



Rocks and Minerals Pacing Guide¹

Use the information below to assist you in determining the amount of time needed to complete the entire unit. These recommendations assume the **average science class period is 45-60 minutes in length**. We recommend teaching science a minimum of three sessions per week in order to maintain consistency and keep students engaged. Many teachers accomplish this by rotating a science unit with a social studies unit, enabling you to teach more science sessions in one week and finish the unit in fewer weeks. We highly recommend that all teachers participate in the Expository Writing and Science Notebook Program in order to more fully develop students' science understandings, as well as their scientific thinking and writing skills. To implement the science-writing curriculum requires a separate 20 to 30 minutes for a science-writing mini-lesson and independent writing time. Time for these mini-lessons is not included in this pacing guide.

Lesson and Common Assessments (See corresponding lesson in Instructional Guide (I.G.) for lesson planning)	Recommended Number of Periods	Big Idea(s) of Lesson	Considerations for Planning	Recommended Applications and Extensions
<p>Lesson 1: Sharing What We Know about Rocks. Teacher activates students' prior knowledge and records on class charts. Students observe and describe properties of three rocks.</p>	2	<p>GLE 1.1.1 Understand how to use properties to sort natural and manufactured materials and objects. <i>Identify, describe and sort objects using observed physical properties such as hardness, shape, smell, texture, and magnetic properties.</i></p> <p>GLE 1.1.5 Understand physical properties of Earth materials including rocks, soil, water and air. <i>Describe and sort rocks based on physical properties.</i></p> <p>Big Idea: Different rocks have different observable properties.</p>	<ul style="list-style-type: none"> It is recommended that you do not teach these lessons out of sequence. We start with rocks because students have prior knowledge about rocks and can observe rocks everywhere quite easily. 	<ul style="list-style-type: none"> Create a rock learning center. Ask students to bring in rocks they have found. Encourage other students to examine the rocks with a hand lens.
<p>Lesson 2: Observing Rocks: How Are They the Same and Different? Students explore the properties of nine additional rocks and sort the rocks based on the similarities and differences of their properties.</p>	1	<p>GLE 1.1.1 Understand how to use properties to sort natural and manufactured materials and objects. <i>Sort common objects by multiple simple properties. (e.g., texture and color; size and shape).</i></p> <p>GLE 1.1.5 Understand physical properties of Earth materials including rocks, soil, water and air.</p> <p>GLE 1.2.3 Know that common materials are made of smaller parts.</p> <p>Big Ideas: Different rocks have different observable properties (and have a number of different uses). Rocks can be sorted according to similar and different properties.</p>	<ul style="list-style-type: none"> Make a copy for each pair of students of the blank graphic organizer for sorting by multiple properties found at the end of this lesson in the instructional guide. At the end of this lesson have students keep all 12 rocks on the trays, instead of returning each rock to the appropriate container. 	<ul style="list-style-type: none"> Have students use a graphic organizer to sort rocks by multiple properties. Have students play <i>20 Questions</i> with a partner. One student picks a rock he wants his partner to guess. The other student tries to guess which rock it is. The student tries to guess which rock it is before 20 questions are used up.
<p>Lesson 3: Learning More about Rocks. Students sort rocks on the basis of observable properties into three main classes: igneous, sedimentary, and metamorphic. Students also read, "Rocks-Here, There, Everywhere" and use a graphic organizer to organize the important</p>	2	<p>GLE 1.1.5 Understand physical properties of Earth materials including rocks, soil, water and air.</p> <p>GLE 1.3.5 Know that fossils provide evidence of plants, animals that existed long ago. <i>Identify a fossil in a rock.</i></p> <p>Big Ideas: Rocks are made from minerals. Rocks are formed in different ways. The properties of rocks reflect the way they were formed (and the minerals in them).</p>	<ul style="list-style-type: none"> You will need to make copies of the reading selection, "Rocks-Here, There, Everywhere" prior to teaching the lesson. Make sure all students are able to see a fossil in a rock sample. 	<ul style="list-style-type: none"> Language Arts integration: Use the multiple copies of the <i>Rocks and Minerals</i> book, which comes in the kit, to read pages, 25-27, "Rocks: From Beginning to End", pages 47-49, "Telling Earth's Story, Layer by Layer", and pages 52-54, "A Scientist Who's

