# Changes in Materials for *Rocks and Minerals*

Science & Technology STC® for Children®

Since publication of the *Rocks and Minerals* Teacher's Guide First Edition and the Student Activity Book, a change in materials has been made to the *Rocks and Minerals* unit which affects Lessons 4, 5, 9, 11, 14, 15, and 16. The materials change for *Rocks and Minerals* requires revised instructions in the unit's printed materials.

Galena is a form of lead sulfide, a compound that commonly occurs in the earth's crust and is widely used in earth science classes. The National Center for Environmental Health at the Centers for Disease Control and Prevention in Atlanta has indicated that skin contact with galena is not dangerous. When handled properly in the classroom galena does not pose a health hazard. However, as a safeguard to children we will no longer supply galena in the *Rocks and Minerals* unit. Pyrite has been substituted for galena in the class set of mineral specimens.

This errata set includes the following:

- For the *Rocks and Minerals* Teacher's Guide First Edition— revised pages 5, 7-8, 11, 39-41, 43, 48, 75-77, 79, 91, 111, 117, and 126

- For the *Rocks and Minerals* Student Activity Book — revised pages 32, 34, and 56

Photocopy and distribute these new instruction pages as needed.

If you have questions about these changes or about the module in general, call Carolina's product information staff at 800-227-1150 (8 am–5 pm ET, M–F), or email *stc@carolina.com*.

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## Materials List

Listed below are the materials needed for teaching *Rocks and Minerals* to 30 students. Please note that metric and English equivalents in this unit are only approximate.

- 1 *Rocks and Minerals* Teacher's Guide
- 15 *Rocks and Minerals* Student Activity Books
- 12 samples of each of the following numbered rocks:
  1. granite
  2. gneiss
  3. conglomerate
  4. limestone (fossiliferous)
  5. shale
  6. sandstone (pink with layers)
  7. obsidian
  8. basalt
  9. pumice
  10. slate
  11. marble
  12. schist (with garnet)
- 19 samples of each of the following lettered minerals:
  - A. feldspar
  - B. quartz (displaying hexagonal form)
  - C. pyrite (displaying cubic form)
  - D. calcite
  - E. fluorite
  - F. graphite
  - G. hematite (black specular variety)
  - H. gypsum (massive form/alabaster)
  - I. magnetite
  - J. muscovite
  - K. sulfur (crystalline)
  - L. talc
  - M. halite
  - N. gypsum (massive and fibrous/satin spar variety)
  - O. gypsum (bladed selenite crystal aggregate in "desert rose" form)
  - P. quartz (pink massive crystals)
  - Q. hematite (red variety)
  - R. biotite
  - S. gypsum (clear selenite crystal)
- 1 pack of 100 disposable gloves
- 35 plastic containers with lids, 0.5 liter (1 pt)
- 30 hand lenses
- 1 piece of Iceland spar calcite
- 15 flexible magnets, 25 × 20 × 5 mm (1 × 1 × ¼ in)
- 15 cardboard trays
- 15 white porcelain streak plates
- 15 black porcelain streak plates
- 15 penlights with batteries
- 15 steel nails, size 12
- 15 droppers
- 15 plastic cups, 90 ml (3 oz)
- 1 roll waxed paper
- 3 sheets of transparent film

- *15 egg cartons
- *15 copper pennies
- *1 roll of clear tape
- *1 roll of masking tape
- * Newsprint pad, 61 × 91 cm (24 × 36 in)
- *15 pieces of manila paper, 10 × 15 cm (4 × 6 in)
- * Cardboard, enough for 15 75-mm (3-in) squares
- *1 pad of Post-it® notes, 76 × 127 mm (3 × 5 in)
- * Colored markers
- * Assorted crayons or colored pencils
- * Glue
- * Stapler
- * Scissors
- * Old newspapers
- * Paper towels
- * Dish detergent
- * Liquid tile cleaner
- * Small bucket

***Note:** These items are not included in the kit. They are commonly available in most schools or can be brought from home.

additional situations that invite students to formulate hypotheses, make generalizations, and explain how they arrived at a conclusion.

**Brainstorming:** Brainstorming is a whole-class exercise in which students contribute their thoughts about a particular idea or problem. When used to introduce a new science topic, it can be a stimulating and productive exercise. It also is a useful and efficient way for the teacher to find out what students know and think about a topic. As students learn the rules for brainstorming, they will become increasingly adept in their participation.

To begin a brainstorming session, define for students the topics about which they will share ideas. Explain the following rules to students:

- Accept all ideas without judgment.
- Do not criticize or make unnecessary comments about the contributions of others.
- Try to connect your ideas to the ideas of others.

**Cooperative Learning Groups:** One of the best ways to teach hands-on science is to arrange students in small groups. Materials and procedures for *Rocks and Minerals* are based on groups of two. There are several advantages to this organization. It provides a small forum for students to express their ideas and get feedback. It also offers students a chance to learn from each other by sharing ideas, discoveries, and skills. With coaching, students can develop important interpersonal skills that will serve them well in all aspects of life. As students work, they will often find it productive to talk about what they are doing, resulting in a steady hum of conversation. If you or others in the school are accustomed to a quiet room, this busy atmosphere may require some adjustment.

