Indiana Rock Set

For Elementary School Students

Teacher's Guide

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Note to teachers

The following educational materials have been designed to provide you with appropriate information and resources for teaching about rocks *specifically as they relate to Indiana.* Included are lesson ideas, assessments, and the Indiana Rock Set. Completion of all parts of the lessons requires a few materials not included with the set. These materials, which are identified in the lessons, should be inexpensive and easy for you to locate.

Children have a natural interest and curiosity about rocks. We hope this curriculum will enable you to capitalize on that interest and engage your students in the study of geology in meaningful ways that promote development of science skills and concepts. Lessons are designed to progress from the concrete to the abstract, giving children the firsthand experiences necessary to give meaning to new vocabulary that is introduced.

When you have finished the lessons, please fill out and return the Feedback Sheet on page 21. This will help us improve the lessons.

Background Information: Rocks and Minerals in Indiana

What are minerals?

According to the *Glossary of Geology*, a mineral is a "naturally occurring inorganic element or compound having an orderly internal structure and characteristic chemical composition, crystal form, and physical properties." The world contains more than 2,100 kinds of minerals. There are metallic minerals such as copper, silver, iron, and nickel. Nonmetallic minerals include sulfur, graphite (the "lead" in pencils), gypsum, borax, and quartz. Rock-forming minerals are the building materials of the earth.

What are rocks?

Rocks are the building blocks that form the solid crust of the Earth. They may be massive, such as in granite mountains, or small, as in gravel. They may be made up entirely of one mineral or a combination of many minerals. Rocks may occur as individual pieces of gravel or boulders or may occur in the form of bedrock (extensive layer of solid rock usually found beneath soil or other unconsolidated deposits). There are many different kinds of rocks, and their properties (including the way they look) depend on the kinds of minerals they contain and how they formed.

What kinds of rocks are there?

Rocks can be difficult to classify because one type of rock may be very similar to another. However, rocks can usually be assigned to one of three major groups based on how they formed:

Igneous rocks form when very hot liquid magma within the Earth becomes solid as it cools. This can happen below the Earth's surface or at the surface (volcanoes).

Sedimentary rocks form at the surface of the Earth either from accumulation and cementation of rock fragments, minerals, and fossils, or by precipitation of solids from seawater and other surface waters. Many of these sediments were moved by wind, water, waves, currents, ice, or gravity before forming rock.

Metamorphic rocks form when already solid rock is transformed by heat and pressure without completely melting. All kinds of rocks can be changed, resulting in a new crystalline structure, the formation of new minerals, or a change in texture.

How old are rocks?

Rocks at the surface of the Earth are many different ages. They range from over three billion years old to rocks formed yesterday (erupted as lava from a volcano). Rocks are continually changing. Younger rocks are often made from materials derived from older rocks as they are broken up and then transformed through processes and forces such as weathering, deposition, cementation, and mineral changes wrought by changes of temperature and pressure. This process of change is known as the rock cycle.

Do we have all three of the major rock types here in Indiana?

Yes, but sedimentary rocks are the only type found at the surface that actually formed here in Indiana. Igneous and metamorphic rocks are found at the surface over most of the state, but they did not form here. How can this be? The answer to that question is part of Indiana's geologic history. During the Ice Age, when glaciers advanced across much of the state, they carried with them igneous and metamorphic rocks that were broken free from bedrock sources in Canada and Michigan. As the glaciers melted, these rocks were deposited as part of the material left behind by the glaciers. Approximately four-fifths of the state is covered by this glacial material, but in the south-central part of the state, the bedrock (sedimentary rock, such as sandstone and limestone) is exposed at the Earth's surface.

Time required:
1-2 class periods.

Grade level:
Options for both primary and upper/intermediate students are included.

Materials:
Rock samples (one per student—collect ahead of time or use those provided), magnifier, measuring tools (balance, ruler, etc.), investigation sheets (included).

