Rocks, Minerals, and Gemstones

SCHOLASTIC

Rocks, Minerals, and Gemstones

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an imprint of
SCHOLASTIC
www.scholastic.com

Published by Tangerine Press, an imprint of Scholastic Inc., 557 Broadway; New York, NY 10012

Scholastic Canada Ltd. Markham, Ontario	Scholastic Australia Pty. Ltd Gosford, NSW	Scholastic New Zealand Ltd. Greenmount, Auckland

10 9 8 7 6 5 4 3 2 1

ISBN: 978-0-545-19868-4

Printed in Jiaxing, China

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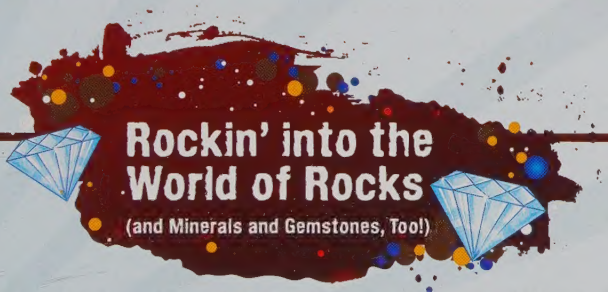


Hey, rock hounds! Get ready to check out the awesome world that's literally under your feet. With this kit, you'll get the scoop on all kinds of cool things about rocks, minerals, and gemstones. You also get to try out some experiments that truly *ROCK*! Of course, you can't become a rock expert without some special equipment.

Rock and Mineral Samples
Your kit comes with quartz, lodestone, and metamorphic rock.

Streak Plate
You'll need this plate for the mineral color activity on pages 16-17.

Tweezers
Use this tool to handle rock samples.

Tray
Keep all of your rock and mineral samples organized with this handy tray.

Sticker Sheet
Keep track of your samples. Put these stickers on your tray to label your rock collection.

Magnifying Glass
Get up close and personal with your samples!

Two-sided Poster
This handy poster helps you identify cool rocks and sparkly gems.

It's a Rock...No, It's a Mineral

So, what exactly are minerals and rocks?

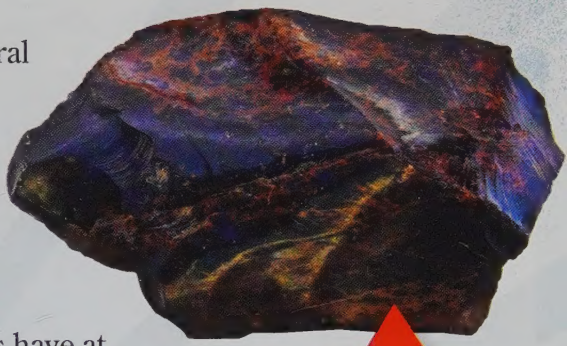
- Minerals are solids that are formed naturally on Earth; they aren't made by humans.

- Most minerals are made up of crystals. A **crystal*** is a solid that's made up of **atoms** repeated in a certain pattern. The pattern in which the crystals are organized is what gives a mineral its individual shape.

- Minerals are made up of certain chemicals. A **geologist**—a scientist who studies rocks and minerals—can tell what kind of mineral he or she is looking at by testing to see what chemicals it's made of.

* Words in bold are defined in the glossary starting on page 24.

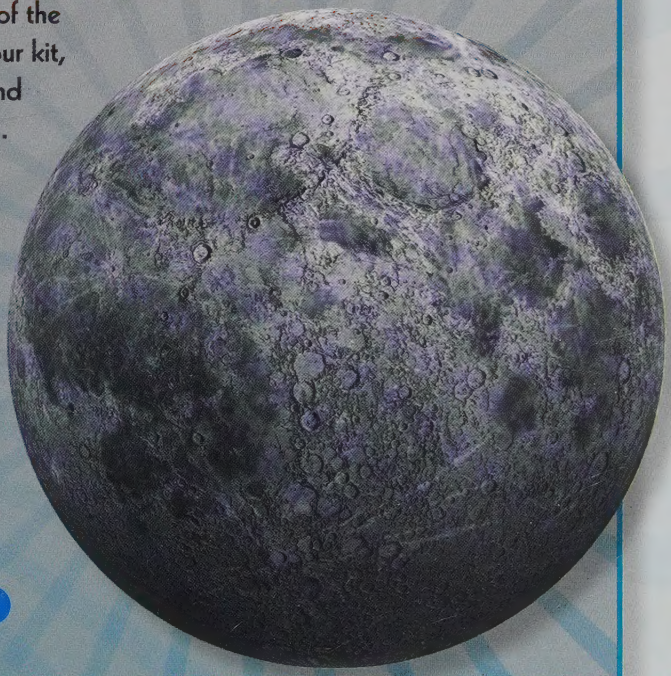
Okay, so that's what a mineral is. But what's a rock? Basically, a rock is any old chunk of solid earth. Seriously! Almost all rocks are made up of minerals. Some rocks contain only one mineral, but most rocks have at least two minerals in them. One kind, obsidian, also known as volcanic glass, doesn't have any minerals in it at all.



