Changes in Materials for *Rocks and Minerals*

Science & Technology STC™ for Children

Since publication of the *Rocks and Minerals* Teacher's Guide Second Edition and the Student Investigations 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** Second Edition, Section 3: Materials Management and Safety— revised pages 1, 5-7, and 10-13 (Note: page 14 is now blank)
- For the *Rocks and Minerals* **Teacher's Guide** Second Edition, Section 4: Unit Investigations and Blackline Masters— revised pages 27-29, 31, 36, 63-65, 67, 79, 99, 105, and 114

- For the *Rocks and Minerals* **Student Investigations** 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*.

CAROLINA
Carolina Biological Supply Company
800.334.5551 www.carolina.com
0811

Contents

Materials List

This Materials List chart is a cross-reference guide for the materials supplied in the *Rocks and Minerals* unit kit (Item Number 97-2001). It gives the description of each item as it is listed in the lessons of the Teacher's Guide, and provides the cross-reference description of the item as it appears on the kit's packing list, which you will find in the *Rocks and Minerals* unit kit box(es). Please note that the metric and English equivalent measurements in this unit are approximate. For additional information about the materials in this unit kit, please contact Carolina at 800-227-1150 or www.carolina.com.

Item Description in Teacher's Guide	Item Description on Packing List	Lesson Number (Quantity Used)
Black streak plate (unglazed porcelain tile)	Pack of 15 black porcelain streak plates	7 (15), 15 (15), Assessment 2 (15)
Cardboard tray	Pack of 15 paper trays	1 (15), 2 (15), 3 (15), 4 (15), 5 (15), 6 (15), 7 (15), 8 (15), 9 (15), 12 (15), 13 (15), 14 (15), 15 (15), 16 (15), Assessment 2 (15)
Class set of 19 mineral specimens	Class set of 19 mineral specimens	
Biotite specimens (labeled "R")	Pack of 16 biotite specimens (labeled "R")	15 (15), 16 (15)
Calcite specimens (labeled "D")	Pack of 16 calcite specimens (labeled "D")	5 (15), 6 (15), 7 (15), 8 (15), 9 (15), 10 (15), 11 (15), 12 (15), 13 (15), 14 (15), 15 (15), 16 (15)
Feldspar (plagioclase) specimens (labeled "A")	Pack of 16 feldspar (plagioclase) specimens (labeled "A")	4 (15), 5 (15), 6 (15), 7 (15), 8 (15), 9 (15), 10 (15), 11 (15), 12 (15), 13 (15), 14 (15), 15 (15), 16 (15)
Fluorite (blue crystal) specimens (labeled "E")	Pack of 16 fluorite (blue crystal) specimens (labeled "E")	5 (15), 6 (15), 7 (15), 8 (15), 9 (15), 10 (15), 11 (15), 12 (15), 13 (15), 14 (15), 15 (15), 16 (15)
Graphite specimens (labeled "F")	Pack of 16 graphite specimens (labeled "F")	5 (15), 6 (15), 7 (15), 8 (15), 9 (15), 10 (15), 11 (15), 12 (15), 13 (15), 14 (15), 15 (15), 16 (15)
Gypsum specimens (labeled "H")	Pack of 16 gypsum specimens (labeled "H")	5 (15), 6 (15), 7 (15), 8 (15), 9 (15), 10 (15), 11 (15), 12 (15), 13 (15), 14 (15), 15 (15), 16 (15)
Gypsum (satin spar) specimens (labeled "N")	Pack of 16 gypsum (satin spar) specimens (labeled "N")	12 (15), 16 (15), Assessment 2 (15)
Gypsum (selenite crystal) specimens (labeled "S")	Pack of 16 gypsum (selenite crystal) specimens (labeled "S")	12 (15), 16 (15), Assessment 2 (15)
Gypsum (selenite desert rose) specimens (labeled "O")	Pack of 16 gypsum (selenite desert rose) specimens (labeled "O")	12 (15), 16 (15), Assessment 2 (15)
Halite specimens (labeled "M")	Pack of 16 halite specimens (labeled "M")	12 (15), 16 (15), Assessment 2 (15)
Hematite specimens (labeled "G")	Pack of 16 hematite specimens (labeled "G")	5 (15), 6 (15), 7 (15), 8 (15), 9 (15), 10 (15), 11 (15), 12 (15), 13 (15), 14 (15), 15 (15), 16 (15)
Hematite (red) specimens (labeled "Q")	Pack of 16 hematite (red) specimens (labeled "Q")	15 (15), 16 (15)
Magnetite (lodestone) specimens (labeled "I")	Pack of 16 magnetite (lodestone) specimens (labeled "I")	5 (15), 6 (15), 7 (15), 8 (15), 9 (15), 10 (15), 11 (15), 12 (15), 13 (15), 14 (15), 15 (15), 16 (15)

