOTES templates to help students gain understanding of significant ideas and terms.
- The NSTA Press Reading, student investigation, and subsequent Rock Cycle Diagram allow students to gain deeper understanding, explore the three types of rocks, and apply their new knowledge to real-life Earth materials.
- Upon completion, the teacher can project the Rock Cycle Diagram onto the Smart Board (or White Board) for completion by students.
- It is imperative that the teacher circulates and checks for student understanding/misunderstanding.

Explain: How can I help students make sense of their observations?

- See attached lesson for detailed plans.
- From the very beginning, students are using the Primary Source Analysis Tool to make and explain observations.

- The student investigation is set up in a way that encourages students to make sense of observations of real-life Earth materials.
- Lesson culmination encourages students to make an evidence-based claim to generalize the features of rocks.
- THE TEACHER MUST CHECK FOR UNDERSTANDING AND CLARIFY MISCONCEPTIONS AS THEY ARISE.

Extend/Elaborate: How can my students apply their new knowledge to other situations?

- See attached lesson for detailed plans.
- From the beginning, students are shown that rocks tell a story – the history of Earth.
- Students take their previous knowledge of weathering and erosion and new knowledge of the 3 types of rocks to formulate a basic understanding of the rock cycle.
- Through the NSTA reading, students begin to see rocks as an important tool in gathering evidence and solving crimes.
- This activity could segue into a discussion on Earth's history, as the presence of Igneous and Metamorphic Rocks gives us a glimpse into how the areas have changed over time. Ex – The presence of Granite indicates volcanic activity.

Evaluate: How can I help my students self-evaluate and reflect on the learning?

- See attached lesson for detailed plans.
- Students complete the Primary Source Analysis Tool from the beginning of this lesson.
- Teacher leads a nonjudgmental conversation in which students are free to discuss their observations and receive feedback from their peers from the Primary Source Analysis Tool.
- The Lab Sheet for the student investigation allows students to work cooperatively. The "Big Reveal" allows students to listen to their peers and change their own thinking based on peer and teacher feedback. Lastly, "The Rock Cycle" from NSTA Press allows for independent practice of the new concepts, with teacher input on misunderstanding.

Unit 2 – Lesson 1

2 Class Periods (45 minutes each)

Rocks Rock! Introduction to the Rock Cycle & Prerequisite Knowledge

Julie M. Senka

This lesson sets out to tie previous understandings into a new concept – the rock cycle. Unit 1 focused on the processes of weathering and erosion to make and move sediment. This lesson precedes multiple opportunities to explore the rock cycle and fits weathering and erosion into it, generating a deeper understanding of the processes that shape Earth's landscapes. Subsequent activities are standards-based and allow students to learn concepts, practice essential vocabulary, and reflect on their hands-on experiences. Ultimately, the teacher can move on to identifying the 3 types of rocks and into further detail on the unique processes that create them. The processes are the key to understanding the history of the area, and by investigating rocks, students can learn about the landscape and how it has changed over time.

SEP	Ask Questions – Why are rocks different? How do rocks change? How are rocks made? Analyze and Interpret Data – Why do rocks look the way they do? Constructing explanations Engaging in argument from evidence Obtaining, evaluating, and communicating information.
BIG IDEAS/DCI	Earth's features are the result of geological processes. Change on Earth is generally slow. There are 3 different types of rocks. Rocks form in different ways, and their appearances give us clues to their histories and what made them.
CCC	Stability and Change – Identify factors that disrupt stability and lead to change over time. Cause and Effect – An external (force) cause produces a predictable effect in rocks. Structure and Function – Features of rocks determine their uses. Energy & Matter – Rocks are changed due to the cycling of energy in the rock cycle.
Misconceptions	Rocks are the same and come from the same places. Rocks are distributed evenly throughout the world. Metamorphic rocks are made from magma. Rocks are boring and tell us nothing about Earth.

Day 1 –

Part 1: 15 minutes

- The teacher should display the LOC Image, "Contents of Abraham Lincoln's Pockets…" on a Smart Board or through students' computers. HIDE THE NAME OF THE ARTIFACT. Using the Primary Source Analysis Tool, the teacher should guide a discussion on what students observe, and then infer why they are important, based on what is present. The teacher should also warn students to not disclose what it truly is, because there is always one student who knows.

- Students may not know every object. The teacher should point out the names and uses of unknown objects:
    - Wallet (Later on point out it holds Confederate money)
    - Watch fob
    - Handkerchief
    - Eyeglasses (2 pairs)
    - Eyeglass Case
    - Eyeglass Lens Polisher
    - Pocket Knife
    - Cufflink or "Sleeve button"

- Then, the teacher should get students to infer their significance and importance. Allow students to have a healthy discussion, piggybacking off of ideas, offering a counter-argument or evidence to support a claim.
    - Person had bad eyesight due to 2 pairs of eyeglasses.
    - Person was a man because usually, men carry wallets, pocketknives, and wear cuff links – This conversation turns interesting!
    - "Stuff" is old.
    - Person is a grandparent because grandparents use handkerchiefs.
    - Person must be "important" because we only keep important people's belongings.

- Last, the teacher should allow students to guess whose artifacts they are. If students do not guess, disclose that the artifacts tell the story of a man, Abraham Lincoln, and what was so important to him, that he carried with him on the night he was killed. If not already done, the teacher should point out that the money is a Confederate bill. The teacher should point out that no one really knows why Lincoln carried a Confederate bill, and since he passed, we can't ask him. We can only speculate and rely on what we know to hypothesize.

- Students will naturally ask why this is Science. The teacher can point out the obvious – we make inferences based on observations, but hidden in this gem, is a parallel to rocks. Rocks tell a story of where they were, what they were, and what Earth was. Using evidence, we can listen to Earth's story and the changes that have happened over time.