obsidian

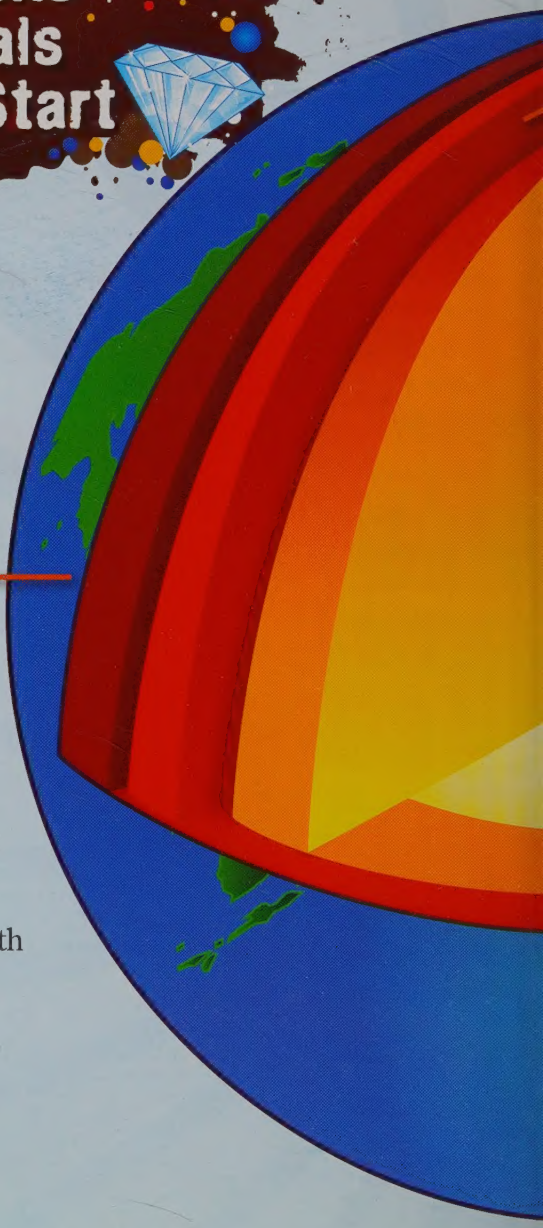
Fast Fact

Quartz, one of the minerals in your kit, has been found on the Moon.



