

# Rocks and Minerals

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## Big Ideas

Content- Rocks and Minerals emerge from the ever changing Earth.

Inquiry-The Means to understand rocks and minerals is to explore their properties and their formations in order to differentiate between them.

Nature of the field-Geologists study and explore changing rocks and minerals around the world to increase personal wealth, improve environmental conditions, and expand knowledge.

## Enduring Outcomes

(What will students need to recall, know or do to demonstrate understanding of the Big Idea?)

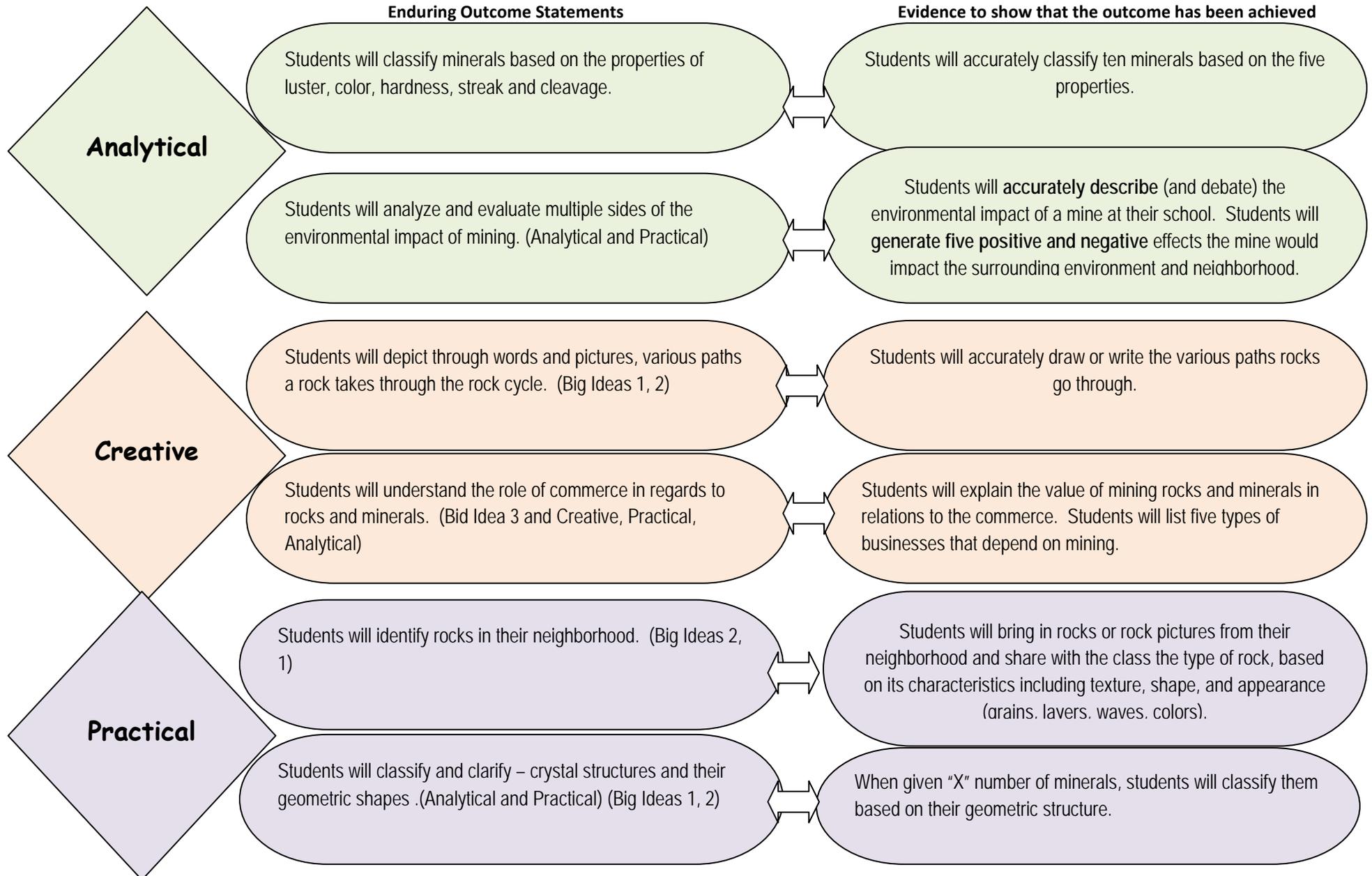
Students will: identify various rocks-Practical, Memory (Inquiry)  
depict through words and pictures, various paths a rock takes through the rock cycle- Creative, Memory (Inquiry)  
use academic vocabulary in their discussions and writing-Memory  
classify and clarify crystal structures and their geometric shapes-Application, Memory, Practical (Inquiry)