**Venn Diagrams:** The Venn diagram is a useful tool for sorting, classifying, and comparing information. It will be used in three lessons of the *Rocks and Minerals* unit. You will make the first circle of the Venn diagram in Lesson 4, where students summarize their ideas about rocks. In Lesson 13, you will make the second circle of Venn diagram to summarize students' ideas about minerals. You will complete the Venn diagram by connecting the two circles in Lesson 16, when students compare the properties of rocks and minerals. Properties common to rocks and minerals will appear in the area where the circles intersect.

**Learning Centers:** You can give supplemental science materials a permanent home in the classroom in a spot designated as the learning center. Students will probably bring in samples of rocks and minerals they have found. You can place the students' samples in this area. Students can also use the center as an "on your own" project center, as an observation post, as a trade-book reading nook, or simply as a place to spend unscheduled time when assignments are done. To keep interest in the center high, change the learning center or add to it often. You might want to include a set of testing materials, science trade books (see the **Bibliography**), and magazine and newspaper articles about rocks and minerals.

## Materials

**Safety Notes:** This unit does not contain anything highly toxic, but common sense dictates that nothing be put in the mouth. In fact, it is good practice to tell your students that, in science class, materials are never tasted. Use your own judgment to caution students when they are about to perform a field test such as the hardness test, which requires a steel nail. Safety tips appear throughout the unit at places where a reminder to students may be warranted.

**Organization of Materials:** To help ensure an orderly progression through the unit, you will need to establish a system for storing and distributing materials. Being prepared is the key to success. Here are a few suggestions:

- Familiarize yourself with the materials as soon as possible.
- Know which activity is scheduled and which materials will be used for it.
- Involve your students in distributing and returning the materials. If you have an existing network of cooperative groups, delegate the responsibility to one member of each group.
- Organize a distribution center and instruct your students to pick up and return supplies to that area. A cafeteria-style approach works especially well when there are large numbers of items to distribute.
- Look at each lesson ahead of time. Some have specific suggestions for handling materials needed that day.
- Management tips are provided throughout the unit. Look for the icon at the right.

## Assessment

**Philosophy:** In the Science and Technology for Children program, assessment is an ongoing, integral part of instruction. Because assessment emerges naturally from the activities in the lessons, students are assessed in the same manner in which they are taught. They may, for example, perform experiments, record their observations, or make oral presentations. Such assessments permit the examination of processes as well as of products, emphasizing what students know and can do.

The learning goals in STC units include a number of different science concepts, skills, and attitudes. Therefore, a number of different strategies are provided to help you assess and document your students' progress toward the goals. These strategies also will help you report to parents and appraise your own teaching. In addition, the assessments will enable your students to view their own progress, reflect on their learning, and formulate further questions for investigation and research.

Figure T-1 summarizes the goals and assessment strategies for this unit. The left-hand column lists the individual goals for the *Rocks and Minerals* unit and the lessons in which they are addressed. The right-hand column identifies lessons containing assessment sections to which you can turn for specific assessment strategies. These strategies are summarized as bulleted items.

**Assessment Strategies:** The assessment strategies in STC units fall into three categories: matched pre- and post-unit assessments, embedded assessments, and additional assessments.

The first lesson of each STC unit is a *pre-unit assessment* designed to give you information about what the whole class and individual students already know about the unit's topic and what they want to find out. It often includes a brainstorming session during which students share their thoughts about the topic through exploring one or two basic questions. In the *post-unit assessment* following the final lesson, the class revisits the pre-unit assessment questions, giving you two sets of comparable data that indicate students' growth in knowledge and skills.

Throughout a unit, assessments are incorporated, or embedded, into lessons. These *embedded assessments* are activities that occur naturally within the context of both the individual lesson and the unit as a whole; they are often indistinguishable from instructional activities. By providing structured activities and guidelines for assessing students' progress and thinking, embedded assessments contribute to an ongoing, detailed profile of growth. In many STC units, the last lesson is an embedded assessment that challenges students to synthesize and apply concepts or skills from the unit.

The study of properties in *Rocks and Minerals* follows a pattern in which students observe, describe, record, and discuss their findings. Specific guidelines for assessments are presented in the first and last lessons, at the end of the section on rocks (Lesson 4), at the beginning of the series of lessons on minerals (Lesson 5), and in Lesson 13. Lesson 15 is an embedded assessment of students' ability to apply previously learned information to three new minerals.

*Additional assessments* can be used to determine students' understanding after the unit has been completed. In these assessments, students may work with materials to solve problems, conduct experiments, or interpret and organize data. In grades three through six, they may also complete self-assessments or paper-and-pencil tests. When you are selecting additional assessments, consider using more than one assessment to give students with different learning styles opportunities to express their knowledge and skills. The *Rocks and Minerals* unit contains four suggestions for additional assessments.

**Documenting Student Performance:** In STC units, assessment is based on your recorded observations, students' work products, and oral communication. All these documentation methods combine to give you a comprehensive picture of each student's growth.

Teachers' *observations and anecdotal notes* often provide the most useful information about students' understanding, especially in the early grades when some students are not yet writing their ideas fluently. Because it is important to document observations used for assessment, teachers frequently keep note cards, journals, or checklists. Many lessons include guidelines to help you focus your observations. The blackline master on pg. 12 provides a format you may want to use or adapt for recording observations.