¹ Pacing Guide for use with the *ROCKS AND MINERALS* Teacher's Manual, National Academy of Science (2002)

categories and their supporting details.				<p>Right on Track”.</p> <ul style="list-style-type: none"> • <i>3 Hard Rocks</i> is a music connection that students love to sing to the tune of <i>3 Blind Mice</i>. • If your students are interested in learning about the rock cycle, it is recommended that you do that as an extension instead of as part of the investigation. • You might consider making a plaster model of fossils to further explain the process of fossilization. (Page 10 in the I.G.)
<p>Lesson 4: Discovering Minerals. Students examine rocks for evidence of minerals in the rocks. They compare/contrast three different minerals.</p>	1	<p>GLE 1.2.3 Know that common materials are made of smaller parts. GLE 1.1.1 Understand how to use properties to sort natural and manufactured materials and objects. GLE 1.2.1 Analyze how the parts of a system go together, and how these parts depend on each other. Big Ideas: The properties of rocks reflect the way they were formed and the minerals in them. Rocks are made up of minerals and may contain organic matter.</p>	<ul style="list-style-type: none"> • Mineral C, galena, is no longer part of the <i>Rocks and Minerals</i> kit. Substitute mineral R for mineral C. There are now only 11 minerals instead of 12. • We recommend that you do not use a Venn Diagram as part of this lesson. 	<ul style="list-style-type: none"> • Since there are only four lessons on rocks, you may want to take some time for more research and exploration at this point before moving on to minerals.
<p>Lesson 5: Sharing What We Know about Minerals. Students observe and describe the properties of eleven minerals, citing the differences and similarities of these minerals.</p>	1	<p>GLE 1.1.1 Understand how to use properties to sort natural and manufactured materials and objects. Big Ideas: Each mineral is composed of only one substance, and that substance is the same in all samples of the mineral. Minerals differ and can be identified according to certain observable properties and physical tests (color, texture, smell/odor, luster, transparency, hardness, shape, and reaction to magnets).</p>	<ul style="list-style-type: none"> • The remainder of the unit focuses on minerals. Students perform various tests on the minerals and then identify the minerals. • All egg cartons are labeled with numbers and all minerals are labeled with letters. To best keep track of the minerals, assign a specific carton to a specific student group for the remainder of the unit. 	<ul style="list-style-type: none"> • Language Arts integration: The first reading selection about Feldspar follows this lesson on page 53 in the teacher’s manual. All of the reading selections are meant to assist students in the identification of the minerals, not to give the answers.
<p>Lesson 6: How Are They the Same and Different? Students observe and record the texture, color and smell of each mineral and begin to construct a Mineral Profile Guide using "field tests."</p>	4	Same as Lesson 5.	<ul style="list-style-type: none"> • Students start constructing their mineral guides in this lesson. It is acceptable to use the black-line master data form for the mineral guide, but if possible have students create the pages of the mineral guide themselves. • There is no lesson designed to test just for smell/odor. However this test can be helpful when identifying mineral K. We include odor as part of the observable properties. 	<ul style="list-style-type: none"> • Language Arts integration: The reading selection for Sulfur occurs after this lesson on page 60 in the teacher’s manual. See lesson 5 for tips on how to incorporate the reading selections.

<p>Lesson 7: Describing the Color of Minerals. Students apply the streak test to obtain the identifying color of each mineral sample and compare the observable color with the streak (identifying) color.</p>	1	<p>GLE 1.1.1 Understand how to use properties to sort natural and manufactured materials and objects. Big Idea: Minerals differ in color.</p>	<ul style="list-style-type: none"> The kit provides you with a white and a black streak plate. The black often causes confusion since the streak will look different on white than on black. Consider using only the white plate to record the identifying color. 	<ul style="list-style-type: none"> Language Arts integration: The reading selection for Hematite and Graphite are on page 67 in the teacher’s manual.
<p>Lesson 8: Shining a Light on the Minerals. Students test each mineral's transparency by shining a light through each mineral and sort each mineral according to its ability to transmit light. Students also plan and conduct a fair test.</p>	2	<p>GLE 1.1.1 Understand how to use properties to sort natural and manufactured materials and objects. GLE 2.1.2 Understand how to plan and conduct simple investigations following all safety rules. <i>Generate a logical plan for, and conduct, a simple controlled investigation with variables kept the same (controlled), one changed variable (manipulated), and measured variable.</i> GLE 2.2.3 Understand why similar investigations may not produce similar results. Big Ideas: 1. Minerals differ in transparency. 2. Scientists conduct fair tests in order to collect consistent and meaningful data.</p>	<ul style="list-style-type: none"> You will need to cut out squares of foil, waxed paper and saran wrap prior to the lesson. Check all pen lights to make sure batteries are still working. This lesson has been modified so you are able to guide students in planning and conducting a fair test. 	<ul style="list-style-type: none"> Language Arts integration: The reading selection for Calcite and Graphite are on page 73 in the teacher’s manual.
<p>Lesson 9: Exploring the Luster of Minerals. Students plan a fair test and then observe, describe, and sort minerals by luster (the way the mineral's surface reflects light) according to their fair test and record information on their Mineral Profile sheet.</p>	1	<p>GLE 1.1.1 Understand how to use properties to sort natural and manufactured materials and objects. Big Idea: Minerals differ in luster.</p>	<ul style="list-style-type: none"> In this lesson the concept of fair test may arise again. Chart the variables that should be kept the same when testing for luster. Students often find this test the most difficult. Therefore, consider doing this lesson as a whole class. 	<ul style="list-style-type: none"> Language Arts integration: The reading selection for Galena and Gypsum are on page 79 in the teacher’s manual. Extension 1 on page 77 in the teacher’s manual is worthwhile.
<p>Lesson 10: Exploring the Hardness of Minerals. Students explore the hardness of eleven minerals by conducting a scratch test on each mineral, using Moh's Scale of Hardness.</p>	1	<p>GLE 1.1.1 Understand how to use properties to sort natural and manufactured materials and objects. Big Idea: Minerals differ in hardness.</p>	<ul style="list-style-type: none"> Pennies are required to conduct the hardness test but they are not included in the kit. You will need to collect enough pennies so each pair has one. 	<ul style="list-style-type: none"> Language Arts integration: The reading selection for Diamonds and Talc are on page 88 in the teacher’s manual. Extension 2 on page 86 is worthwhile.
<p>Lesson 11: Testing the Minerals with a Magnet. Students test minerals with a magnet and observe and describe results, which are discussed and recorded.</p>	1	<p>GLE 1.1.1 Understand how to use properties to sort natural and manufactured materials and objects. GLE 1.3.1 Understand forces in terms of strength and direction. <i>Describe a force that is acting on an object in terms of strength and direction (e.g., magnetic force).</i> Big Idea: Minerals differ in their reaction to magnets.</p>	<ul style="list-style-type: none"> The magnet should only be attracted to one mineral, Magnetite. However, because of impurities, Hematite might have a little Magnetite in it and the magnet may also be attracted to it. 	<ul style="list-style-type: none"> Language Arts integration: The reading selection, “Lodestones Lead the Way” is on pages 94-95 in the teacher’s manual. Extension 1 on page 92 is worthwhile.

