

National Aeronautics and Space Administration



red rocks

High School 21st Century Skills Alignment Document



Red Rocks

High School 21st Century Skills Standards Alignment Document



WHAT STUDENTS DO: Explore red rocks of Earth to explain why Mars is red.

Students will explore Karijini Gorge in Australia and Oak Creek Canyon in Sedona, AZ searching for clues to the environments that formed the red rocks there. They will observe these rock formations at a variety of scales to gather these clues. Finally, they will apply their understanding of red rock formation to answer the question “Why is Mars red?”

NRC FRAMEWORK/NGSS CORE & COMPONENT QUESTIONS

HOW AND WHY IS EARTH CONSTANTLY CHANGING?

NGSS Core Question: ESS2: Earth Systems

How do Earth’s major systems interact?

NGSS ESS2.A: Earth Materials and Systems

INSTRUCTIONAL OBJECTIVES (IO)

Students will be able to

IO1: Interpret evidence in the rocks of Mars at a variety of scales to explain the presence of iron oxide and what it tells us about water in the ancient/present Martian environment.

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1.0 About This Activity

How Students Learn: Science in the Classroom (Donovan & Bransford, 2005) advocates the use of a research-based instructional model for improving students' grasp of central science concepts. Based on conceptual-change theory in science education, the 5E Instructional Model (BSCS, 2006) includes five steps for teaching and learning: Engage, Explore, Explain, Elaborate, and Evaluate. The Engage stage is used like a traditional warm-up to pique student curiosity, interest, and other motivation-related behaviors and to assess students' prior knowledge. The Explore step allows students to deepen their understanding and challenges existing preconceptions and misconceptions, offering alternative explanations that help them form new schemata. In Explain, students communicate what they have learned, illustrating initial conceptual change. The Elaborate phase gives students the opportunity to apply their newfound knowledge to novel situations and supports the reinforcement of new schemata or its transfer. Finally, the Evaluate stage serves as a time for students' own formative assessment, as well as for educators' diagnosis of areas of confusion and differentiation of further instruction. The 5E stages can be cyclical and iterative.

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2.0 Instructional Objectives, Learning Outcomes, Standards, & Rubrics

Instructional objectives and learning outcomes are aligned with

- Achieve Inc.'s, *Next Generation Science Standards (NGSS)*
- National Research Council's, *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*
- National Governors Association Center for Best Practices (NGA Center) and Council of Chief State School Officers (CCSSO)'s, *Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects*
- Partnership for 21st Century Skills, *A Framework for 21st Century Learning*

The following chart provides details on alignment among the core and component NGSS questions, instructional objectives, learning outcomes, and educational standards.

- Your **instructional objectives (IO)** for this lesson align with the 21st Century Skills.
- You will know that you have achieved these instructional objectives if students demonstrate the related **learning outcomes (LO)**, also aligned with 21st Century Skills.
- You will know the level to which your students have achieved the learning outcomes by using the suggested **rubrics**.

Quick View of Standards Alignment:

This alignment document provides full details of the way in which instructional objectives, learning outcomes, 5E activity procedures, and rubric assessments were derived through, and align with the 21st Century Skills. For convenience, a quick view follows:

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HOW AND WHY IS EARTH CONSTANTLY CHANGING?
NGSS Core Question: ESS2: Earth Systems