*Work products,* which include both what students write and what they make, indicate students' progress toward the goals of the unit. Children produce a variety of written materials during a unit. Record sheets, which include written observations, drawings, graphs, tables, and charts, are an important part of all STC units. They provide evidence of each student's ability to

*continued on pg. 11*

*continued from pg. 8*

collect, record, and process information. Students' science journals are another type of work product. In grades one and two, journal writings are primarily suggested as extension activities in many lessons. Often a rich source of information for assessment, these journal writings reveal students' thoughts, ideas, and questions over time.

Students' written work products should be kept together in folders to document learning over the course of the unit. When students refer back to their work from previous lessons, they can reflect on their learning. In some cases, students do not write or draw well enough for their products to be used for assessment purposes, but their experiences do contribute to the development of scientific literacy.

*Oral communication*—what students say formally and informally in class and in individual sessions with you—is a particularly useful way to learn what students know. This unit provides your students with many opportunities to share and discuss their own ideas, observations, and opinions. Some young children may be experiencing such activities for the first time. Encourage students to participate in discussions, and stress that there are no right or wrong responses. Creating an environment in which students feel secure expressing their own ideas can stimulate rich and diverse discussions.

Individual and group presentations can give you insights about the meanings your students have assigned to procedures and concepts and about their confidence in their learning. In fact, a student's verbal description of a chart, experiment, or graph is frequently more useful for assessment than the product or results. Questions posed by other students following presentations provide yet another opportunity for you to gather information. Ongoing records of discussions and presentations should be a part of your documentation of students' learning.

## Glossary

The glossary for this unit is provided as an additional resource for both teachers and students. The definitions are *not* unit specific and are intended to apply across the STC curriculum. The definitions are provided to facilitate discussion and may serve to enhance other unit activities. *Under no circumstances should students be required to memorize the terms or definitions presented in the glossary.*

LESSON 4

# Discovering Minerals

## Overview and Objectives

After reviewing what they now know about rocks, students begin to investigate minerals. As students compare their 12 rocks with 3 minerals, focusing on the similarities and differences between them, they explore the concept that rocks contain minerals. Students also have the opportunity to refine their skills in observing, describing, and recording properties. These activities, coupled with those in Lesson 5, prepare students for Lesson 6, where they begin to assemble the data that they will use to create their "Minerals Field Guide." Students will revisit the concept that rocks contain minerals at the end of the unit.

- Students review and summarize the properties of the rocks they have observed.
- Students compare rocks and minerals and discuss the similarities and differences between them.
- Students observe and describe three minerals.
- Students record and discuss their observations of three minerals.

## Background

Minerals are naturally occurring, solid substances with distinct physical and chemical properties. Different samples of the same mineral sometimes look very different from one another; however, the chemical composition of a given mineral is always the same. That composition, moreover, is consistent throughout the entire mineral. For this reason, geologists often classify minerals on the basis of their chemical composition. The composition of various samples of the same rock, by contrast, is not consistent.

Isolated mineral specimens are rarely found on the surface of the earth. As noted in Lesson 1, most minerals are found in rocks. The mineral grains in some rocks can be observed with the unaided eye or a hand lens. In other cases, minerals can be identified only with a microscope, a chemical test, special X-ray equipment, or a scanning electron microscope.

Geologists classify minerals on the basis of similarities in their internal (atomic) structure. In this lesson, students will examine three minerals: feldspar, quartz, and pyrite. **Feldspar** and **quartz** are members of the **silicate group.** All silicates contain silica and oxygen; they may also contain other minerals such as aluminum and sodium. **Pyrite** is a member of the **sulfide** group. The key element of sulfides is sulfur.

Feldspar is the most common mineral on earth. Many clays are weathered forms of feldspar. Feldspar often appears as very small crystals in a rock. However,

some of the largest individual crystals are also feldspar—they can weigh more than 2,000 tons. Feldspar can be pink, white, or gray. It is a component of most igneous, many metamorphic, and some sedimentary rocks.

Quartz is frequently found in surface rocks. Quartz is resistant to weathering, and small particles of it are commonly found in sedimentary rocks. Quartz is often the predominant mineral in sand.

Quartz is found in a variety of forms. The sample students will examine in this lesson is a single, large crystal. Other forms of quartz that display crystals are named on the basis of their color and include amethyst, citrine, and smoky quartz. The rose quartz used later in this unit and most samples of milky quartz are called **massive;** in other words, they are formed of a mass of crystals.

Some quartz specimens are composed of crystals so small that they are visible only under a microscope. As a result, they are called **microcrystalline.** Examples of these forms of quartz include jasper, chert (flint), and onyx.

Pyrite is made of iron and sulfur. It is sometimes found with real gold. Pyrite is a common mineral that may be found in a range of igneous, metamorphic, and sedimentary rocks almost anywhere in the world. It has a metallic luster and may be found as a cubic shape or as a twelve-sided (dodecahedral) crystal.