Students will classify minerals based on the properties of luster, hardness, color, hardness, streak, and cleavage –Analysis, memory

Students will understand the role of commerce in regards to rocks and minerals-Creative, Memory, Practical, analysis  
Students will analyze and evaluate the environmental impact of mining-Analysis, Memory

## Evidence of Enduring Outcomes

(Rewrite the Enduring Outcomes as seen fit, which may include combining similar outcome statements into a single statement, or even rewriting an outcome statement so it represent more than one type. The goal is to arrive at a connected set of 6 to 8 analytical, creative and practical outcomes; then to determine what kind of evidence is necessary to show that each outcome has been achieved.)



## Essential Questions

What Essential Question is arguable - and *important* to argue about?

**Do we need rocks in our lives?**

**Why are some rocks/minerals valuable and others not?**

What Essential Question lies at the heart of the subject and helps provide purpose for learning?

**What would the world be like without rocks and minerals?**

What Essential Question raises more questions – provoking and sustaining engaged inquiry?

**Why are there igneous rocks in our area?**

What Essential Question raises important conceptual or philosophical issues?

**Does the financial gain outweigh the environmental impact of mining?**

## Instructional Blueprint

<b>Lesson Topics</b>	<b>Content Standards</b>	<b>Measurable/Observable Learning Objectives</b> (What should students know, understand and/or be able to do?)	<b>Instructional Strategies/Tasks to Support Differentiation</b> (Include a balance of <i>analytical, creative, and practical activities</i> )	<b>Assessments that match objectives</b>
<b>1. Rock Buoyancy-Discrepant Event</b>	4ES4.0	Students will engage and explore an event.	<b>Exploration/Cooperative Learning/Class Discussion:</b> Students will work in small cooperative groups to explore the buoyancy of rock and mineral specimens. Students will record the time it takes the specimens to reach the bottom of the plastic container. Students will record their observations in a chart. A class discussion will take place at the end of the discrepant event.	Students will be assessed on their chart observations.
<b>2. Classify Minerals</b>	4ES4.b	Students will be able to classify a set of minerals.	<b>Exploration/Cooperative Learning:</b> Each student will be assigned a job in a cooperative group. The groups will sort minerals based on similarities and will complete an observation grid.	Students will accurately explain their reasoning of their classifications and complete their observation grid.
<b>3. Mineral Properties</b>	4ES4.b	Students will be able to classify a set of minerals based on the five properties.	<b>Direct Instruction/ Class Discussion/ Exploration/ Cooperative Learning:</b> Teacher will briefly explain the five properties of a mineral and how to test each. In the same cooperative group setting the class will explore the set of minerals and classify based on the five properties.	Students will accurately classify ten minerals based on the five properties and complete a mineral property grid.