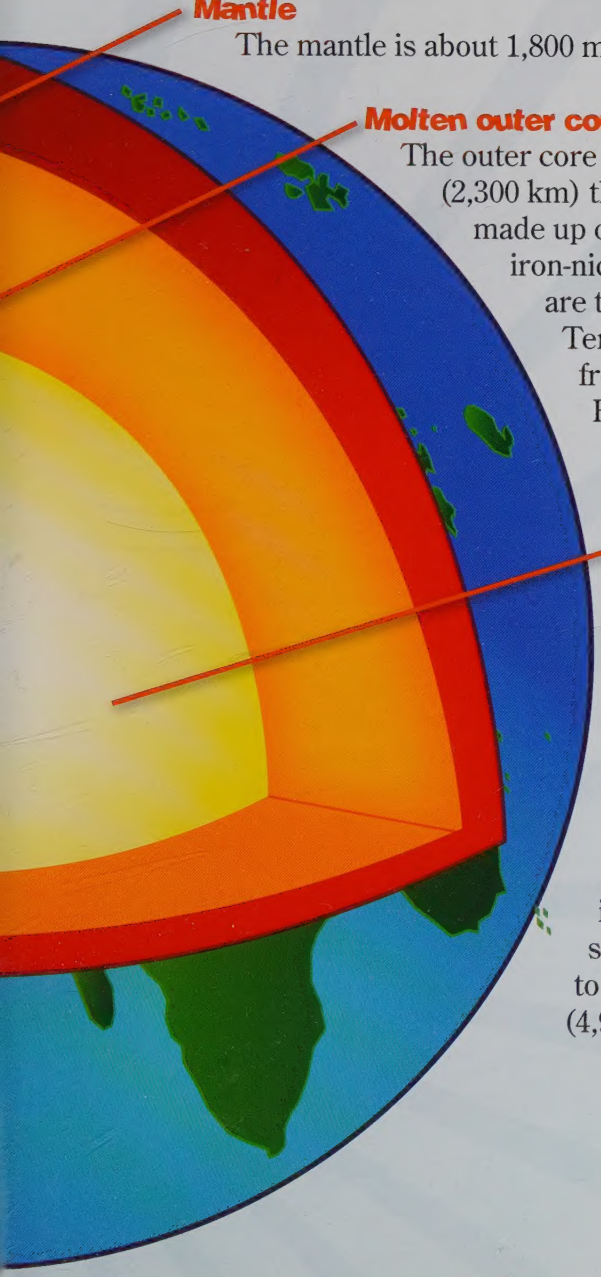
Where Rocks and Minerals Get Their Start

Earth is mostly rock. So, every rock you find was made somewhere in or on our planet! Earth is made up of four layers—the crust, the mantle, the molten outer core, and the core. Take a look at this cross-section of Earth.



Crust

The crust is the rocky outermost layer of Earth. It is what makes up the surface of the continents and the floor of the oceans. Earth's crust is about 25 miles (40 km) thick beneath the continents and about 6½ miles (10.5 km) thick beneath oceans. The ocean's floor is made of basalt, and the crust of the continents is mostly granite.



Mantle

The mantle is about 1,800 miles (2,900 km) thick.

Molten outer core

The outer core is about 1,430 miles (2,300 km) thick. This layer is made up of extremely hot, liquid iron-nickel. Iron and nickel are two chemical elements. Temperatures here range from 7,000° to 9,000° Fahrenheit (3,871° to 4,982° Celsius).

Inner core

Earth's inner core is about 750 miles (1,200 km) thick. It's made up of iron-nickel, too, but there's so much pressure in the core that the iron-nickel is solid metal! Earth's inner core is estimated to be a scorching hot 9,000° to 10,000° Fahrenheit (4,982° to 5,537° Celsius).

And You Thought All Rocks Were the Same

With all the rocks out there, it seems like there must be a zillion kinds. And in a way, there are! Many different chemicals combine to make various kinds of rocks. But even though there's a lot of variety in the way rocks look and feel, every rock falls into one of only three categories: igneous, sedimentary, or metamorphic. Let's take a look at each kind.