## Materials

*For each student*

- 1 science notebook
- 1 **Record Sheet 4-A: Minerals—Record of My Observations**
- 1 **Record Sheet 1-A: Rocks—Record of My Observations** (from Lesson 1)
- 1 hand lens
- 1 pair of disposable gloves

*For every two students*

- 1 set of 12 rocks, labeled 1–12
- 1 set of 3 minerals, labeled A–C
- 1 cardboard tray

*For the class*

- 1 sheet of newsprint, 60 × 90 cm (24 × 36 in)
- 2 colored markers
- 1 pad of Post-it® notes, 76 × 127 mm (3 × 5 in)
- 3 additional plastic containers (for minerals A, B, and C)

## Preparation

1. Draw a large circle on a sheet of newsprint and label it "Rocks." This will be one of two circles in a Venn diagram that students will use to compare rocks and minerals. During this lesson, you will record students' ideas about rocks on Post-it® notes and place the notes inside the circle. You will create the "Minerals" circle in Lesson 13. In Lesson 16, you will overlap the two circles to complete the Venn diagram, which will show the similarities and differences between rocks and minerals. For more information on Venn diagrams, please turn to pg. 7.
2. Wearing a pair of disposable gloves, examine the three minerals to become familiar with their properties. The names of the minerals are feldspar (A), quartz (B), and pyrite (C).
3. Label three of the plastic containers with the letters A, B, and C. Place minerals A to C in them. Set up the materials center with the 12 rocks and 3 minerals in their plastic containers, a cardboard tray for each pair of students, the disposable gloves, and hand lenses.
4. Make a copy of **Record Sheet 4-A: Minerals—Record of My Observations** for each student.

## Procedure

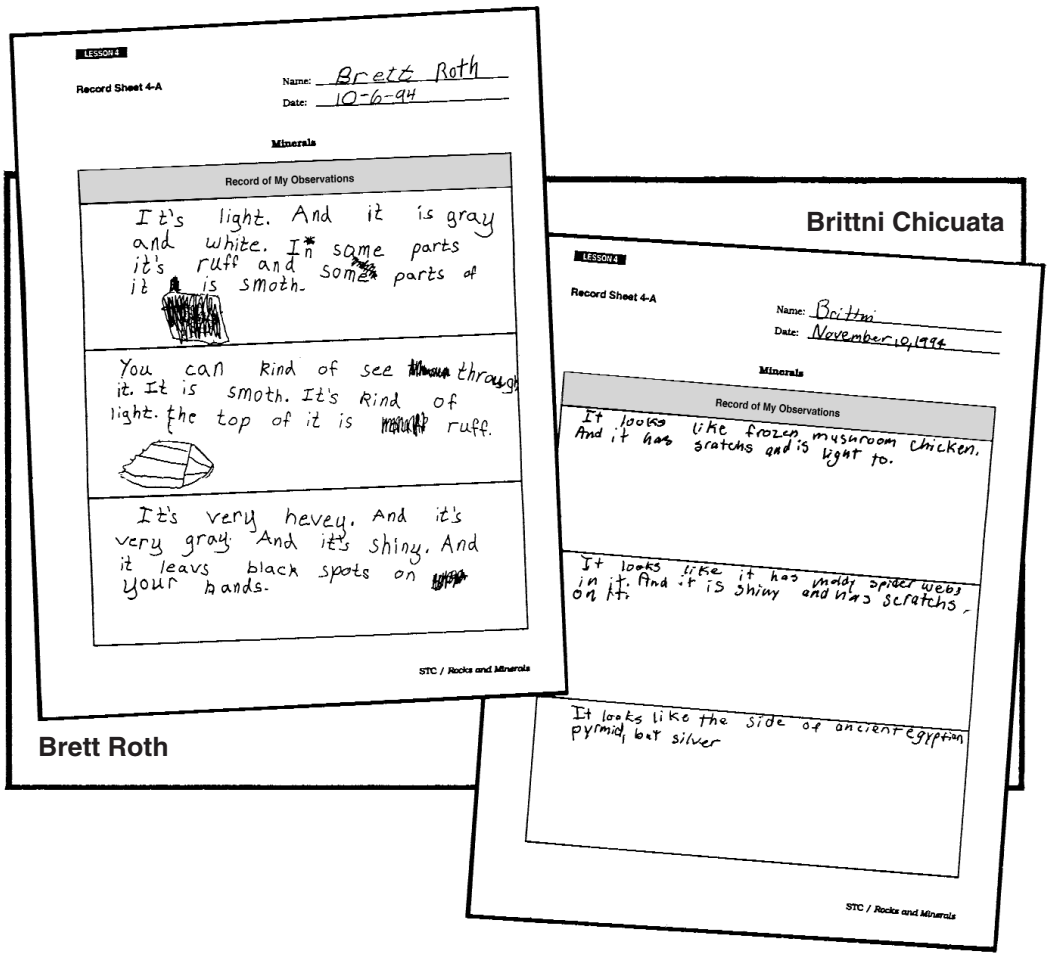
1. Ask the students to review the information they have recorded about rocks on **Record Sheet 1-A: Rocks—Record of My Observations** and in their science notebooks.
2. Ask students to suggest properties shared by all the rocks. Record their ideas on the Post-it® notes. Place the notes inside the circle labeled "Rocks," as shown in Figure 4-1.
3. Have one student from each pair put on a pair of disposable gloves and pick up the 12 rocks and 3 minerals, a cardboard tray, another pair of disposable gloves, and two hand lenses from the materials center.

- Do any of the minerals look like these pieces?
- Which rocks look like they might have little pieces of mineral A in them? Mineral B? Mineral C?