Objectives:
Students will…
1. observe the properties of rocks;
2. compare and contrast different rocks;
3. classify rocks according to their properties;
4. keep a record of observations.

Key concepts/ understandings:
1. Rocks have observable properties such as color, shape, hardness, etc.
2. Different rocks have different properties.
3. Rocks can be classified according to their properties.

Science process skills:
Observing
Classifying
Measuring
Collecting and recording data
Communicating ideas

Lesson One: Exploring Rocks and Their Properties

One of the first questions you or a student may ask about a rock is "*What is it?*" Rather than beginning by identifying rocks, this exercise has been designed to give students firsthand experiences observing properties of rocks so that later identification will be more meaningful. "Soft, white, rough rock" has more meaning for students than "gypsum" at this point. Once students have had the opportunity to form concepts about rocks through observing and classifying them, specific rock types and names can then be introduced.

Part 1: Observing Properties of Rocks

1. Distribute investigation sheet (page 4 or 7), magnifier, and one rock to each student and ask, *"What do you notice about the rock you have?"* Students should record as many observations as possible on their investigation sheet. If students seem to have trouble, they can be prompted with questions such as:

What color is your rock?
Is it only one color?
How does your rock feel?
Can you see individual grains?
Can you separate grains from the rest of the rock?
Are grains rounded or do they have edges?
Is it shiny or dull?
What new things can you see when using the magnifier?

You can challenge students with a goal to make five observations (or some other number). For older students, you may want to include measurements of mass and volume in their observations.

2. Introduce the term ***property.*** A property of a rock is a characteristic that may be seen, felt, tasted, or smelled, such as its hardness, color, shape, or texture. Have students share examples of properties of the rock that they observed. List categories of properties on chart paper or on the board.

3. Think and discuss: *How might various properties make certain rocks more useful or valuable to us?* (See Lesson Four for more on this.)

Correlation to Indiana Science Proficiency Guide Standards:

(Includes both K-Primary and Upper Elementary/Intermediate)

1.1 Values and Attitudes

1.2 Computation and Estimation

1.3 Manipulation and Observation

1.4 Communication Skills

2.2 Scientific Inquiry

3.3 Processes that Shape the Earth

3.4 Structure of Matter

Options for extending further:
Compile student investigation sheets into a "rock journal" to be kept throughout the unit.

Break the lesson up into several sessions, allowing students to observe each of the six sample rocks individually.

Note: As an option, this lesson can be taught using both the Indiana Rock Set and student-collected samples.

Part 2: Comparing

Combine students in pairs and ask them to compare each other's rocks to their own. *How are they alike? How are they different?* Students should record observations on their investigation sheets (page 5 or 7). Follow with a discussion and sharing of observations.

Part 3: Classifying

1. Break the class into groups of 3 to 5 students. Challenge each group to come up with a way to sort its rocks into two distinct groups. As an option, rocks can be placed on construction paper, and students can draw a line around each group then write the property.
2. Ask each group to share the property by which they classified their rocks. Some responses may include "not" (for example "black" and "not black"). This is acceptable.
3. You may wish to repeat this exercise several times to make sure students comprehend, challenging them each time to sort by a new and different property, or stating a property by which to sort.

Assessment:

Assessment may be done through observation and analysis of student investigation sheets. As an option, you may have students carry out an additional assessment task for observation and classification skills. This can be completed individually by students at a center or table in the classroom. Simply place five rock specimens labeled A, B, C, D, and E at the center along with the recording sheets (see Assessment 1, page 6 or 8). The criteria below is provided to assist you in evaluation.