Igneous

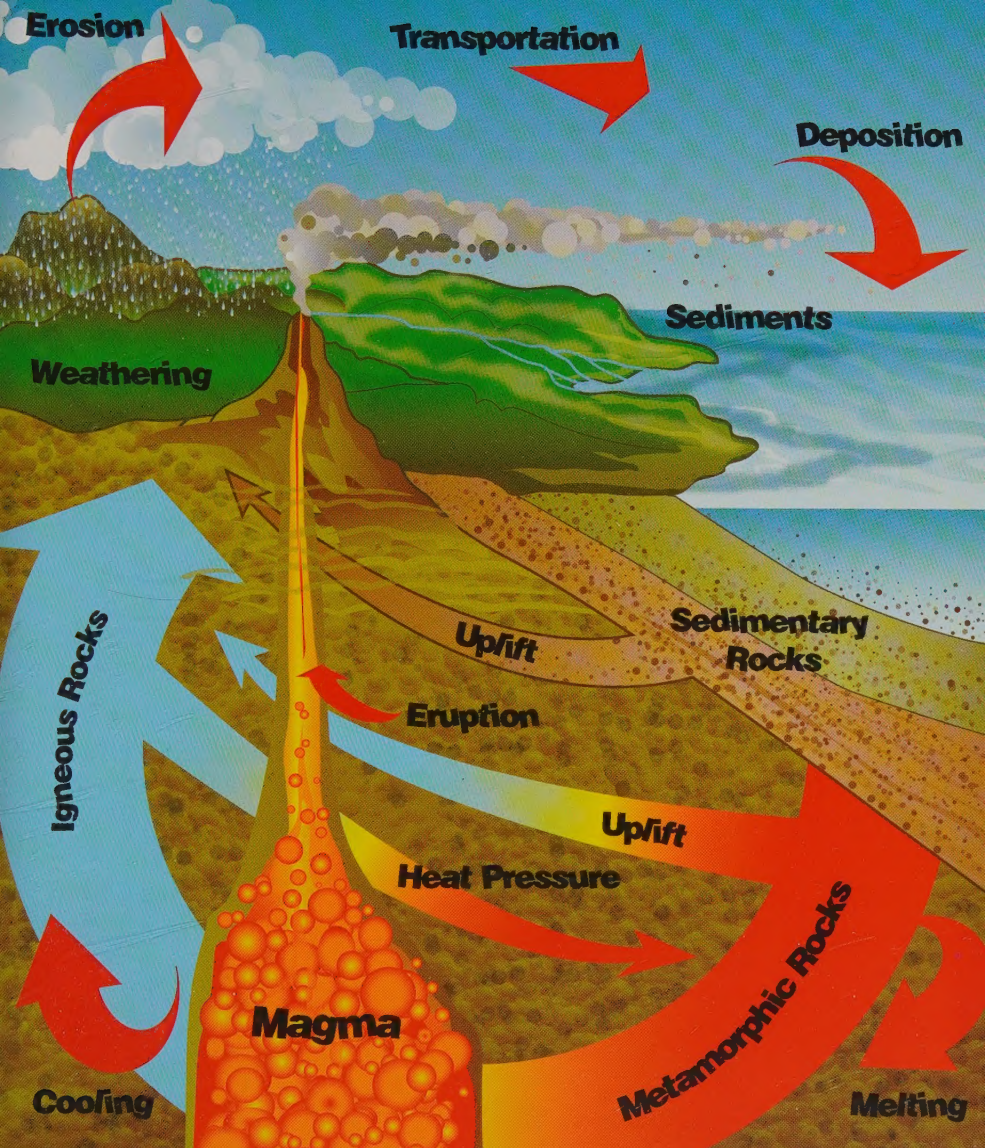
Deep inside the Earth are super-hot **molten** gasses and minerals called **magma**. Sometimes the magma rises and flows out of volcanoes as **lava**. When the lava cools and hardens, it forms igneous rocks such as basalt, andesite, rhyolite, scoria, and pumice.

Sedimentary

Rocks, gravel, and soil get worn down by a process called **erosion**. Erosion usually occurs where there's moving water, like in a stream. As the rocks are carried along the water, they scrape against other rocks and get worn down, forming sediments that get packed down in layers. Over time, they turn into rock. Chemicals in nature, as well as **acid rain**, which is precipitation (like rain or snow) that has high levels of pollution in it, also can cause rocks to erode. Shale, sandstone, and conglomerate are three types of sedimentary rock.

Metamorphic

Extreme temperatures and tremendous pressure inside the Earth can cause rocks to change their appearance. Sometimes, they even take on completely new minerals. These altered rocks are called metamorphic because they've been metamorphosed, or changed. Limestone can turn to marble. Shale turns to slate. And when granite changes, it becomes gneiss.



Rock Cycle

Igneous rocks, sedimentary rocks, and metamorphic rocks are related to each other. This diagram shows the process of how one rock type changes into another over time.

Activity #1.

The Acid Test

What does acid rain do to rocks? Let's see what happens to a rock when you put it in a jar and add vinegar to it.

What You Need

- Marble rock
- Chalk (*a form of limestone—not the kind your teacher uses to write on the board!*)
- Any other rocks you want to test
- Glass jar for each rock you want to test
- Vinegar
- Measuring spoon
- Tweezers in your kit

What You Do

1. Pour two tablespoons of vinegar into each glass jar.

Warning!

If you use the rocks that came in your kit for this activity, you might damage them. To keep your samples looking new, check out your backyard, a garden nursery, or the garden section of your local home improvement store for some rock samples.

2. Using your tweezers, carefully drop the marble rock and the chalk into separate jars. If you're testing other rocks, use the tweezers to put each rock into its own jar of vinegar, too. Wait about five minutes. Do you see anything happening?

What's Going On?

