

What Makes a Mineral?



Have you ever found a rock and wondered what it was? Rocks are made up of minerals. So if you were a geologist, the first thing you'd do is figure out which ones make up the rock. For example, granite is rock made up of the minerals quartz, mica, and feldspar.



This granite rock has different minerals in it. You can tell them apart by their different colors and shapes.

What Is a Rock?

A rock is a naturally occurring solid that is made up of minerals. Most rocks are a mixture of different types of minerals, and some are all one type.

You can think of a rock as a cookie, and ingredients like cookie dough and chocolate chips as different kinds of minerals. You could combine the two ingredients (minerals) to make a chocolate chip cookie (rock), or just use the cookie dough (a mineral) to make a sugar cookie (rock).

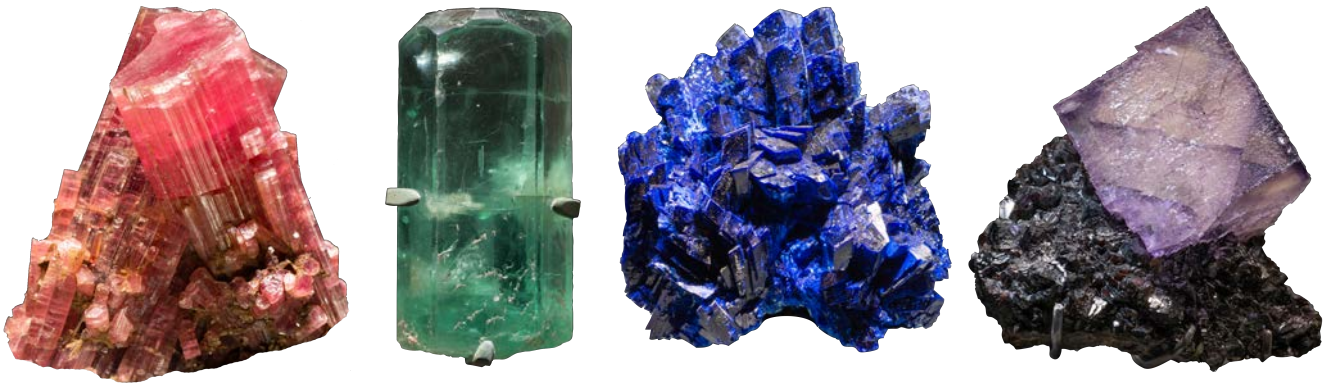
But What Is a Mineral, Anyway?

There are four things that make a mineral a mineral. It has to be naturally occurring. It has to be solid. It has to be inorganic (not produced by living things). And it has to be crystalline.

A mineral is always made of the same set of elements. Elements are the basic building blocks of matter. Everything on Earth is made of elements. Even you! For example, the mineral quartz is made of the elements silicon and oxygen. In minerals, the elements are arranged in a very orderly way. The arrangement is called a crystalline pattern. And the shapes that minerals form in are called crystals.

What Are Minerals Like?

There are over 4,000 known minerals, and new ones are still being discovered. Minerals come in many different colors, sizes, and shapes. They can be as blue as the sky, red as blood, green as grass, clear as water, or black as coal. They can be all colors of the rainbow! Usually, minerals form small crystals inside of rocks. But sometimes they form large crystals. They can be too tiny to see, or too big to get your arms around. And they can be cubic, like boxes, or hexagonal, with six sides, or monoclinic, like stacks of paper. Those are only a few of the possible crystal shapes!



Minerals come in all different colors, shapes, and sizes!

Left to right: tourmaline (pink), beryl (green), azurite (blue), fluorite (purple), and sphalerite (black)

Mineral Properties

What gives a mineral its special properties, like color and crystal shape? One factor is the unique set of elements that make up the mineral. The mineral fluorite is made of the elements calcium and fluorine. It forms cube-shaped crystals because of the way the calcium and fluorine atoms combine.



See those blue cubes? They are fluorite crystals. The crystal shape of the mineral fluorite is cubic.

There are other things that can affect a mineral's appearance. The environment in which it formed can affect its appearance. For example, some quartz crystals form deep underground, while others form closer to the surface. The crystals that form deep underground are likely to be larger than those that form closer to the surface. The same mineral can also look different depending on what other chemicals are present when it forms. For example, "pure" quartz is clear. But if traces of iron are in the environment when the quartz forms, then it can be purple.



See the two colors, clear and purple? Both are quartz crystals. Purple quartz is called amethyst.

With so many minerals, geologists need a system to identify them. Geologists use properties to sort and classify minerals into groups. These properties include color, streak, hardness, and luster. The geologists observe a mineral's properties. They record each one. Then they identify the mineral based on this observed set of properties.

Let's take a look at some of the properties geologists use to identify a mineral.