Item Description in Teacher's Guide	Item Description on Packing List	Lesson Number (Quantity Used)
Muscovite specimens (labeled "J")	Pack of 16 muscovite specimens (labeled "J")	5 (15), 6 (15), 7 (15), 8 (15), 9 (15), 10 (15), 11 (15), 12 (15), 13 (15), 14 (15), 15 (15), 16 (15)
Pyrite specimens (labeled "C")	Pack of 16 pyrite specimens (labeled "C")	4 (15), 5 (15), 6 (15), 7 (15), 8 (15), 9 (15), 10 (15), 11 (15), 12 (15), 13 (15), 14 (15), 15 (15), 16 (15)
Quartz (hexagonal crystal) specimens (labeled "B")	Pack of 16 quartz (hexagonal crystal) specimens (labeled "B")	4 (15), 5 (15), 6 (15), 7 (15), 8 (15), 9 (15), 10 (15), 11 (15), 12 (15), 13 (15), 14 (15), 15 (15), 16 (15)
Quartz (pink crystal) specimens (labeled "P")	Pack of 16 quartz (pink crystal) specimens (labeled "P")	15 (15), 16 (15)
Sulfur (crystal) specimens (labeled "K")	Pack of 16 sulfur (crystal) specimens (labeled "K")	5 (15), 6 (15), 7 (15), 8 (15), 9 (15), 10 (15), 11 (15), 12 (15), 13 (15), 14 (15), 15 (15), 16 (15)
Talc specimens (labeled "L")	Pack of 16 talc specimens (labeled "L")	5 (15), 6 (15), 7 (15), 8 (15), 9 (15), 10 (15), 11 (15), 12 (15), 13 (15), 14 (15), 15 (15), 16 (15)
Cup, 90 mL (3 oz)	Pack of 15 3½ plastic cups	6 (15), 15 (15)
Cup, 480 mL (16 oz) with lids	Pack of 35 16oz plastic cups with lids	1 (3), 2 (12), 4 (15), 5 (12)
Dropper	Pack of 15 plastic droppers	6 (15), 15 (15)
Hand lens	Pack of 30 hand lenses	1 (30), 2 (30), 3 (30), 4 (30), 5 (30), 6 (30), 10 (30), 12 (30), 13 (30), 14 (30), 15 (30), 16 (30), Assessment 2 (30)
Iceland spar calcite sample	Iceland spar calcite	8 (1)
Magnet	Pack of 15 magnets	11 (15), 15 (15), Assessment 2 (15)
Pair of disposable gloves	Pack of 100 disposable gloves	4 (30), 5 (30), 6 (30), 7 (30), 8 (30), 9 (30), 10 (30), 11 (30),12 (30), 13 (30), 14 (30), 15 (30), 16 (30), Assessment 2 (30)
Penlight	Penlight with 2 AAA Batteries	8 (15), 9 (15), 12 (15), 15 (15), Assessment 2 (15)
Set of 12 rock specimens	Set of 12 rock specimens	
Basalt specimens (labeled "8")	Pack of 16 basalt specimens (labeled "8")	2 (15), 3 (15), 4 (15), 16 (15)
Conglomerate specimens (labeled "3")	Pack of 16 conglomerate specimens (labeled "3")	1 (15), 2 (15), 3 (15), 4 (15), 16 (15)
Gneiss specimens (labeled "2")	Pack of 16 gneiss specimens (labeled "2")	1 (15), 2 (15), 3 (15), 4 (15), 16 (15)
Granite specimens (labeled "1")	Pack of 16 granite specimens (labeled "1")	1 (15), 2 (15), 3 (15), 4 (15), 16 (15)
Limestone specimens (labeled "4")	Pack of 16 limestone specimens (labeled "4")	2 (15), 3 (15), 4 (15), 16 (15)
Marble specimens (labeled "11")	Pack of 16 marble specimens (labeled "11")	2 (15), 3 (15), 4 (15), 16 (15)