You should have seen small bubbles fizzing on the surfaces of the marble rock and the chalk. (*If you tested other rocks, too, did bubbles form on any of those samples?*) Marble and chalk contain the mineral calcite. When calcite mixes with an acid, such as vinegar, bubbles form. If you were to leave your samples in the vinegar for several days, they would become rounded—or maybe even dissolve completely! This is an example of how acid rain, which is full of harmful chemicals like nitric and sulfuric acid, can harm rocks and other materials in nature.

Grab your magnifying glass and get a good look at the chalk. Can you see the holes?

Fast Fact

Acid rain comes from factories, cars, trucks, trains, and planes. All of these emit polluting fumes, or exhaust, when they're running. This exhaust drifts into the sky and mixes with the moisture in the air. Then, the pollutants comes back down to the ground in the rain or snow.

Activity #2.

My Sediments Exactly!

As you learned on page 6, sediments settle into layers. Let's check out how that works.

What You Need

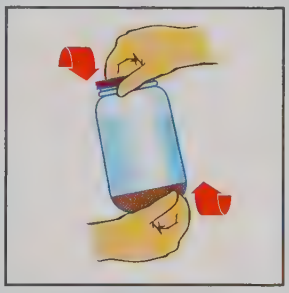
- Clear glass jar with lid
- Water
- Rocky soil (*This is dirt that either has a rocky surface or that is mixed with a hard, crusted layer of rocks and hard dirt. Basically, you're looking for really hard, rocky dirt!*)
- Magnifying glass in your kit

What You Do

1. Fill the jar with water about ¾ of the way up.

2. Put the rocky soil in the jar until it's about 4 inches (10 cm) thick. Put the lid on the jar and close tightly.

3. Gently shake the jar, and then let it set for several hours. Pull out your magnifying glass for a closer look. What do you see?



What's Going On?

When sediments are transported in moving water by erosion, they are often deposited in layers. In your jar, you should see gravel at the bottom, sand grains in the middle, and mud at the top. This is how these sediments get deposited in nature. The heaviest pieces fall to the bottom and are squeezed by the pressure of the objects above them. Over time, this pressure causes the pieces on the bottom turn to rock.

Fast Fact

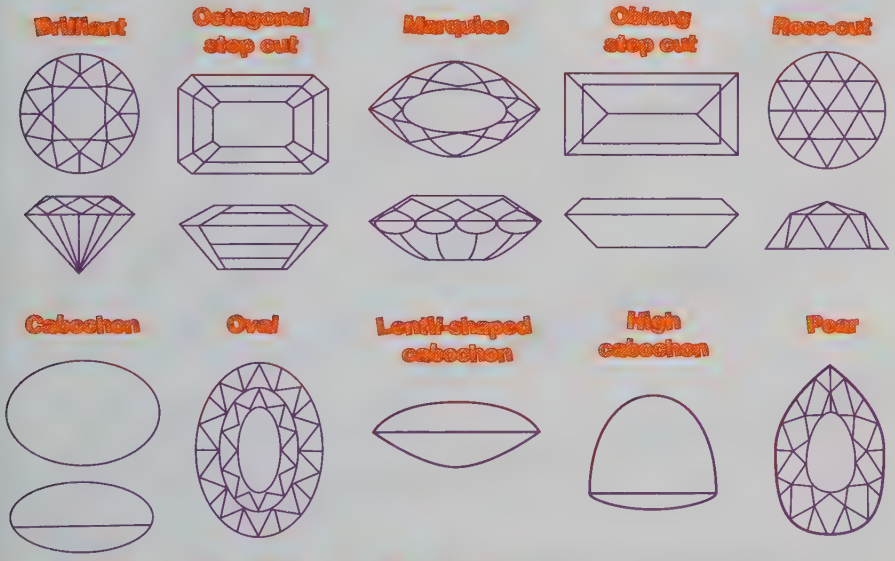
It takes millions of years for sediment to become rocks. The Grand Canyon is made up of mostly sedimentary rock. The bottom layers are more than a billion years old! Sedimentary rock can be found covering about 75 percent of the earth's land areas.

Gemstones: Now That's Some Serious Bling!

Would it surprise you to learn that gemstones (*you know—rubies, diamonds, emeralds, and the like*) are minerals? Many minerals are beautiful to look at, but they break easily. Not gemstones! These beautiful stones are hard, which is why they're used to make jewelry.