How do Earth’s major systems interact?
NGSS ESS2.A: Earth Materials and Systems

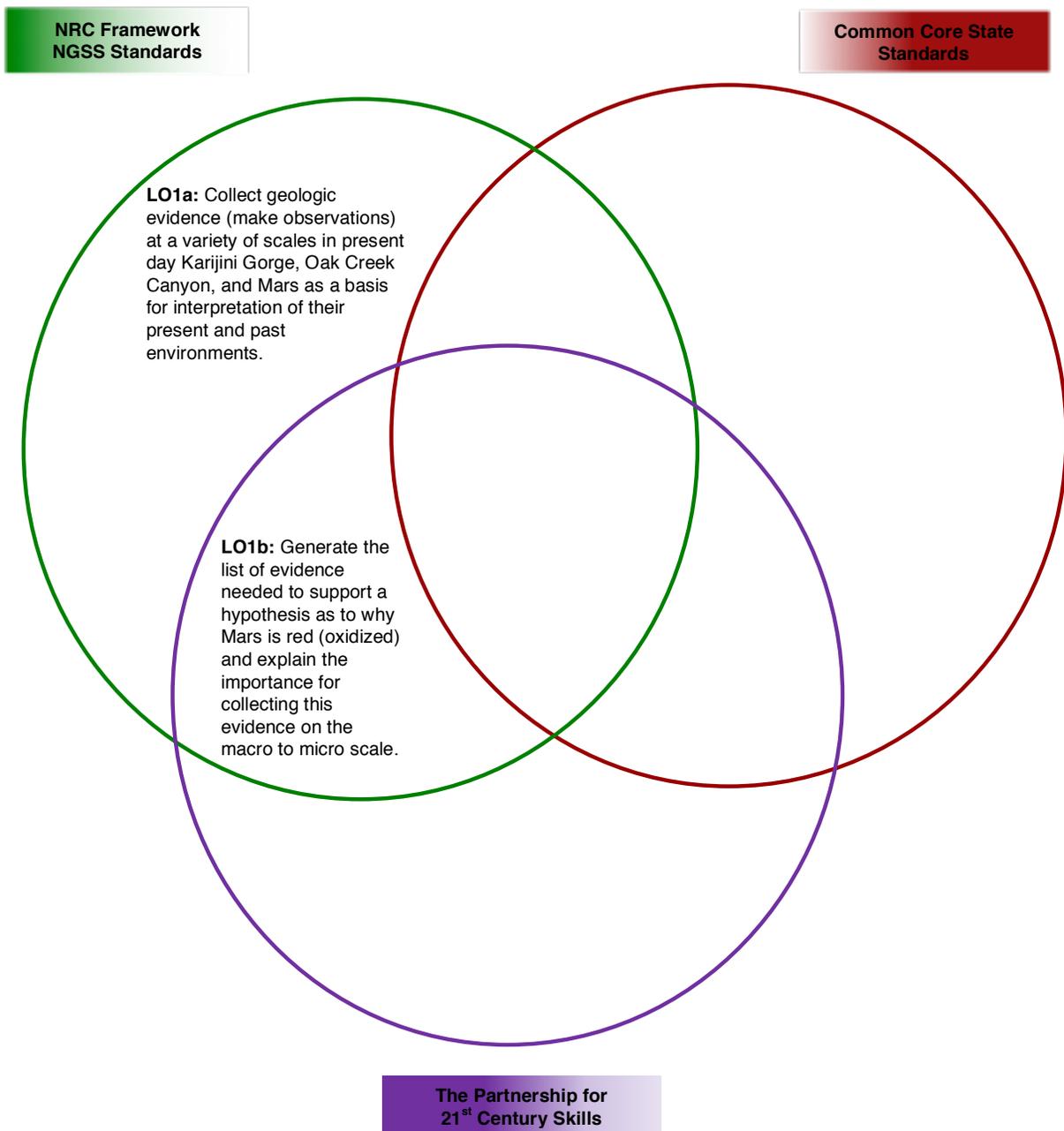
Instructional Objective <i>Students will be able to</i>	Learning Outcomes <i>Students will demonstrate the measurable abilities</i>	Standards <i>Students will address</i>
<p>IO1: Interpret evidence in the rocks of Mars at a variety of scales to explain the presence of iron oxide and what it tells us about water in the ancient/present Martian environment.</p>	<p>LO1a: Collect geologic evidence (make observations) at a variety of scales in present day Karijini Gorge, Oak Creek Canyon, and Mars as a basis for interpretation of their present and past environments.</p> <p>LO1b: Generate the list of evidence needed to support a hypothesis as to why Mars is red (oxidized) and explain the importance for collecting this evidence on the macro to micro scale.</p>	<p>Communication Grade 12 Benchmark</p> <p>Flexibility and Adaptability Grade 12 Benchmark</p>

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3.0 Learning Outcomes, NRC Framework, NGSS, Common Core, & 21st Century Skills Connections

The connections diagram is used to organize the learning outcomes addressed in the lesson to establish where each will meet the Next Generation Science Standards, Common Core Standards, and the 21st Century Skills and visually determine where there are overlaps in these documents. See NGSS Alignment Document and Common Core State Standards Alignment Document for details on their specific alignments.