7. Have students return their supplies to the materials center, throw away their gloves, and wash their hands. Instruct students that the proper way to take off their gloves is by holding on to the gloves at the wrist opening and pulling the glove up over their fingers. This turns the glove inside out as it is pulled off.

***Figure 4-3***

*Third-graders' observations about minerals*




## Final Activities

1. Ask students to review **Record Sheet 4-A** and to share their descriptions of each mineral. Figure 4-3 shows samples of third-graders' recorded observations about minerals.
2. Ask students to think about how rocks and minerals are similar and different. Ask them to record their thoughts in their notebooks.

**Management Tip:** You may temporarily put the rocks away after this lesson. Students will not use them again until Lesson 16.

feldspar family. The quartz family includes amethyst, citrine, and jasper. The mica family includes biotite and muscovite.

After they examine their 12 minerals, students read about feldspar, one of the minerals in their set. They will read about one or two minerals at the end of each of the next seven lessons. Again, remember that knowing the names of the minerals is not the focus of these activities. In Lesson 14, students are challenged to apply all the information they have gathered to help them identify each mineral by name.

## Materials

*For each student*

- 1 science notebook
- 1 **Record Sheet 4-A: Minerals—Record of My Observations** (from Lesson 4)
- 1 hand lens
- 1 pair of disposable gloves

*For every two students*

- 1 set of 12 minerals, labeled A–L
- 1 egg carton
- 1 cardboard tray
- 1 colored marker

*For the class*

- 4 sheets of newsprint, 60 × 90 cm (24 × 36 in)
- 12 plastic containers

## Preparation

1. Label two sheets of newsprint "What We Know about Minerals" and two sheets "What We Want to Know about Minerals." Post both sheets prominently in the room.

**Management Tip:** Keep the two class lists on display throughout the rest of the unit. Add new ideas and questions as they arise. As a question is answered, put a check by it. The lists will also be used for comparison in the post-unit assessment.

2. Wearing gloves, examine several samples of each of the 12 minerals. Note the similarities and differences among samples of a single mineral and of the different minerals. The names of the minerals are as follows:

| | |
|---|---|
| A. Feldspar | G. Hematite |
| B. Quartz | H. Gypsum |
| C. Pyrite | I. Magnetite |
| D. Calcite | J. Muscovite |
| E. Fluorite | K. Sulfur |
| F. Graphite | L. Talc |

3. Label nine additional plastic containers, place the nine new minerals in them, and add them to the materials center, along with the other minerals, hand lenses, disposable gloves, and cardboard trays. Place the 15 markers and egg cartons aside. You will distribute them during Step 7 of the **Procedure** section.

LESSON 9

# Exploring the Luster of Minerals

## Overview and Objectives

Having observed the amount of light they could see through each of their minerals, students examine a second property related to how minerals interact with light: luster. The students' review of all the information they have recorded on their mineral profile sheets strengthens their understanding that each mineral has certain properties that make it possible to distinguish it from others.

- Students observe, discuss, and describe the luster of minerals when they are placed under bright light.
- Students sort their minerals according to similarities and differences in luster.
- Students record the results of the luster test on their mineral profile sheets.
- Students summarize the information they have recorded on each mineral and begin to identify its distinguishing properties.

## Background

A mineral's luster, or shine, depends on the way its surface reflects light. Minerals that reflect light like polished metal are said to have a **metallic** luster. All other minerals have a **nonmetallic** luster. Geologists distinguish among several nonmetallic lusters: dull, waxy, pearly, and brilliant. The terms used to describe luster are difficult to define because they rely on individual perceptions and language. To make their descriptions of luster as useful as possible, geologists use specific minerals for comparisons.

To help students develop a common set of words that they can use in describing the luster of their minerals, shine a penlight on various objects in the classroom, one at a time, and ask students to describe how the objects look. To illustrate a metallic luster, such as that of pyrite, shine the light on an unpainted metal table leg or a pencil sharpener. As an illustration of a dull luster, such as that of gypsum, shine the light on the wall. Use a window as an example of glassy luster, similar to that of quartz. Make sure your students understand that not everyone will see objects in the same way. At the same time, help them try to reach agreement on the terms they will use when they apply the luster test to their minerals.

At the end of the lesson, students read about pyrite and gypsum, two minerals with lusters that are distinctly different.

LESSON 9

## Materials

*For each student*

- 1 science notebook
- 1 set of 12 **Mineral Profile Sheets**
- 1 pair of disposable gloves

*For every two students*

- 1 copy of the blackline master **Sorting Minerals by Luster**
- 1 set of 12 minerals in an egg carton
- 1 cardboard tray
- 1 penlight

*For the class*

- 1 sheet of newsprint
- 1 colored marker

Examples of objects with metallic luster: foil wrap, metal spoon, jar lid
Examples of objects with waxy luster: polished shoe, plastic margarine tub
Examples of objects with glassy luster: drinking glass, vase, eyeglasses
Examples of objects with dull luster: eraser, unfinished wooden block

## Preparation

1. Make sure that all the penlights are working. Replace batteries if needed.
2. Identify objects in the classroom that have different lusters when illuminated by a penlight. Examples include a table leg (metallic), window (glassy), floor (waxy), and chalkboard (dull).
3. Draw an enlarged version of the blackline master **Sorting Minerals by Luster** (pg. 80) onto a sheet of newsprint. Title the newsprint "Ways to Describe the Luster of an Object." Divide the chart into four squares and label them "metallic," "glassy," "waxy," and "dull."
4. Make one copy of the blackline master **Sorting Minerals by Luster** for each student pair.
5. Review the **Student Instructions for Performing the Luster Test** on pg. 78 of this guide (pg. 33 of the Student Activity Book). Wearing gloves, determine the luster of each of the 12 minerals.
6. Read the information about pyrite and gypsum on pg. 79 of this guide.