Item Description in Teacher's Guide	Item Description on Packing List	Lesson Number (Quantity Used)
Obsidian specimens (labeled "7")	Pack of 16 obsidian specimens (labeled "7")	2 (15), 3 (15), 4 (15), 16 (15)
Pumice specimens (labeled "9")	Pack of 16 pumice specimens (labeled "9")	2 (15), 3 (15), 4 (15), 16 (15)
Sandstone specimens (labeled "6")	Pack of 16 sandstone specimens (labeled "6")	2 (15), 3 (15), 4 (15), 16 (15)
Schist specimens (labeled "12")	Pack of 16 schist specimens (labeled "12")	2 (15), 3 (15), 4 (15), 16 (15)
Shale specimens (labeled "5")	Pack of 16 shale specimens (labeled "5")	2 (15), 3 (15), 4 (15), 16 (15)
Slate specimens (labeled "10")	Pack of 16 slate specimens (labeled "10")	2 (15), 3 (15), 4 (15), 16 (15)
Square of transparent film, 75 × 75 mm (3 × 3 in)	Pack of 3 transparent film sheets	8 (30)
Steel nail	Pack of 15 D nails	10 (15), 15 (15), Assessment 2 (15)
Waxed paper, 75 × 75 mm (3 × 3 in)	75ft roll of waxed paper	8 (15)
White streak plate (unglazed porcelain tile)	Pack of 15 white porcelain streak plates	7 (15), 15 (15), Assessment 2 (15)

Safety Information

Most school districts, schools, and teachers have their own safety procedures for science class. STC materials are designed to be used under the supervision of a teacher in a suitably equipped classroom. Although STC procedures are designed to be safe and STC provides Safety Tips in lessons that require them, it is the teacher's responsibility to ensure that the safety regulations of the local school district are discussed with students and enforced uniformly. Teachers may wish to develop a Safety Contract that students and parents must sign before students can engage in science classroom activities. (A sample Safety Contract appears on pg. 12.)

General Safety Guidelines

When planning the lessons and discussing safety precautions with students, note the following points:

- Emphasize each student's responsibility for practicing safe science classroom procedures.
- Remind students that every substance in science class should be treated as a chemical, even if it is a common food.
- Remind students to wash their hands before leaving the science classroom.
- Advise students that classroom behavior that is disruptive or dangerous or that interferes with another student's right to learn may result in the disruptive student being removed from the class.

Other Safety Considerations

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.

SAFETY CONTRACT

I am learning to be a good scientist. I know that I must be organized, neat, and well behaved in the science classroom. I promise to:

- Prepare for all activities: I will listen to directions and make sure I understand before I start. I will work only at my assigned station.

- Care for equipment: I will handle objects carefully. I will not eat, drink, or taste anything in science class. This includes food and drink as well as other items. I will use my science materials only for the science activities. I will not play with things like rubber bands, paper clips, or powders.

- Follow directions: I will wait until I receive my teacher's permission to begin an activity. I will do each step in order and I will not try unknown things.

- Observe carefully: I will be as quiet and calm as possible so that I can learn more.

- Explore carefully: I will explore using the senses of touch, smell, sight, and hearing. When using powders, I will try not to make dust because someone might breathe it. I will try not to touch my eyes when I am working, in case there is something on my hands that should not get in my eyes.

- Keep careful records: I will record my observations by writing or drawing on my record sheets.