Student response indicates an understanding of properties.	Yes	No
Student correctly identified two properties/observations for each rock.	Yes	No
Student classified rocks into two distinct groups according to the property he/she stated.	Yes	No

Lesson One: Exploring Rocks and Their Properties

Investigation Sheet—Part 1 (Primary)

Name: _____ Date: _____

Draw a picture of your rock here:

List as many observations as you can about your rock:

Lesson One: Exploring Rocks and Their Properties

Investigation Sheet—Part 2 (Primary)

Name: _____ **Date:** _____

Partner: _____

Ways our rocks are alike:	Ways they are different:

Lesson One: Exploring Rocks and Their Properties

Assessment 1 (Primary)

Name:_____ **Date:**_____

What is a property? _____

_____

Observe the rocks labeled A, B, C, D, and E. Write two things you observe about each rock:

A: _____

_____

B: _____

_____

C: _____

_____

D: _____

_____

E: _____

Sort the rocks into two groups. Write the letters in the boxes below. Write the property you used to group the rocks.

Group 1:	Group 2:
Property: _____	**Property:** _____

Lesson One: Exploring Rocks and Their Properties

Investigation Sheet (Upper/Intermediate)

Name: _____ **Date:** _____

Sketch the rock you are observing below:

Sketch your partner's rock below:

Observations about your rock:

Compare the two rocks.

Properties they have in common:

Ways they differ:

Lesson One: Exploring Rocks and Their Properties

Assessment 1 (Upper/Intermediate)

Name:_____ **Date:** _____

What is a *property*?_____

_____

Observe each of the rocks labeled A, B, C, D, and E.
Give two properties of each rock you observe:

A: _____

_____

B: _____

_____

C: _____

_____

D: _____

_____

E: _____

_____

Classify the rocks into two distinct groups. Each of the rocks (A,B,C,D, and E) must be placed in a group. Write the letters of the rocks in the boxes below. State the property by which you classified each group.

Group 1:	Group 2:
Property: _____	**Property:** _____

Time required:
2 class periods (1 for each part).

Grade level:
Options for both primary and upper/intermediate students are included.

Materials:
Rock samples, magnifiers, steel nails, pennies, glass plates, eyedroppers, cups, vinegar, baking soda, investigation sheets.

Objectives:
Students will…
1. observe properties of rocks and test their hardness by trying to scratch samples with a nail and their fingernail;
2. observe results when attempting to scratch a penny and a glass plate with each rock;
3. use a hardness scale to rank rocks according to hardness;
4. observe the reaction when an acid (vinegar) is mixed with carbonate (baking soda);
5. use an acid (vinegar) to test rocks for the presence of carbonate;
6. record observations throughout.

Key concepts/ understandings:
1. A rock's hardness can be measured by its ability to scratch or be scratched by other objects.
2. Different rocks have different hardnesses.
3. Carbonate reacts with an acid by bubbling.
4. Carbonate is found in some rocks.

Science Process Skills:
Observing
Classifying
Experimenting
Inferring
Recording Data

Lesson Two: Investigating the Properties of Rocks Further

We can often learn much about the things around us by observing them carefully, but sometimes we can learn more by *doing something* to those things and noting what happens. In the next two lessons, students will be investigating specific properties of rocks, including ***hardness*** and ***chemical composition*** *(presence of carbonate),* which can be useful for identifying rock types.

Part 1: How hard are rocks?

Different rocks vary in their hardness, which is an indication of their ability to scratch or be scratched. A hard rock is not easily scratched by rocks or other objects, while a soft rock is easily scratched. A hardness scale is very useful when trying to identify minerals. But hardness is not so useful when trying to identify rocks because it may vary from one sample to the next due to differences in structure, mineral composition, and how the grains of the rock (if present) are cemented together. Despite the limited usefulness of scratch tests in identifying rocks, they are used in this lesson because they provide a good introduction to the concept of hardness as it applies to geologic materials. The ranges given in the keys in the margin of page 10 and on page 16 pertain only to the rocks included with the Indiana Rock Set.

Procedure:
Begin with a statement and some questions for the class:

> *You may have heard the phrase "hard as a rock." What does this mean? Are all rocks hard? Are some rocks harder than others? In this investigation, you will attempt to answer those questions.*

1. Break the class into groups of 3 to 5 students and distribute lettered rock samples (place samples on a piece of paper next to the letters designated in the margin of page10) and investigation sheets (pages 11-13) to each group. Instruct students to handle each rock and try to determine its hardness in relation to the other samples. Then discuss the following:

> *Are all rocks hard?*
> *Are some rocks harder than others?*
> *If so, can you put the rocks in order from hardest to softest?*

Each group should record its predictions on its investigation sheet.