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4.0 Evaluation/Assessment

Use the (N) *Red Rocks Alignment Rubric* as a formative and summative assessment, allowing students to improve their work and learn from mistakes during class. The rubric evaluates the activities using the 21st Century Skills.

5.0 References

- Achieve, Inc. (2013). *Next generation science standards*. Achieve, Inc. on behalf of the twenty-six states and partners that collaborated on the NGSS.
- Bybee, R., Taylor, J., Gardner, A., Van Scotter, P., Carson Powell, J., Westbrook, A., Landes, N. (2006) *The BSCS 5E instructional model: origins, effectiveness, and applications*. Colorado Springs: BSCS.
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- The Partnership for 21st Century Skills (2011). *A framework for 21st century learning*. Retrieved March 15, 2012 from <http://www.p21.org/>

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(M) Teacher Resource. Red Rocks 21st Century Skills Alignment (1 of 2)

You will know the level to which your students have achieved the **Learning Outcomes**, and thus the **Instructional Objective(s)**, by using the suggested **Rubrics** below.

 Partnership for 21st Century Skills		
Instructional Objective	21st Century Skill	Grade 12 Benchmark
IO1: Interpret evidence in the rocks of Mars at a variety of scales to explain the presence of iron oxide and what it tells us about water in the ancient/present Martian environment.	Communication	Students model the practices of research science by informing others about their work, developing effective explanations, constructing and defending reasoned arguments, and responding appropriately to critical comments about their explanations.
	Flexibility and Adaptability	Students are able to revise their own scientific ideas and hypotheses based on new evidence or information.

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(M) Teacher Resource. Red Rocks 21st Century Skills Alignment (2 of 2)

 Partnership for 21 st Century Skills		
Learning Outcomes	21 st Century Skill	Grade 12 Benchmark
LO1b: Generate the list of evidence needed to support a hypothesis as to why Mars is red (oxidized) and explain the importance for collecting this evidence on the macro to micro scale.	Communication	Students model the practices of research science by informing others about their work, developing effective explanations, constructing and defending reasoned arguments, and responding appropriately to critical comments about their explanations.
	Flexibility and Adaptability	Students are able to revise their own scientific ideas and hypotheses based on new evidence or information.

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(N) Teacher Resource. Red Rocks 21st Century Skills Alignment Rubric

Related Rubrics for the Assessment of Learning Outcomes Associated with the Above Standard(s):

Partnership for 21st Century Skills

	Expert	Proficient	Intermediate	Beginner
Communication	Introduces claim clearly, provides counter-claim, and groups related information logically; Develops the claim with facts, definitions, concrete details, or other examples related to the claim; Links ideas using words, phrases, and clauses; Uses domain-specific vocabulary to support the claim and evidence; Provides a concluding statement related to the explanation.	Introduces claim clearly, provides a counter-claim, and groups related information logically; Develops the claim with details or other examples related to the claim; Uses domain-specific vocabulary to support the claim and evidence; Provides a concluding statement related to the explanation.	Introduces claim, provides a general observation; Develops the claim with details, or other examples related to the claim; Links ideas using words or phrases; Uses domain-specific vocabulary to support the claim.	Introduces claim; attempts to provide details or unrelated examples; Uses day to day vocabulary to support the claim.
Flexibility and Adaptability	Generates a hypothesis based on observations and revisits the hypothesis multiple times after gathering evidence at a variety of scales.	Generates a hypothesis based on observations and revisits the hypothesis once after gathering evidence at a variety of scales.	Generates a hypothesis based on observations and revisits the hypothesis after gathering evidence.	Generates a hypothesis.

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