- Clean up afterwards: I will put away my equipment when I am done and wash my hands and my workspace.

- Follow all additional safety rules.

- Report accidents: I will report any injury or accident to my teacher immediately.

I will share good science safety with students and family so that I can be a good investigator.

Student Signature: _____ **Date:** _____

I have read this Safety Contract and understand what is expected of my child during science laboratory activities.

Parent Signature: _____ **Date:** _____

Chemical Information

Material Safety Data Sheets

Carolina Biological Supply Company is committed to providing a safe and useful product for study in the classroom. Most of the "chemical" components in our STC unit kits are common household items that can be purchased in any grocery store. As with any such thing, misuse or mishandling can present a physical or health hazard to teachers and students. Therefore, provided in this section are Material Safety Data Sheets (MSDS) for such "chemical" components. These MSDS describe the basic hazards of a material and explain how the material can be safely handled, used, and stored.

The MSDS contained in this section were prepared in accordance with the federal Occupational Safety and Health Administration (OSHA) Hazard Communication Standards and the American National Standards Institute (ANSI). The information presented in each MSDS is consistent with federal and state health, environmental, and safety laws or regulations. The language used in the MSDS was developed for the widest audience possible. The intended audience generally includes employers, employees, emergency responders, environmental professionals, and medical professionals.

Carolina Biological Supply Company believes the supplying of MSDS for products used in the STC unit kits will enhance the safety awareness of teachers in the classroom. Teachers who have questions regarding any MSDS should contact the local health and safety professional for your institution or Carolina at 800-227-1150.

Chemical Disposal Guidelines

With the ever-increasing interest in protecting the environment and the need for schools to serve as model global citizens, how classroom chemicals are disposed of should be a major concern to students, parents, teachers, other school district personnel, and members of the community. It is irresponsible for anyone to suggest that all chemical wastes can be simply poured down the drain or evaporated in a laboratory fume hood (or anywhere else, for that matter).

In the United States, the disposal of chemicals is regulated by federal, state, and local agencies. Following are some guidelines from Carolina to help you find the information you need to dispose of chemical wastes safely.

- We recommend that each school district appoint a coordinator to serve as a local advisor assisting with the disposal process. (If your district does not appoint an individual for this role, you, the classroom teacher, may need to take on this responsibility.) The coordinator should first obtain a U.S. Environmental Protection Agency (EPA) waste generator identification number for your school site, if this has not already been done. Contact your state's hazardous waste management agency or the EPA to obtain the generator identification number. For a list of these agencies and how to contact them, visit the EPA Web site at www.epa.gov.
- Next, locate a waste removal vendor for removing your chemical wastes. Seek a vendor who is properly licensed. The vendor will need to know what chemicals you have to be disposed of.
- Today, best practice in chemical waste disposal is to accumulate chemical wastes in properly labeled waste containers. Keep these containers closed at all times except when waste is being added. Your coordinator can tell you when and where to move the containers.

A number of different resources are available that provide additional information about chemical disposal. The American Chemical Society is an excellent resource for such information. You can visit their Web site at www.chemistry.org. You may also want to refer to the following National Science Teachers

Association publications for additional laboratory safety information: *Exploring Safely: A Guide for Elementary Teachers, Inquiring Safely: A Guide for Middle School Teachers,* and *Safety in the Elementary Science Classroom, Second Edition* or visit the NSTA Web site at www.nsta.org.

At the state level, departments of environmental management or environmental protection regulate chemical waste disposal. The EPA Web site, www.epa.gov, can link you to a listing of these agencies' phone numbers and addresses. Plus, you'll find other helpful information, such as teacher resources and interesting things for students to read and do. This site also provides a current list of EPA regional offices, addresses, and phone numbers, along with the Resource Conservation and Recovery Act (RCRA) Hotline, a federal center established to answer questions about solid and hazardous waste.

Other important information resources include your state's or county's science supervisor, state science teacher association, local college and university environmental health and safety specialists, and the Laboratory Safety Workshop (whose Web site is accessible through Carolina's site, www.carolina.com).