2. Distribute the testing materials (penny, nail, glass plate) to the groups and instruct them to perform a scratch test on each of the samples, recording their observations on their investigation sheets as they go. For younger students, you may wish to guide them through each test, recording results as a class depending on ability level of the class. ***Note:*** You may need to rub the rock after scratching to determine if the object has truly scratched the surface or merely left its own residue.

3. When students have had sufficient time to complete the investigation, review the data as a class. Clarify and revisit any inconsistencies or differences of opinions in the data between groups. You may wish to make an overhead of the data chart to fill in.

Correlation to Indiana Science Proficiency Guide Standards:

(Includes both K-Primary and Upper Elementary/ Intermediate)

1.1 Values and Attitudes

1.4 Communication Skills

1.5 Critical Response Skills

2.2 Scientific Inquiry

2.3 The Scientific Enterprise

3.3 Processes That Shape the Earth

3.4 Structure of Matter

7.1 Numbers

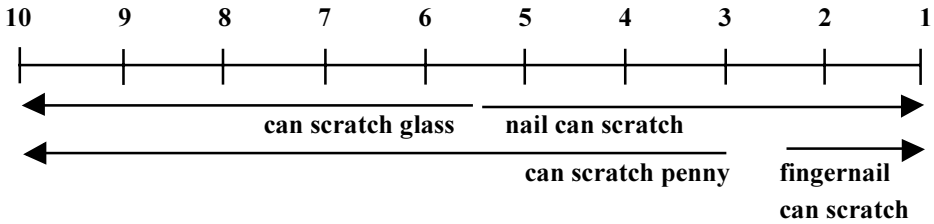
8.4 Scale

KEY:
Hardness ranges for samples:
A (limestone): 3-5.5
B (dolomite): 3-5.5
C (gypsum): 2.5 or less
D (chert): 5.5 or greater
E (sandstone): 3 or greater
F (shale): 2.5 or less

Samples containing carbonate:
A (limestone)
B (dolomite)

Note: Refer to the "Teacher's Indiana Rock Set Identification Key" (page 16) for specific information about each sample.

4. Using a number line as a model, discuss using a ***scale*** to compare the hardness of a rock. Use the scale provided, making an overhead or chart.



5. Based on the data they recorded during their investigations, have the groups assign each rock a hardness range. For example, if a nail can scratch a rock, and the rock can scratch a penny, its hardness range is 3-5.5. Then ask the students to again put the rocks in order from hardest to softest (keeping in mind that some rocks may have the same hardness range) and record the letters and hardness ranges on the investigation sheets. How do these ratings match their original predictions? Discuss and resolve any differences of opinion in the data.

Note: The sandstone presents an interesting problem. The sand grains are composed of quartz and will scratch glass (hardness range of 5.5 or greater); but they are poorly cemented and can easily be broken free of the rock by a nail, leaving a scratch (hardness range of 5.5 or less). Because of this contradiction, further testing is required before a hardness range can be determined. The rock will scratch a penny and cannot be scratched by a fingernail, therefore, it's hardness range for this lesson is 3 or greater, which places it higher on the relative scale than all the other rocks except chert. This problem provides a good opportunity to discuss how cementation affects the hardness of a rock.

Part 2: Chemical Composition: Presence of Carbonate

Some rocks contain a chemical compound known as ***carbonate***. When certain acids are applied to rocks containing carbonate, they react with the carbonate to produce carbon dioxide bubbles. This is similar to the reaction between baking soda (sodium bicarbonate) and vinegar (contains acetic acid). Two rocks that contain carbonate are included in the rock set. The limestone will bubble vigorously when acid is applied. The dolomite, however, will bubble so slowly that a magnifier typically must be used to see the bubbles.