There are two kinds of gemstones: precious and semiprecious. Precious gemstones are the most valuable; they include diamonds, rubies, emeralds, and sapphires. They're made from **transparent**, or see-through, crystals. Semiprecious stones are usually made from quartz, which is **translucent** (*light passes through, but you can't see through*), and turquoise or malachite, which are **opaque** (*light can't pass through*).

Gemstones can be cut into a variety of shapes, such as:



Fast Fact

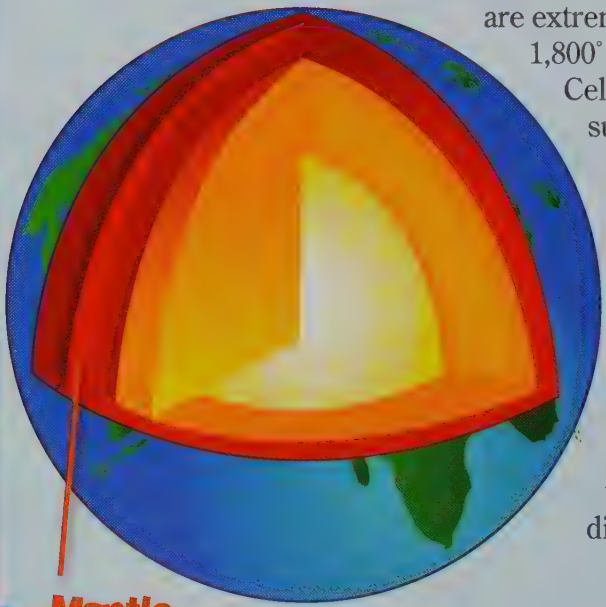
The size of a gemstone is always measured in carats. The word carat comes from an Arabic word meaning "bean" or "seed." A long time ago, the weight of a gemstone was compared to the weight of a seed from the carob tree. A carat is 0.0071 ounces (200 milligrams).

Diamonds, Diamonds

Most gemstones are made up of several different ingredients, like silicon, oxygen, calcium, and iron. Not diamonds! These rare stones have just one ingredient—carbon. And it's pretty amazing how carbon, a soft, common material that's found everywhere on and in the Earth, can form diamonds.

Here's how it happens:

In the Earth's mantle, temperatures are extremely high—about 1,800° Fahrenheit (982.2° Celsius). Pressure is super-high, too—about 40,000 times greater than what it is on the Earth's surface. This combination of high temperatures and extreme pressure force the carbon atoms in the mantle to crystallize, or bond together, forming diamonds.



Mantle

Fast Fact

One of the most famous gemstones in the world is the Hope Diamond. This blue beauty was discovered in India sometime during the 1600s. It weighs 45.52 carats and is on display at the Smithsonian Institution in Washington, D.C.

So, how do we actually get diamonds? They are moved up to Earth's crust through volcanic activity. Diamonds are found in kimberlite rock in the neck of certain volcanoes. Miners use large machines to blast and crush the rock to get to the diamonds.

Fast Fact

One of the largest diamonds ever found is the 3,106-carat Cullinan diamond. It was cut into nine large gems and about 100 smaller ones. The two largest stones are now part of the British crown jewels.

Because diamonds are so hard, they aren't damaged by all the blasting and crushing. In fact, diamonds are the most valuable gemstones because they're the hardest minerals—and because it's so difficult to get to them!

Fast Fact

When it comes to diamonds, the talk isn't always pretty. Sometimes, the gemstones are illegally traded to fund fighting in war-torn countries. These diamonds are called *conflict diamonds* or *blood diamonds*. Thanks to the efforts of the United Nations and the global diamond industry, far less than one percent of diamonds found in stores are conflict diamonds.

Color and Streak

Minerals come in all different colors. And while sometimes you can use color to figure out what kind of mineral you have, colors can fool you! Many minerals are a certain color when they're buried in the Earth, but once they're dug up and are exposed to air, they may change color. So, in order to figure out what a mineral's true color is, and therefore what kind of mineral you've got, you need to do a streak test.

Activity #3. True Colors

Grab some mineral samples and see if you can figure out what they are by revealing their true colors.

What You Need

- Minerals in this kit, or some that you find outdoors
- Streak plate in this kit
- Piece of paper
- Pencil

Warning!

DO NOT raid your mother's or sister's jewelry box for this activity! Use the mineral samples that came in your kit, or head outside to look for some stones. You also might be able to score some mineral samples in the garden department of your local home improvement store.