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<b>4 Crystal Structures and geometric shapes</b>	4MG3.6	Students will classify minerals based on their crystal structures and their geometric shapes.	<b>Direct Instruction/ Class Discussion/ Exploration/ Cooperative Learning:</b> Teacher will briefly describe geometric shapes and their relationship to crystal structures. In cooperative groups students will classify minerals based on their crystal structures and their geometric shapes.	When given a set of minerals, students will classify them based on their geometric structure.
<b>5a. Introduction to Rocks 5b. Igneous Rocks</b>	4ES4.0 4ES4.a	5a. Students will understand what materials make up rocks.  5b. Students will understand how an igneous rock is formed and its characteristics.	<b>Exploration/Direct Instruction/ Class Discussion:</b> Students will make observations about a set of rocks. Students will share observations with each other. Teacher will pose questions asking students what they think rocks are made of. Teacher will give instruction on introduction to rocks and igneous rocks and how they are formed.  Will also discuss discrepant event in regards to explaining, extending, and evaluating the event.	Students will explain how an igneous rock is formed within a class discussion and complete a Cloze worksheet. A formal summative assessment will follow with the rock garden activity.
<b>6. Sedimentary Rocks</b>	4ES4.0 4ES4.a	Students will understand how a sedimentary rock is formed and its characteristics.	<b>Exploration/Direct Instruction/ Class Discussion:</b> Students will make observations about a set of sedimentary rocks. Students will share observations with each other. Teacher will give instruction on sedimentary rocks and how they are formed. Will also discuss discrepant event in regards to explaining, extending, and evaluating the event.	Students will explain how a sedimentary rock is formed within a class discussion and complete a Cloze worksheet. A formal summative assessment will follow with the rock garden

				activity.
<b>7. Metamorphic Rocks</b>	4ES4.0 4ES4.a	Students will understand how a metamorphic rock is formed and its characteristics.	<b>Exploration/Direct Instruction/ Class Discussion:</b> Students will make observations about a set of metamorphic rocks. Students will share observations with each other. Teacher will give instruction on metamorphic rocks and how they are formed. Will also discuss discrepant event in regards to explaining, extending, and evaluating the event.	Students will explain how a metamorphic rock is formed within a class discussion and complete a Cloze worksheet. A formal summative assessment will follow with the rock garden activity.
<b>8. Rock Garden</b>	4ES4.0 4ES4.a 4MG3.6	Students will identify rocks in their neighborhood.	<b>Exploration/Student Presentation:</b> After learning the characteristics of the three types of rocks, students will go on a rock hunt in their neighborhood. Students will bring in rocks or rock pictures from their neighborhood and present to the class the type of rock, based on its characteristics including texture, shape, and appearance (grains, layers, waves, colors).	Students will accurately identify their rocks they found based on their characteristics and present their information to the class.
<b>9. Vocabulary Review</b>	4ES4.0 4ES4.a	Students will apply the correct terminology of the vocabulary words in formal and informal assessments.	<b>Extend:</b> Students will create a vocabulary concept grid, giving the concept word in box 1, the definition in box 2, examples in box 3, non-examples in box 4, critical attributes in box 5, and non-critical attributes in box 6.	Students will accurately complete the vocabulary concept grid.
<b>10. Rock Cycle (Will be conducted in several class periods)</b>	4ES4.0 4ES4.a	Students will understand the various paths a rock can take throughout the rock cycle to form into a new rock.	<b>Direct Instruction/Class Discussion/Cooperative Learning:</b> Teacher will pose questions about rocks and whether they change or not. After a class discussion, the teacher will introduce the rock cycle by asking the students to recall the water cycle, and then compare the two. Once students recall the water cycle, the teacher will describe (using a visual) one	Students will accurately draw or write the various paths rocks go through.

			piece of the rock cycle. Students will then follow along with their own paper of the rock cycle, drawing in arrows that direct the various paths a rock can take. Once students have an understanding of the cycle (after a few class periods), they will work in partners quizzing one another on the cycle.	
<b>11. Resources in Rocks</b>	<b>4ES4.0</b> <b>4ES4.b</b>	<b>Students will know what resources are found in rocks and their uses.</b>	<b>Direct Instruction/Cooperative Learning:</b> Brainstorm a list of resources that students know are found in rocks. Students will work in cooperative groups to research more resources that are found in rocks. Once students have found the resources rocks give us, we will then discuss all the uses that those resources are used for.	Students will compile a list of resources from rocks and their uses.
<b>12. Mining Activity (to be conducted during multiple class periods)</b>	<b>4ES4.0</b> <b>4ES4.b</b>	<b>Students will analyze and evaluate multiple sides of the environmental impact of mining.</b>	<b>Direct Instruction/Class Discussion/ Cooperative Learning:</b> Teacher will display pictures on PowerPoint and discuss the different mining types using a concept chart. Class will brainstorm and discuss the environmental impact of each type of mining. The teacher will present the class with an imaginative scenario of a mining company developing a mine on the playground. In small groups students will <b>accurately describe</b> (and debate) the environmental impact of a mine at their school. Students will <b>generate</b> and record <b>five positive</b> and <b>negative</b> effects the mine would impact the surrounding environment and neighborhood.	In their cooperative groups, students will design a poster which examines five positive and five negative effects of a mine site located on their school site. Each group will present their poster to the class and must show understanding of the major issues a mine brings to the community.
<b>13. Commerce</b>	<b>4ES4.0</b> <b>4ES4.b</b>	Students will understand the role of commerce in regards to rocks and minerals.	<b>Direct Instruction/Small Groups/Inquiry Based Learning:</b> Students will view pictures of businesses involved with rocks. Students will brainstorm a list of businesses in small groups. The class will develop a chart of at least five businesses. Class will take a field trip around school to identify examples of rocks and minerals used around the school. They will also	Students will explain the significance of mining rocks and minerals in relation to the commerce through their written project.