For any additional laboratory safety information, please contact Carolina at 800-227-1150 or www.carolina.com.

The *Rocks and Minerals* unit kit does not contain any material that requires a Material Safety Data Sheet.

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, see Teaching Strategies in Section 2 of this guide.
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

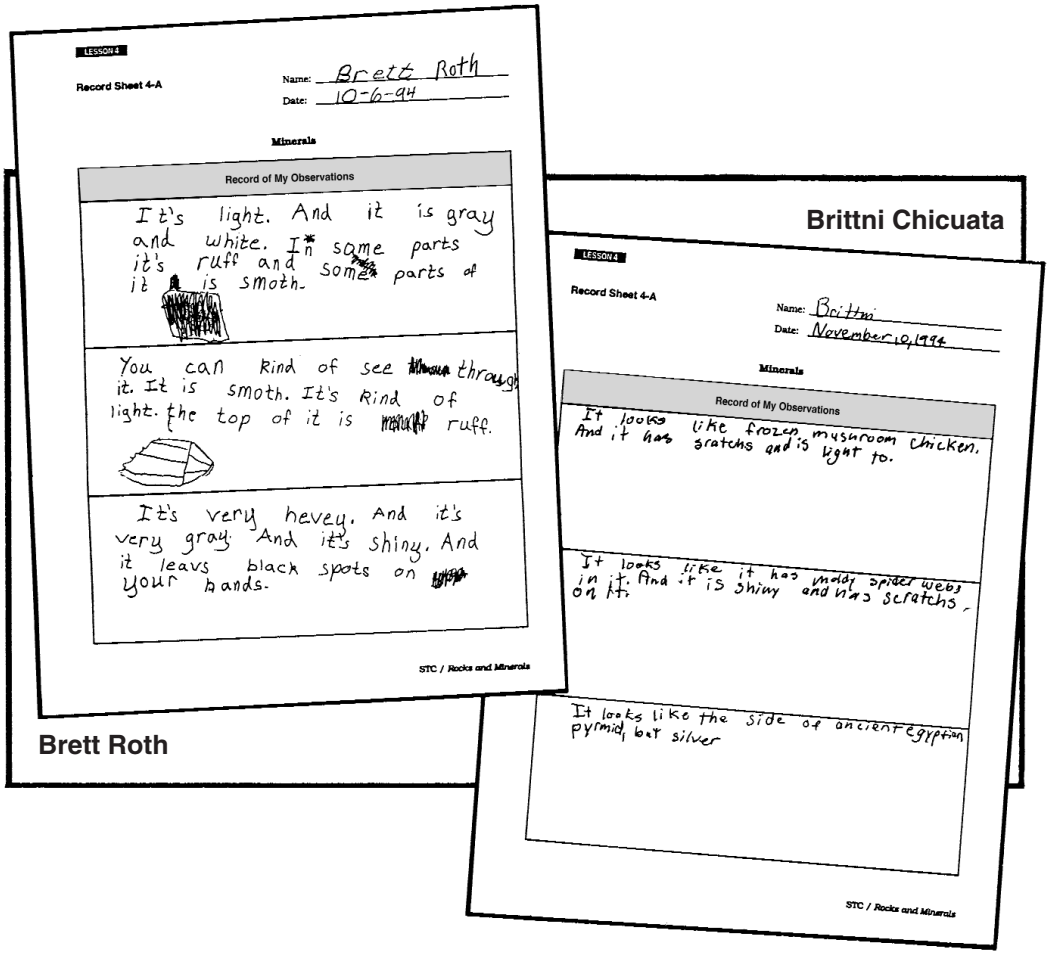
1. Ask the students to review the information they have recorded about rocks on **Record Sheet 1-A: Rocks—Record of My Observations** and in their science notebooks.
2. Ask students to suggest properties shared by all the rocks. Record their ideas on the Post-it® notes. Place the notes inside the circle 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** 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** in this guide (pg. 33 of the Student Investigations book). Wearing gloves, determine the luster of each of the 12 minerals.
6. Read the information about pyrite and gypsum in 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 Investigations book 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

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?

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