What You Do

1. Rub the mineral on the streak plate.
2. Notice the color that the mineral leaves on the plate. That's the mineral's true color!
3. Record your observations for each mineral on the piece of paper.

What's Going On?

A streak test is one of the first things you can do to figure out what kind of mineral your sample is. Don't get discouraged. The samples in your kit may or may not leave a colored streak. Many minerals leave behind a white or colorless streak. You'll just need to do more tests on those to figure out what they are!

Some Minerals and Their Colors

Mineral	Color	Streak Color
Hematite	Black or dark red	Reddish brown
Azurite	Light or dark blue	Light blue
Turquoise	Blue, green, blue-green	Bluish white
Calcite	White, pink, yellow, brown	White
Apatite	White, yellow, green, red, blue	White
Fluorite	White, yellow, green, red, blue	White
Quartz	Brown, colorless, violet, gray, yellow	White

Note: You and your parents can check the internet for more information about other minerals and their streak colors.

Mohs Hardness Scale

Another way to tell what kind of mineral sample you have is to test its hardness. A mineral's hardness refers to how easily its surface can be scratched by other materials. In fact, hardness is one of the most important tests! Remember what you read about diamonds? One of the reasons why they're so expensive and valuable is because they're the hardest minerals. The harder the mineral, the more valuable it is.

The Mohs Hardness Scale was invented in the early 1800s by a German scientist named Friedrich Mohs as a way to rank minerals by hardness. Check it out:

Fast Fact

Diamonds aren't just for jewelry! Because they're so hard, diamonds are used to make drill bits that help miners cut through solid rock. These diamonds are called *industrial diamonds*.

Warning!

Once again, DO NOT use anyone's jewelry for this activity! You easily could damage an expensive piece. Head outside to find your samples, or take a trip to your trusty home improvement store for some.

Diamonds can scratch any mineral below it, but no other mineral can scratch diamonds. Corundum can scratch all of the minerals ranked lower, but it can't scratch diamond. Topaz can scratch the minerals below it, but it can't scratch corundum or diamond. Talc, the softest mineral, can't scratch any other mineral. Chances are you probably won't come across any diamonds or topaz while you're rock-hunting in your backyard. Not to worry! You can also use some common household items to figure out the hardness of minerals that you find.

Item	Hardness
Fingernail	2½
Copper penny	3½
Glass	5 to 5½
Iron nail	6

Take a look at the chart above. Let's say you found a mineral sample, and you're able to scratch it with your fingernail. That means your sample has a hardness of less than 2½. If you're able to scratch a sample with a copper penny but not with your fingernail, the mineral's hardness is somewhere between 2½ and 3½. Easy stuff, right?

CAUTION! CAUTION! CAUTION! CAUTION! CAUTION!

An iron nail has a sharp point that can leave a nasty scratch. Be sure to ask a senior rock hound (*a.k.a., a parent*) for help using the nail to do the scratch test.

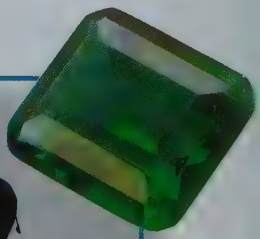
Luster and Density and Magnetism Oh, My!

As you've seen, geologists have several ways to tell different minerals apart. But they can also figure out what mineral they're dealing with by observing luster, density, and magnetism. First, let's look at **luster**. Have you ever stopped to pick up a mineral because it was shiny? If you have, you've studied luster. A mineral's luster is the way light reflects off its surface. Some minerals are super-shiny and almost look like mirrors. Others may look waxy, silky, or pearly. Luster is just one of the qualities that make a mineral a gemstone.

Density is how heavy something is compared to the amount of space it takes up. Suppose you have two mineral samples, each the same size. Whichever one is heavier is also the denser mineral. Heavy, dense minerals usually have some kind of metal in them.

Speaking of metal, **magnetism** is the attraction of a magnet to a mineral because the mineral contains the metal iron. Some minerals have so much iron in them that they can be picked up by a strong magnet!

Fast Fact



An 840-pound (381-kg) emerald was discovered in Brazil in 2001. That's about as heavy as four baby elephants!

Activity #4.

It's Magic! (Well, Magnetic, Anyway)

Test some mineral samples to see if they're attracted to a magnet.