			identify non examples (tire from rubber). Students will search the internet for examples of businesses. They will design their own business based on research and following a template. Students who need scaffolding may work in pairs. Others will work individually.	Students will list five types of businesses that depend on mining.
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## Attachments

### **Attachment 1: Context form that addresses the “context” prompts.**

Each group member will send in their own Context.

### **Attachment 2: Standards (state and/or national content standards) this unit will address.**

#### **California Content Standards Grade 4 Science and Math**

- 4ES4.0 The properties of rocks reflect the process that formed them.
- 4ES4.a Students know how to observe and to differentiate among igneous, sedimentary, and metamorphic rocks by their properties and methods of formation (the rock cycle).
- 4ES4.b Students identify common rock-forming minerals and ore minerals using a table of diagnostic properties.
- 4MG3.6 Visualize, describe and make models of geometric solids in terms of the number and shape of faces, edges, and vertices.

### **Attachment 3: One detailed assessment related to a single lesson selected from the instructional blueprint. This should include any instructions or prompts you will provide to the students. Also include a rubric and/or other applicable evaluation criteria used to assess levels of mastery related to quality, proficiency, performance, and/or understanding.**

#### Assessment

A mining company has mineral rights to the rocks under our school field and will develop a mine. Design a poster which examines five positive and five negative effects of a mine site located on our school site. You may research on the internet or use books. Be prepared to present your poster to the class. You must show that you understand the major issues a mine brings to the community. Your poster paper will be provided by the teacher.

**Poster Rubric: Positive and Negative Effects of Mining**

	<b>1 Beginner Rocker</b>	<b>2 Intermediate Rocker</b>	<b>3 Advanced Rocker</b>	<b>4 Rocker Superstar</b>
<b>Negative Effects</b>	Vaguely describes 5 negative environmental impacts	Partially describes 5 negative environmental impacts	Clearly describes 5 negative environmental impacts	Clearly describes and explains 5 negative environmental impacts
<b>Positive Effects</b>	Vaguely describes 5 positive environmental impacts	Partially describes 5 positive environmental impacts	Clearly describes 5 positive environmental impacts	Clearly describes and explains 5 positive environmental impacts
<b>Poster Organization</b>	Difficult to read. No variance of color. Lacks organization.	Legibly written. Lacks variance of color. Impacts are progressing towards organization.	Legibly written. Demonstrates limited variance of color. Impacts are somewhat organized.	Clearly written with enough variance of color to be seen throughout the room. Impacts are clearly organized.
<b>Presentation</b>	Voice is projected and clear. Faces audience with good posture. Able to fully answer audience's questions. Student completes one of the above criteria.	Voice is projected and clear. Faces audience with good posture. Able to fully answer audience's questions. Student completes any two of the above criteria.	Voice is projected and clear. Faces audience with good posture. Able to fully answer audience's questions. Student completes any three of the above four criteria.	Voice is projected and clear. Faces audience with good posture. Able to fully answer audience's questions. Student completes all four of the above criteria

**Attachment 4: A 2 to 3 page double-spaced reflective analysis that address the “reflective analysis” prompts.**

Each group member will send in their own Reflective Analysis.