<p>Lesson 12: Describing the Shape of Minerals. Students observe and describe the shape of the eleven minerals in the set and observe and describe four new mineral samples.</p>	2	<p>GLE 1.1.1 Understand how to use properties to sort natural and manufactured materials and objects. Big Idea: Minerals differ in shape.</p>	<ul style="list-style-type: none"> Refer to the teacher’s manual on pages 97-98 for Background information on shape. 	<ul style="list-style-type: none"> Language Arts integration: Use the multiple copies of the <i>Rocks and Minerals</i> book, which comes in the kit, to read pages, 20-22, “Salt”. Language Arts integration: The reading selection for Quartz and Flourite are on page 101 in the teacher’s manual. Students will benefit from creating their own crystals after this lesson. Directions for making crystals are in the instructional guide.
<p>Lesson 13: Comparing Samples of the Same Mineral. Students compare and contrast several samples of the same mineral; they review and summarize properties of minerals.</p>	1	<p>GLE 1.1.1 Understand how to use properties to sort natural and manufactured materials and objects. Big Idea: Each mineral is composed of only one substance and that substance is the same in all samples of the mineral.</p>	<ul style="list-style-type: none"> We recommend that you do not use a Venn Diagram as part of this lesson. 	
<p>Lesson 14: Identifying the Minerals. Students identify the minerals using mineral identification cards compiled by geologists.</p>	1-2	<p>GLE 1.1.1 Understand how to use properties to sort natural and manufactured materials and objects. GLE 2.1.3 Understand how to construct a reasonable explanation using evidence. GLE 2.1.5 Understand how to report investigation and explanation of objects, events, systems, and processes. Big Ideas: Each mineral is composed of only one substance, and that substance is the same in all samples of the mineral. Minerals differ in color, texture, smell/odor, luster, transparency, hardness, shape, and reaction to magnets.</p>	<ul style="list-style-type: none"> You will need to copy a set of mineral identification cards for each student. Use the revised mineral identification cards found at the end of the instructional guide. Consider setting out the testing materials in case some students need to retest. 	
<p>Lesson 15: Exploring New Minerals. Students investigate three new minerals and apply what they have learned in order to identify the minerals.</p>	1	Same as Lesson 14.	<ul style="list-style-type: none"> This lesson is an opportunity for assessment. 	<ul style="list-style-type: none"> The extension on page 119 in the teacher’s manual is worthwhile.
<p>Lesson 16: How Are Rocks and Minerals Used? Students discuss and examine the uses of rocks and minerals and learn more about how rocks are used.</p>	2	<p>GLE 2.1.3 Understand how to construct a reasonable explanation using evidence. GLE 2.1.5 Understand how to report investigation and explanation of objects, events, systems, and processes. <i>Summarize an investigation by describing explanations and conclusions.</i> Big Idea: The properties of rocks and minerals determine how they are used.</p>	<ul style="list-style-type: none"> This lesson is an opportunity for research. Students can further explore the use of rocks and minerals using the mini reports in the manual or create and present their own report. 	<ul style="list-style-type: none"> Language Arts integration: Use the multiple copies of the <i>Rocks and Minerals</i> book, which comes in the kit, to read pages, 7-9, “Stored Sunshine” and pages 13-16, “Minerals: Can’t Live Without Them”.