What You Need

- A magnet
- Mineral samples in your kit
  (and other samples you'd like to test)

What You Do

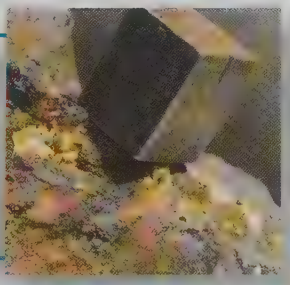
Hold the magnet near your mineral samples, one at a time. Do you notice anything happening?

What's Going On?

If the magnet is being pulled toward any of your minerals, you know you've got a sample that contains iron. (*Keep in mind, though, that if a mineral has only a small amount of iron, the attraction may not be strong enough to move the mineral toward the magnet.*) The general rule is that the darker a mineral is, the more likely it is to have iron in it.

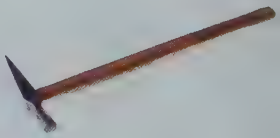
Fast Fact

Lodestone, a magnetic mineral, was used as an early compass. a compass's relationship to magnets.



Box O' Rocks (and Minerals!)

So, now that you know all about rocks and minerals, maybe you'd like to start collecting some yourself. Great! Here's a list of things you'll need to become a bona fide rock hound:



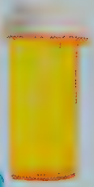
Rock hammer—A rock hammer has a square head and a chisel (*pointed*) edge. Use the square head to break rocks apart and the chisel edge to dig through layers of soft rock.

Safety goggles—Always wear safety goggles when you're using your rock hammer, as pieces of the rock can fly off and cause an injury.

Magnifying glass—Keep this tool handy to check out your samples.

Small squirt bottle for vinegar—Check to see if any of your samples contain calcite by squirting a little bit of vinegar on them. If the vinegar starts to fizz, the sample is made of calcite.

Iron nail, penny, and glass without sharp edges—Use these to conduct hardness tests.



Small container with lid—An empty pill bottle is perfect for storing fragile rocks, like crystals.

Collection bags (*cloth or heavy plastic*)—Add your samples to the bag as you're out collecting.

Index cards—Use index cards to write down information about your samples, such as where and when you found them.

Empty egg carton or small box—This is a great way to store and organize your rock collection. Be sure to use the stickers from this kit to identify your rocks.

Rocks and minerals poster in your kit—Your poster can be a great tool to help you start identifying different samples that you find.

Rock collecting can be a lot of fun! Here are just a few guidelines to keep in mind:

- Safety first! Never go exploring on your own. Tell your parents where you're going to study rocks. Do not visit unfamiliar territory without a guide.
- Always ask first before collecting on private property.
- When you're looking for rocks, check out places where rocks are exposed, like river banks, canyons, and the base of hillsides.
- Geologists take careful notes about their findings. You should, too. Be sure to keep records of where you found your samples. Include photos or maps of the locations. Also, write down the results of hardness and streak tests.
- If you're having trouble figuring out what kind of rock you have, hop online with a parent to check out rock websites, or take a trip to your local library to learn more about your sample.

Fast Fact

You might want to keep all of your rock-hunting tools in a small bag or backpack. That way, you can take it wherever you go!

Glossary

Acid rain: Precipitation, like rain or snow, that has high levels of pollution in it

Atoms: The building blocks of everything in nature

Crystal: A solid that's made up of atoms in a repeating pattern

Density: A measure of how heavy something is for the amount of space it takes up

Erosion: The moving of pieces of rock that causes other rocks and materials to wear down

Geologist: A person who studies rocks and minerals

Lava: Magma that has come out of a volcano

Luster: The way light reflects off the surface of a mineral

Magma: A mixture of super-hot minerals and gasses deep inside the Earth

Magnetism: The attraction of a magnet to a mineral that contains iron

Mineral: A solid that occurs naturally in the Earth, has a definite crystalline structure, and has a defined chemical formula

Molten: Melted

Opaque: The inability of light to pass through a mineral; an opaque
gemstone is one through which light can't pass, like turquoise.

Rock: Any large chunk of solid earth

Sediment: Rocks, gravel, and soil that are worn down by erosion

Translucent: The ability for light to pass through a mineral; a translucent gemstone is one through which light passes, but you can't see through it, like quartz.

Transparent: The ability to see through something; a transparent gemstone is one that you can see through, like a diamond.

Rocks, Minerals, and Gemstones