## Procedure

1. Review observations students have made and results of the tests they have done thus far by asking questions such as the following:
   - Which minerals have a special smell?
   - Which minerals have a special feel or texture?
   - Which minerals have a streak color that is different from their observable color?
   - Which minerals can you see light through?
2. Let students know that today they will perform a second test with their penlights to learn about another property of minerals: luster. Explain that luster refers to how the surface of an object looks when light is shined on it. Show the chart on which you have written the words "metallic," "glassy," "waxy," and "dull."

3. Darken the room. Illuminate several metallic objects with the penlight. Ask students which word on the chart best describes the luster of those objects. Help students reach agreement.

   **Note:** Try to keep the amount of light that you shine on the object constant. If not, students may focus on the size of the circle of light rather than on how the illuminated object looks.

4. Repeat Step 3 with the waxy, glassy, and dull objects. Turn the lights on.
5. Ask one student from each pair to collect their carton of minerals, two pairs of disposable gloves, and a cardboard tray while you distribute penlights.
6. Review the **Student Instructions for Performing the Luster Test.** Turn the lights off again. Ask students to follow the directions to test the luster of each mineral. Listen for, and encourage students to use, the terms from the class list.
7. Turn on the lights. As a group, discuss the students' descriptions of the luster of each mineral. If necessary, compare the mineral with some of the classroom objects used at the beginning of the lesson.

   **Note:** Different samples of the same mineral may have different lusters; in fact, different parts of the sample may even have different lusters. Therefore, it may be valid for students to describe one end of a quartz crystal as "glassy" and the other end as "waxy." If students ask, explain that these differences are caused by impurities in the minerals, the way the specimen broke when it was collected, or simply the way the mineral was formed.

8. Have students return their minerals to the materials center, throw away their gloves, and wash their hands. Collect the penlights.

## Final Activities

1. Ask students to read the information on pg. 34 of the Student Activity Book (pg. 79 of this guide) about pyrite and gypsum, each of which has a distinctive luster.
2. Now have students quietly review all the information they have about each mineral. Ask them to think about which pieces of information they could use to describe a mineral in a way that would allow someone else to identify it from a collection of minerals.
3. Ask students which minerals they now think they can identify by name. Encourage them to focus on matching the information they have recorded on their mineral profile sheets with information from the reading selections. Make sure students know that they will learn the names of all of their minerals after they have completed all of the tests.

## Extensions

LANGUAGE ARTS

1. Ask students to apply their new vocabulary and observation skills by identifying objects in their homes that have the same luster as those described in class. Have students write a description of the objects to share in class the following day.

MATHEMATICS

2. Make a "real graph" with categories that correspond to the descriptors chosen by the class. Ask students to find objects to hang on the graph for each category (for example, buttons, jar lids, plastic spoons, foil, waxed paper, paper cups).

## Reading Selections

### Galena

Would you be excited to find a piece of golden rock? It may not be real gold! Pyrite is nicknamed "fool's gold" because its color might fool you into thinking you have found a piece of real gold.

Pyrite is shiny and hard. It is a mineral that can be found almost anywhere in the world. It breaks more easily than gold. Real gold is very difficult to destroy.

Pyrite is made of iron and sulfur. It is sometimes made into pendants and beads for jewelry. Pyrite crystals look like real gold, but do not cost as much as real gold.

The name pyrite comes from the Greek word for fire, possibly because pyrite will make a spark when it strikes steel, iron, or flint. In early colonial times pyrite was used in muskets and pistols and worked much like our modern-day lighters. In a musket or pistol, a little piece of iron pyrite was held in a clamp against a small iron wheel. When the trigger was pulled the wheel released and spun very fast. As the wheel was spinning it would scrape against the pyrite and make sparks. The sparks would fire the gunpowder in the musket or pistol.

Pyrite has not been used in guns since colonial times. Today the sulfur from pyrite is used to make chemicals for industrial purposes.

Can you find pyrite in your minerals? Can you describe its luster?

### Gypsum

Gypsum looks dull and earthy. It is usually found in small pieces. These pieces are ground up and used to make plaster of Paris. Have you seen plaster of Paris? What color is it?

Casts for broken bones used to be made from gypsum. Today, gypsum is used to construct walls in homes and buildings. The building material called "drywall" is really "gypsum board."

Artists sometimes use large pieces of a special kind of gypsum to carve beautiful statues. The name of this special gypsum is alabaster. It is pink or white. Have you ever seen an alabaster statue? It looks a lot like polished plaster!

Is gypsum in your set of minerals? What color was its streak?