Procedure:

1. Break the class into groups of 3 to 5 students and distribute cups with baking soda (label "carbonate") and vinegar (label "acid"), and eyedroppers to each group. Instruct students to add drops of acid to the carbonate and observe what happens. Discuss observations. Ask students *"How could we find out which of our rock samples contain carbonate?"*

2. Distribute rock samples, magnifiers, and investigation sheets (pages 11-13). Instruct them to complete the acid test for each sample, recording observations.

3. Discuss results with the class. Clarify and revisit any inconsistencies in the data between groups. You may wish to make an overhead of the data chart.

Lesson Two: Investigating Properties Further

Investigation Sheet (Primary)

Name:_____ **Date:**_____

Handle the rocks and try to put them in order from hardest to softest, then write the letters in the first row of empty boxes in the chart below. Then perform scratch tests (see below) and again put them in order from hardest to softest (some rocks may have the same hardness range). Write the letters and hardness ranges (H. Range) in the second row of empty boxes. Did you get them in the right order before you did the scratch tests?

Letter		Letter		Letter		Letter		Letter		Letter	
Letter	H. Range	Letter	H. Range	Letter	H. Range	Letter	H. Range	Letter	H. Range	Letter	H. Range

hardest ⟶ **softest**

Perform a scratch (part 1) or acid (part 2) test on each rock:

Rock A:

Can you scratch the rock with your fingernail?	**Yes**	**No**
Can you scratch a penny with the rock?	**Yes**	**No**
Can you scratch the rock with a nail?	**Yes**	**No**
Can you scratch glass with the rock?	**Yes**	**No**
Does acid make the rock bubble?	**Yes**	**No**

Rock B:

Can you scratch the rock with your fingernail?	**Yes**	**No**
Can you scratch a penny with the rock?	**Yes**	**No**
Can you scratch the rock with a nail?	**Yes**	**No**
Can you scratch glass with the rock?	**Yes**	**No**
Does acid make the rock bubble?	**Yes**	**No**

Rock C:

Can you scratch the rock with your fingernail?	**Yes**	**No**
Can you scratch a penny with the rock?	**Yes**	**No**
Can you scratch the rock with a nail?	**Yes**	**No**
Can you scratch glass with the rock?	**Yes**	**No**
Does acid make the rock bubble?	**Yes**	**No**

Rock D:

Can you scratch the rock with your fingernail?	**Yes**	**No**
Can you scratch a penny with the rock?	**Yes**	**No**
Can you scratch the rock with a nail?	**Yes**	**No**
Can you scratch glass with the rock?	**Yes**	**No**
Does acid make the rock bubble?	**Yes**	**No**

Rock E:

Can you scratch the rock with your fingernail?	**Yes**	**No**
Can you scratch a penny with the rock?	**Yes**	**No**
Can you scratch the rock with a nail?	**Yes**	**No**
Can you scratch glass with the rock?	**Yes**	**No**
Does acid make the rock bubble?	**Yes**	**No**

Rock F:

Can you scratch the rock with your fingernail?	**Yes**	**No**
Can you scratch a penny with the rock?	**Yes**	**No**
Can you scratch the rock with a nail?	**Yes**	**No**
Can you scratch glass with the rock?	**Yes**	**No**
Does acid make the rock bubble?	**Yes**	**No**

Lesson Two: Investigating Properties Further

Investigation Sheet (Upper/Intermediate)

Name: _____ **Date:** _____

Handle the rocks and try to put them in order from hardest to softest, then write the letters in the first row of empty boxes in the chart below. Then perform scratch tests (see below) and again put them in order from hardest to softest (some rocks may have the same hardness range). Write the letters and hardness ranges (H. Range) in the second row of empty boxes. Did you get them in the right order before you did the scratch tests?

Letter		Letter		Letter		Letter		Letter		Letter	
Letter	H. Range	Letter	H. Range	Letter	H. Range	Letter	H. Range	Letter	H. Range	Letter	H. Range

hardest ⟶ **softest**

Complete the scratch tests. Write your observations in the boxes.