Crystal Shape

Minerals form in repeating patterns called crystals. These repeating crystal patterns determine a mineral's shape. The patterns form because the elements that make up different minerals fit together in different ways. They fit together like Lego toys, or like stacks of fruit at a grocery store. The shapes of the crystals depend on which elements the mineral is made of.



See all the different crystal shapes?
Each one is a different mineral.

Color

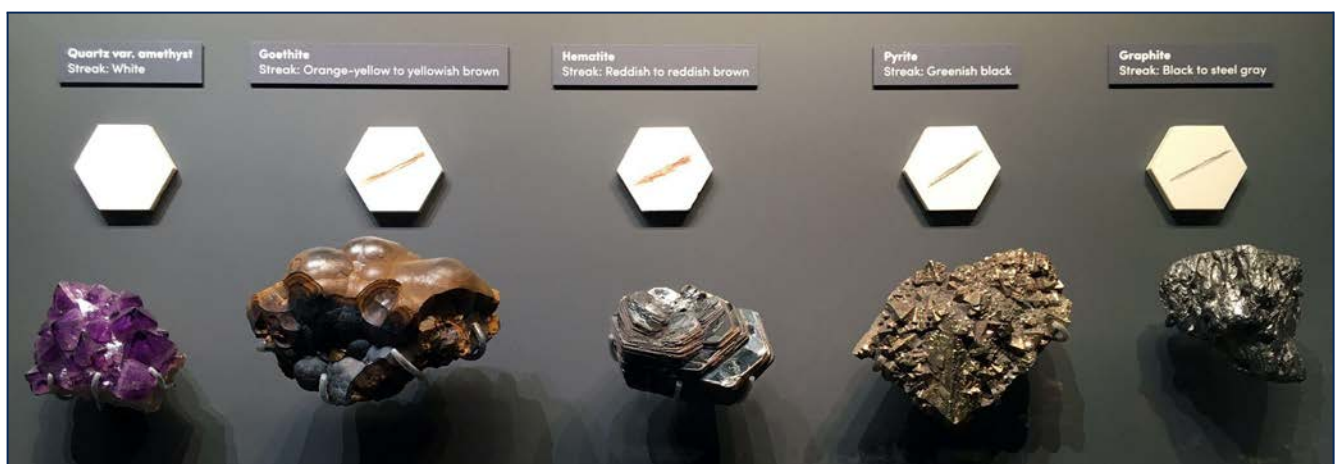
A mineral's color is easy to describe, but it isn't always a good tool for identification. That's because sometimes the same mineral can be found in a range of colors. Quartz can be anywhere from clear or white to purple, pink, and even black! Still, geologists record a mineral's color. Later, this can help them figure out where and how the mineral formed.



See all the different colored crystals? They are all quartz crystals.

Streak

A mineral might come in many colors, but its streak is always the same. Streak is the color a mineral leaves behind if you scratch it against a black or white ceramic tile. It's a fine powder of tiny bits of the mineral. A mineral's streak can be different from its color. Golden pyrite leaves a greenish-black streak. But a particular mineral's streak is always the same, no matter what its color. You could test clear, purple, and black pieces of quartz, and the streak will always be white.



See the streaks on the white tiles? They show the colors of different mineral powders.

Hardness

To test a mineral's hardness, a geologist could try to scratch it with different objects of known hardness, such as pennies, glass, and fingernails. If the object leaves a scratch, it's harder than the mineral. If it doesn't, the mineral is harder. Hardness is measured on a scale from one to ten, from softest to hardest. Talc is a one. It's so soft, even a fingernail could scratch it. Diamond is a ten. It's the hardest mineral, so nothing leaves a scratch. A mineral will scratch another mineral that is softer. Diamond (10) scratches quartz (7), quartz scratches pyrite (6), and pyrite scratches talc (1).



Talc is so soft that even a fingernail can scratch it.

Luster

Another way geologists tell minerals apart is luster. Luster describes how a mineral reflects light. That's how shiny or dull it is. Minerals might shine in different ways. Pyrite is shiny like a metal. Quartz is shiny like glass. Some minerals don't shine at all. Talc looks pearly.



Pyrite has a metallic luster.

Identifying Minerals Using Properties

When geologists study a mineral, they record its properties in a table. Then they compare those properties with known minerals.

Look at this table of three known minerals.

Mineral	Color	Luster	Hardness	Streak	Common Crystal Shape
Quartz	Clear, white, gray, black, pink, purple	Glassy, shiny	7 (hard)	White	Six-sided crystals with sharp points at the ends (hexagonal)
Talc	White	Dull, pearly	1 (very soft)	White	Can form flat crystals (monoclinic or triclinic), but often found in chunks
Pyrite	Gold, yellow	Metallic, shiny	6 (hard)	Greenish, black	Box-shaped crystals (cubic)

If a geologist finds a shiny mineral with boxy crystals and a hardness of six, what could it be?

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