LESSON 11

# Testing the Minerals with a Magnet

## Overview and Objectives

In Lessons 7 to 10, students performed field tests to explore the color, transparency, luster, and hardness of minerals. They recorded their findings and results in their own terms, which reflected their personal perceptions. In this lesson, students are introduced to a test that has conclusive, "yes-no" results: testing with a magnet identifies magnetite. Students continue developing their problem-solving skills as they apply the results of this test to make inferences about the identities of their minerals.

- Students test minerals with a magnet and observe and describe the results.
- Students record and compare results of their test.
- Students read to learn more about magnetite.

## Background

Scientists use positive and negative tests to identify the presence or absence of a property. Students will perform such a test in this lesson. The test is negative for most minerals; in other words, it produces no discernible results. Nonetheless, the test does provide conclusive information for identifying those few minerals that are magnetic. Geologists use this test to identify minerals in rocks. The results help them determine how the rocks can be used.

Three commonly found minerals are magnetic; of these, **magnetite** and pyrite are the only ones in the students' set. This special property of magnetite has made it important for centuries as a magnet and compass. At the end of this lesson, students will learn more about one form of magnetite, called lodestone, by reading "Lodestones Lead the Way."

## Materials

*For each student*

1 science notebook
1 set of 12 **Mineral Profile Sheets**
1 pair of disposable gloves

*For every two students*

1 set of 12 minerals in an egg carton
1 magnet

## CALCITE

**Feel:** Rough and smooth
**Color:** Mostly white and other light colors
**Streak:** White
**Hardness:** Soft to medium; scratched by penny (also scratches penny)
**Light:** Light shines through
**Luster:** Glassy
**Shape:** Some flat sides, can be a cube or a slanted cube



## FELDSPAR

**Feel:** Rough
**Color:** Milky white, pinkish brown, or light greenish gray
**Streak:** White
**Hardness:** Medium to hard; barely scratched by nail (may also scratch nail)
**Light:** No light shines through
**Luster:** Glassy
**Shape:** No special shape, flat sides



## FLUORITE

**Feel:** Smooth
**Color:** Blue, green, yellow, purple
**Streak:** White or pale
**Hardness:** Medium; scratched by nail
**Light:** A little light shines through
**Luster:** Glassy
**Shape:** Cube



## PYRITE

**Feel:** Rough and smooth
**Color:** Brassy yellow or dull gold
**Streak:** Greenish black or brownish-black
**Hardness:** Medium; scratched by nail
**Light:** No light shines through
**Luster:** Metallic
**Shape:** Cube

## Procedure

1. Ask students to share what they learned in Lesson 14 when they compared the information on their mineral profile sheets with the information on the mineral identification cards.
   - How was their information different from that of the geologist?
   - Which properties did they describe that the geologist did not?
   - What information did the geologist's mineral identification card have for each mineral that the students' profile sheet did not?
2. Ask students to think about each sample of pyrite that they observed in Lesson 13. What was the same about the samples? What was different? Encourage students to explain their answers.
3. Repeat the questions in Step 2 for fluorite and sulfur. How many different samples of a mineral do students think a geologist examines before she or he can identify it?
4. Let students know that they now will become amateur geologists. Their job will be to gather enough information, or clues, to identify three "mystery minerals."
5. Distribute three mineral profile sheets to each student. Ask them to label the sheets for minerals P, Q, and R in the first box after the word "Mineral."
6. Review the test supplies that are available for students' use in the materials center.
7. Ask one student from each pair to collect a set of minerals, a sample of each of the three mystery minerals, a cardboard tray, two pairs of disposable gloves, and two hand lenses from the materials center.
8. Challenge the students to decide which tests they will use to identify the mystery minerals.
9. Allow about 20 minutes for students to observe, test, and record the properties of the three mystery minerals on their mineral profile sheets.
10. Invite students to share with the class what they learned about each of the three minerals.
11. Now ask students to compare mystery mineral P with the 12 minerals in their egg carton. Remind them to review the information they have recorded in their "Minerals Field Guides." Use questions such as the following:
    - Which minerals in their set are similar to mineral P?
    - Which properties do they share?
    - In what ways are the minerals that are similar also different?
12. Repeat Step 11 with minerals Q and R.
13. Ask students to compare the properties of the 3 mystery minerals with the properties of their 12 known minerals. Challenge them to discover whether any of the mystery minerals are in fact ones they have already studied.
14. Ask students to share their conclusions. What properties did each mineral have that led to this conclusion? What properties did the minerals not have?
15. Make sure students realize that two of the minerals are the same as those in their sets. Clarify any confusion by emphasizing similarities and differences among mineral samples.

The science of mineralogy has changed over time. Originally, geologists concentrated on identifying minerals. Later, they began to focus on what minerals can reveal about the history of the earth and how they can be used. By examining rocks, which are made of minerals, scientists can learn about the pressure under which the minerals grew, changes in the temperature of the earth, the composition of meteorites, and even changes in the intensity of the earth's magnetic field.

New technologies have made it possible for scientists to duplicate minerals in the laboratory. Synthetic minerals are used for jewelry as well as industrial purposes. Synthetic quartz crystals and diamonds, for example, are now used extensively in industry. Overall, natural minerals are used in far greater quantities than synthetic minerals.

Minerals are the source of many metals. Any mineral that contains metal in large enough amounts to be worth mining is called an ore. Mineral ores are the source of metals such as iron, copper, aluminum, zinc, and mercury. Minerals and their byproducts are used for a wide range of industrial purposes. Students will probably be surprised to learn that minerals can be found in almost every aspect of their environment.