Rock	Can it be scratched by: Fingernail?	Nail?	Will it scratch: Penny?	Glass?	Hardness Range:	Does it bubble?
A						
B						
C						
D						
E						
F						

Time required:
1 class period

Grade level:
Primary and upper/ intermediate

Materials:
Rock samples (lettered)
Rock identification sheet

Objectives:
Students will…
1. identify rock samples by matching their observations to the properties listed for each type of rock.

Key concepts/ understandings:
1. Rocks are classified according to their properties.
2. All the rocks given a certain name have similar properties.

Science Process Skills:
Observing
Identifying

Options for extending further:
Students can create and share their own rock collections, using books on geology and field guides to help them identify specimens.

Lesson Three: Name that rock! Using properties to help us identify rocks.

Now that students have acquainted themselves with some properties of the samples in the Indiana Rock Set, they can use this knowledge to identify the rocks by name. Several options for teaching are given below. A criterion for evaluation is included below, but specific letter grade designations are left to the teacher.

Suggested options for teaching:

1. Students may use their investigation sheets from the first two lessons and the rock samples as they work individually on this task. Identify the rocks using the letter designations shown on the teacher's key (page 16). You may want to write the letter on a piece of paper and place the corresponding rock on the paper. Distribute rock identification sheets (page 15) and have students match the descriptions with the rocks.

2. Students work in groups with their observation notes from their investigation sheets. They discuss as a group and then match the samples to the descriptions on the identification sheet.

3. The teacher displays the names of the rocks and their descriptions to the class, and students determine which sample matches each description.

Assessment is based on the number of correctly identified rocks.

Students should now refer to the rock samples by name, so it is important for the teacher to follow up and clarify any misunderstandings. A visual display may be placed in the room for student reference.

Name that rock!
Identification Sheet
Assessment 2

Name:_____ **Date:**_____

Write each rock's letter next to the name with the description that matches the rock.

____ Dolomite

- May be many colors, but in Indiana is often brown or gray.
- Feels slightly rough.
- Composed mostly of tiny crystals of the mineral dolomite (visible with a magnifier).
- A few bubbles will form when acid is applied (with this particular sample a magnifier is typically required to see the bubbles).
- Hardness range of 3-5.5.

____ Sandstone

- May be many colors, including brown, reddish brown, light pink, gray, or white.
- Feels rough.
- Composed of sand grains, which are mostly crystals of the mineral quartz (visible with the naked eye).
- Hardness range of 3 or greater.

____ Limestone

- May be many colors, but typically is an off-white or shade of light brown or gray.
- Depending on size of grains, may feel rough or smooth.
- Generally contains fossil fragments (sometimes rounded and not easily identified) made of the mineral calcite.
- Bubbles vigorously in acid.
- Hardness range of 3-5.5.

____ Chert

- May be many colors, but in Indiana is most often a shade of brown, gray, or black, or has bands of those colors.
- Feels very smooth.
- Composed mostly of microscopic crystals of the mineral quartz.
- Forms sharp edges when broken.
- Hardness range of 5.5 or more.

____ Shale

- Mostly shades of gray, but sometimes black or a shade of red or green.
- Feels very smooth (and soapy).
- Composed mostly of tiny crystals of quartz and clay minerals (visible only with a microscope) .
- Hardness range of 2.5 or less.

____ Gypsum

- Mostly white in color.
- Feels slightly rough.
- Composed mostly of the mineral gypsum (crystals look like ice through magnifier).
- Hardness range of 2.5 or less.

Teacher's Indiana Rock Set Identification Key

Sample A: Limestone

- May be many colors, but typically is an off-white or shade of light brown or gray.
- Depending on size of grains, surface texture may be rough or smooth.
- Generally contains fossil fragments (sometimes rounded and not easily identified) made of the mineral calcite (by definition, limestone is at least 50 percent calcite).
- Bubbles vigorously in acid.
- Medium hardness—calcite has a hardness rating of 3 (may need magnifier to see scratch on penny).
- Hundreds of uses, including facing for buildings, decorative carvings, road construction material, soil conditioner, and in cosmetics and pharmaceuticals.