- Throughout the discussion, the teacher should allow students to relate to the material. Example – My grandfather carries one of those – Again, the teacher can continue to instill the idea that uses change over time. A handkerchief was necessary because disposable tissues were not available.

Part 2: 25-30 minutes

- The teacher should show the Rock Cycle Video at Study Jams. (4 minutes) http://studyjams.scholastic.com/studyjams/jams/science/rocks-minerals-landforms/rock-cycle.htm
- As the video plays, students should take important notes on whiteboards. The teacher should guide students in transferring important notes to the Rock Cycle Notes Sheet." Students can click on terms in "Key Vocabulary" to get a definition for each term at the menu of the Rock Cycle Video. If individual computers are not available, the teacher can project this.
- The teacher can begin circulating and noting when there are misconceptions or areas that need clarification. A sample Student Tracking Sheet has been included.

Part 3: 5 minutes

- Teacher should distribute "The Rock Cycle Song" to students.
- Teacher should model the song first, sung to the tune of "Row, Row, Row, Your Boat"
- Kids should join in singing the song. To ensure participation, dismiss the group that sings the best first, etc.

Day 2 –

Part 1: 22 minutes

- Students should begin by singing "The Rock Cycle Song."
- Distribute reading, "Rock Solid Evidence" from Once Upon an Earth Science Book by Jodi Wheeler Toppen by NSTA Press.
- Students should read the article aloud and highlight key points, annotating where necessary. (Depending on students' reading levels, this could be assigned the previous night and done at home.) This reading and previous notes should be used in the investigation that follows.

Part 2: 23 minutes

- Teacher should prepare, in advance, 6 rock samples for students to investigate after viewing the Study Jams video. There should be 2 samples of each of the three types of rocks. Rock samples are fairly inexpensive and can be purchased from a supplier, such as Flinn Scientific, Ward's Science, or Boreal.
- The samples I used are fairly easy to obtain and fairly representative of the class of rock. The article identifies Diorite and Sandstone, and those samples could easily be included in the student investigation.
- Personal relevance is created because students are asked to reflect on where they may have seen this rock before and stating those experiences to peers should be encouraged.
- The teacher should pay attention to student conversations, encourage collaborative discussion, and continue to monitor student progress.
- The teacher should encourage students to use their notes and recollection from the Study Jams video to help them with drawing conclusions.
- Encourage students to spend the necessary time completing the activity. It is not a race or competition to see who gets done first. Encourage productive discussion and collaboration.

Day 3 –

Part 1: 22 minutes -

- Students should begin by singing "The Rock Cycle Song."
- The Great Reveal – The teacher should be as enthusiastic as possible for the reveal. The teacher can redistribute white boards, markers, and erasers for students to share and discuss their inferences.
- For example, the students can write: Sample # _____ is _____ because _____. This is getting students to make evidence-based claims. Student groups should take turns presenting their claim and evidence for each rock type. Students should be allowed to revise their answers based on peer interactions and feedback. For example, "We thought it was _____, but now, we think _____ because…"
- Allow students to identify the distinguishable characteristics of the three types of rocks.

Part 2: 23 minutes

- Using "The Rock Cycle" from Once Upon an Earth Science Book by Jodi Wheeler Toppen from NSTA Press, the teacher should begin closing the activity. Independently, the students should complete the rock cycle diagram and ensuing questions.
- The teacher should circulate around the room as students answer questions and help as needed. Hints, such as "Ign" means fire…which rocks are created by fiery stuff called magma, can help students. The teacher should document which students are working toward mastery, and which need more intense help.
- Project the Rock Cycle Diagram onto a Smart Board or White Board and allow students to complete it. Students should discuss answers to the Questions aloud.

Assessment – As this is the first unit in the lesson, assessment should be very informal. The objective of the lesson is to get students engaged in the study, versus assessing their knowledge. Teacher observations should be made and recorded that identify students who may be struggling with the content. In future lessons, the teacher should pay attention to the progress or lack of, that these students are making.

Sample Mastery Tracking Sheet

Student	Concept that Needs Clarification/Reinforcement	Steps for Improvement

Student Comments During Activity (Use pencil to adjust)

Student Name	Got There!	Getting There!	Needs Help Getting There!	Notes to myself. What did I notice?

Suggested Modifications & Differentiation Strategies for the Lesson and Students.

- Reading can be assigned for Homework in order to save time.
- Vocab can be projected for students to complete.
- For students who struggle, a copy of NOTES can be provided.
- For students who are working toward Mastery –
    - they can explain the similarities in their rocks, paying attention to history, formation, and geographic location. Generalizations can be made and shared with the class for feedback.
    - The teacher can provide additional samples to classify based on the generalizations.
- For students who struggle –
    - The teacher may want to work more individually with students to point out the samples from the reading. Ask students what the rock looks like, what its characteristics are, and if other samples show those same characteristics.
    - The teacher can load the Study Jams Video or pull other slideshows from Study Jams to show further examples - http://studyjams.scholastic.com/studyjams/jams/science/index.htm

Rock Cycle Song –

(Sing to the tune of "Row, Row, Row Your Boat")

SEDIMENTARY rock

Has been formed in **layers**

Often found **near water** with

Fossils from decayers.

Then there's **IGNEOUS** rock

Here since Earth was born,

Molten **Lava, cooled and hardened**

That's how it is formed.

These two types of rocks

Can also be **transformed.**

With **pressure, heat** and chemicals

METAMORPHIC will be born.

**Some words were changed from the original for better flow and rhyme. Original song came from

https://www.caveofthemounds.com/wp-content/uploads/2016/12/RockCycleSongPK-2.pdf