The following are common uses for the minerals included in this unit:

A. Feldspar: Ceramics (both porcelain and glazes), medicines such as Kaopectate™ (from kaolin, a weathered form of feldspar), household abrasive cleaners, glassmaking

B. Quartz: Radios, watches, computers, jewelry, glass, abrasives, optics

C. Pyrite: Source of sulfur, used in the production of sulfur dioxide for the paper industry and in the manufacture of sulfuric acid

D. Calcite: Fertilizer, medicine, cement

E. Fluorite: Enamel, optics, steel manufacturing, toothpaste

F. Graphite: Lubricant, electrodes, pencils, high-temperature tools, batteries, sports equipment

G. Hematite: Source of iron ore, paint pigment (red ocher)

H. Gypsum: Plaster (orthopedic casts, drywall), fertilizer, furnace and stove linings, sculpture (only from alabaster), cement, baked goods

I. Magnetite: Source of iron ore

J. Muscovite: Electric insulators, furnace and stove windows

K. Sulfur: Medicines, gunpowder, fireworks, fungicides, matches, fertilizer

L. Talc: Baby powder, hand lotion, lipstick, paint, paper

M. Halite: Salt, food additive, deicing agent; as sodium hydroxide, used in paper, soap, and petroleum manufacture

N. Gypsum (satin spar): See H

O. Gypsum (bladed selenite crystal aggregate): See H

P. Quartz: See B

Q. Hematite: See G

R. Biotite: No current commercial uses; once used for heat-resistant windows in ovens and furnaces

S. Gypsum (clear selenite crystal): See H

4. Your teacher will now shine a flashlight on other objects. Again, discuss what you see and decide which word from the chart best describes the luster of these objects.
5. Pick up your minerals, a tray, and two pairs of disposable gloves. Your teacher will give you a penlight.
6. Put on your disposable gloves. Following the instructions on pg. 33, test and record the luster of each mineral. Be ready to discuss what you have observed and recorded.
7. Return your minerals, tray, and penlight to the materials center. Throw away your gloves.
8. On pg. 34, read about two minerals that have a special luster. They are pyrite and gypsum.
9. Quietly review all the information you have recorded so far on your mineral profile sheets. Think about what you have read about the minerals. How would you describe a mineral so that someone else could pick it out from the set?
10. Share your ideas with the class. As another student describes the properties of a mineral, try to pick it out.
11. Do you think you can identify any of your minerals by name? Which ones? Why? Share your ideas with the class.

## Idea to Explore

Find some objects at home that have the same lusters as the objects you observed in class. Write a description of the objects. Share them with the class.

## Reading Selections

### Pyrite

Would you be excited to find a piece of golden rock? It may not be real gold! Pyrite is nicknamed "fool's gold" because its color might fool you into thinking you have found a piece of real gold.

Pyrite is shiny and hard. It is a mineral that can be found almost anywhere in the world. It breaks more easily than gold. Real gold is very difficult to destroy.

Pyrite is made of iron and sulfur. It is sometimes made into pendants and beads for jewelry. Pyrite crystals look like real gold, but do not cost as much as real gold.

The name pyrite comes from the Greek word for fire, possibly because pyrite will make a spark when it strikes steel, iron, or flint. In early colonial times pyrite was used in muskets and pistols and worked much like our modern-day lighters. In a musket or pistol, a little piece of iron pyrite was held in a clamp against a small iron wheel. When the trigger was pulled the wheel released and spun very fast. As the wheel was spinning it would scrape against the pyrite and make sparks. The sparks would fire the gunpowder in the musket or pistol.

Pyrite has not been used in guns since colonial times. Today the sulfur from pyrite is used to make chemicals for industrial purposes.

Can you find pyrite in your minerals? Can you describe its luster?

### Gypsum

Gypsum looks dull and earthy. It is usually found in small pieces. These pieces are ground up and used to make plaster of Paris. Have you seen plaster of Paris? What color is it?

Casts for broken bones used to be made from gypsum. Today, gypsum is used to construct walls in homes and buildings. The building material called "drywall" is really "gypsum board."

Artists sometimes use large pieces of a special kind of gypsum to carve beautiful statues. The name of this special gypsum is alabaster. It is pink or white. Have you ever seen an alabaster statue? It looks a lot like polished plaster!

Is gypsum in your set of minerals? What color was its streak?

- How was the information on your profile sheets different from the information on the cards?
- Did your profile sheets have any information that was not on the cards?
- Did the cards have any information that was not on your profile sheets?

2. Think about the samples of pyrite that you observed in Lesson 13. How were they the same? How were they different?
3. Now think about all the samples of magnetite that you observed. How were they similar and different? What about the sulfur samples? How many different samples of a mineral do you think that geologists must look at before they can identify a mineral?
4. Your teacher will give you new profile sheets for the three mystery minerals. The minerals are labeled P, Q, and R. The sheets are just like your other mineral profile sheets. Write your name on each sheet. Then label each sheet by writing P, Q, or R in the small box after the word "Mineral."
5. Your job today is to collect as much information as you can about the three mystery minerals and try to identify them. Use any of the field tests that you think might help you learn more about the mystery minerals.

***Figure 15-1***

*Exploring the mystery minerals*