Sample B: Dolomite

- May be many colors, but in Indiana is often brown or gray.
- Slightly rough surface texture.
- Composed mostly of tiny crystals of the mineral dolomite (visible with a magnifier).
- A few bubbles will form when acid is applied (with this particular sample a magnifier is typically required to see the bubbles).
- Medium hardness—the mineral dolomite has a hardness rating of 3.5-4.
- Used mostly in concrete and road construction.

Sample C: Gypsum

- Mostly white in color.
- Slightly rough surface texture.
- Composed mostly of the mineral gypsum (crystals look like ice through magnifier).
- Very soft—hardness rating of about 2 (can be scratched with fingernail).
- Mostly ground into a powder and used to make wallboard and plaster.

Sample D: Chert

- May be many colors, but in Indiana is most often a shade of brown, gray, or black, or has bands of those colors.
- Very smooth surface texture.
- Composed mostly of microscopic crystals of the mineral quartz.
- Forms sharp edges when broken.
- Very hard—quartz has a hardness rating of 7.
- Indiana chert was used in the past by Indians, who shaped it into arrowheads, knives, and other tools.

Sample E: Sandstone

- May be many colors, including shades of brown, red, gray, or white.
- Rough surface texture.
- Composed of sand grains, which are mostly crystals of the mineral quartz (visible with the naked eye).
- Medium hardness—quartz has a hardness rating of 7 and the quartz grains in this sample will scratch glass; but the grains are not well cemented so the rock can be scratched with a nail. These tests are contradictory, but because the rock will scratch a penny and cannot be scratched with a fingernail, a hardness range of 3 or greater may be assigned.
- Mostly used for facing buildings.

Sample F: Shale

- Mostly shades of gray, but sometimes black or a shade of red or green.
- Smooth surface texture (this sample feels soapy.
- Composed mostly of tiny crystals of quartz and clay minerals (visible only with a very powerful microscope).
- Soft—hardness rating of about 2.5 (can be lightly scratched with fingernail).
- Mostly ground into a powder and used in pottery, bricks, and other ceramic products.

Time required:
1 class period.

Grade level:
Primary and upper/ intermediate

Materials:
Protective eyewear, hammers, mortar and pestel, chisels, other tools for students to use, investigation sheets.

Objectives:
Students will…
1. observe their environment and identify uses of rocks;
2. discuss properties of rocks and infer their uses based on their properties.

Key concepts/ understandings:
1. Rocks have many properties which are useful to people.
2. Rocks can be used in different ways based on their properties.
3. Rocks are a useful resource for people.

Science Process Skills:
Observing
Recording and reporting data
Inferring

Correlation to Indiana Science Proficiency Guide Standards:

(Includes both K-Primary and Upper Elementary/ Intermediate)

1.1 Values and Attitudes

1.5 Critical Response

6.2 Materials and Manufacturing

7.2 Symbolic

Lesson Four: Rocks in Our Daily Lives

How properties make rocks useful.

Now that students have had the opportunity to examine rocks more closely and explore properties which are useful for identifying rocks, they will be asked to think critically about how other properties influence how we use these rocks in our daily lives. Students will further investigate the properties of rocks that make them useful to us. Then, they will attempt to match specific rock samples to their described uses based on the properties they've observed.

Part 1: Rocks Around Us

Procedure:

1. Invite students to go on a rock hunt around your school grounds or at home. The goal is to identify uses of rocks in our daily lives. An investigation sheet is provided (page 18).
2. Lead students in a discussion of the observations they made during the rock hunt. In what kinds of ways do we use rocks as a resource?
3. To incorporate mathematics into the lesson, have students categorize ways we use rocks and make a bar graph of their results (for example: decoration, building, etc.). Younger students can do this as a class.
4. Ask students to think critically about how we use rocks. Prompt student thinking with the following question: *What determines the usefulness of certain rocks? (their properties).* The class should brainstorm properties of rocks that make them useful for specific purposes.

Part 2: A Perfect Match

Procedure:

1. After reading the descriptions of the uses of the rocks in the Indiana Rock Set on the investigation sheet (pages 19 and 20), students should be encouraged to explore and manipulate the rocks further in order to match each rock to its use. They may want to try to crush the rocks into a powder; if they can do this, add water and see if the new material can be shaped or poured into a mold and dried. The rock uses on the investigation sheets will provide students with an idea of where to start. Free exploration should be encouraged, and students should record their observations about each rock sample. WARNING! Protective eyewear must be worn to avoid injury from flying chips. As a further precaution, students should wrap specimens in a towel before hitting them with a hammer. Exploration of the chert sample should be conducted by an adult as a demonstration for the students. Striking chert with a hammer can create small, very sharp, glass-like pieces, and may create a spark. (Chert is a variety of flint, which was struck against a steel plate to make a spark to ignite gunpowder in flintlock rifles and to start campfires.)
2. Ask students to determine which of the samples they believe matches the described use (see teacher's key, page 16, for rock uses). Students should discuss and defend their reasons for believing one of the samples to be used for that purpose. Differences in opinion are resolved through thinking aloud and discussion. You may want to have students explain why certain rocks would *not* be suitable for some uses.

Lesson Four: Rocks in Our Daily Lives

Investigation Sheet—Part 1

Rock Hunt!

Name: _____ Date: _____

Directions: Look closely around you. Do you see any rocks that are being used for something? Where? How are they being used? Record your observations in the boxes below.

Location	Way rock is being used

Lesson Four: Rocks in Our Daily Lives

Investigation Sheet—Part 2

A Perfect Match

Name: _____ **Date:** _____

1. **This rock was used in the past by Indians, who shaped it into arrowheads, knives, and other tools because it makes sharp edges when broken.**

Name of rock: _____

Reason I think this rock was used in this way: _____

_____

_____

2. **This rock type is used often for facing buildings because of its attractive appearance, its ability to be cut into blocks, and because it is composed of a hard mineral that resists erosion.**

Name of rock: _____

Reason I think this rock is used in this way: _____

_____

_____

3. **This rock is used to make wallboard and plaster because it can be easily ground into a fine powder, heated, mixed with water, poured into molds to create shapes or between paper boards to make wallboard, and dried until it hardens.**

Name of rock: _____

Reason I think this rock is used in this way: _____

_____

_____

4. **This rock type has hundreds of uses including in road construction materials, soil conditioner, and in cosmetics and pharmaceuticals. But this particular specimen is a sample of a rock that is used for facing buildings (and has been used in many famous buildings, such as the Empire State Building in New York City) and for sculpting because of its attractive appearance and because it can be easily shaped with a chisel, saw, or plane.**

Name of rock: _____

Reason I think this rock is used in this way: _____

_____

_____

5. **This rock is used mostly in concrete and as a road construction material.**

Name of rock: _____

Reason I think this rock is used in this way: _____

_____

_____

6. **This rock is used to make pottery, bricks, and other ceramic products because it can be easily ground into a powder, mixed with water, poured into a mold or shaped, and dried in an oven until it has hardened.**

Name of rock: _____

Reason I think this rock is used in this way: _____

_____

_____

Help us improve these materials

We would appreciate your feedback concerning the *Indiana Rock Set For Elementary School Students*. Please take a few moments to answer the questions below and send the sheet to:

Indiana Geological Survey
Education Extension
611 N. Walnut Grove
Bloomington, IN 47405

Grade Level:

Were these educational materials (background, activities, assessments) appropriate for use in your classroom?

What did you like most about the materials?

How can we make them better?

Would you recommend the materials to a colleague? Why or why not?