

MINERALS

What Is a Mineral?



A mineral, by definition, must meet **four criteria**. It must:

- be a naturally occurring substance
- be a solid
- have an ordered atomic structure
- have a definite chemical composition

A rock, by definition, is a solid mass of one or more minerals (or mineral grains, as in the case of coal).



PREVIEW

Please login or register to download the printable version of this study guide.

www.newpathlearning.com

it cannot
one or
h as

How We Identify Minerals

Minerals are identified based on their physical properties. There are a number of physical properties that can be easily tested in the laboratory. The results can be compared with charts of minerals' physical properties in order to identify an unknown mineral sample. Scientists use these physical properties to determine a mineral's identity.

1. **Hardness.** A mineral's hardness is determined by comparing the mineral to the known hardnesses of the minerals in the Moh's Hardness Scale. From softest to hardest, the minerals on the Hardness Scale are as follows: 1=Talc, 2=Gypsum, 3=Calcite, 4=Fluorite, 5=Apatite, 6=Orthoclase Feldspar, 7=Quartz, 8=Topaz, 9=Corundum, 10=Diamond. An unknown mineral that is harder than fluorite but softer than apatite has a hardness between 4 and 5.

2. **Specific Gravity** is a measure of the density of a mineral. The density is determined by comparing the mass of the mineral with the mass of an equal amount of water.
3. **Streak** is the color of a mineral when it is crushed to a powder. This is found by rubbing the specimen on a piece of unglazed porcelain. Minerals with a hardness greater than 7 do not leave a streak.
4. **Cleavage** is a description of how a mineral breaks on flat planes. For example, galena breaks into cubes (cubic cleavage). Fluorite breaks into diamond shapes (octahedral cleavage).
5. **Fracture** is a description of how a mineral breaks when it doesn't naturally break into flat planes. Hackly, conchoidal (shell-shaped), earthy, and irregular are some of the fracture descriptions.
6. **Color** is sometimes used to help identify a mineral. This is helpful for some minerals. But other minerals occur in so many different colors that color ultimately is not the best property to use for identification.
7. **Luster** is a description of how a mineral reflects light. Some minerals have a metallic luster (also called opaque), while others are glassy, greasy, or pearly.
8. **Crystal System** is a description of the internal arrangement of the molecules in the mineral. The crystal systems are determined by the internal arrangement of the molecules in the mineral.



PREVIEW

Please login or register to download the printable version of this study guide.

www.newpathlearning.com

There are also some interesting physical properties that are unique to some minerals. When weak hydrochloric acid is applied to calcite, a chemical reaction causes the specimen to fizz. Hematite always has a deep, blood red streak. Clear calcite breaks a single ray of light into two in a physical property called double refraction. Magnetite and lodestone are magnetic.

Lesson Checkpoint:
How many different mineral species are there?

How Do Minerals Form?

Minerals form in a wide variety of geologic environments. Some, like garnet, asbestos, talc, and kyanite, form as a result of intense heat and pressure present during the creation process of the mineral.



GARNET

Other minerals form from liquid rock (magma) as the magma cools. As the magma cools, ions in the magma combine to form specific minerals.

Some minerals form (like tourmaline)



Please login or register to download the printable version of this study guide.

www.newpathlearning.com

nesium
gnesium,
e



Amethyst

Yet another group of minerals form as ocean water evaporates. As the water evaporates, the concentration of dissolved minerals gets higher and higher until the minerals start to precipitate and crystallize out of the ocean water. The most common mineral to form this way is halite (rock salt). Another precipitate mineral, as these are called, is gypsum.

Lesson Checkpoint:
What is the mineral name for rock salt?

Our Mineral Resources

Very few minerals are mined and used as they are. Nearly all mineral resources need to be processed to one degree or another. Rarely, some deposits can be used as is. The native copper found in Michigan's Upper Peninsula can be used with very little processing, for example. By comparison, the massive copper ore deposits of Arizona must be processed to remove the copper from the copper minerals.

The concentration of the desired element or material in an ore deposit can determine whether the deposit is useful or not. Usually it is the value or price of the desired mineral that determines whether or not it is worth it for a company to mine the mineral. If the price of silver rises, silver ore with lower concentrations of silver can be mined for a profit. If the price is low, however, a company could lose money mining the silver ore.

In most cases, the reserves of mineral materials in the Earth are sufficient to supply our needs. There is little to no danger of running out of quality minerals. For example, sulfuric acid is made from sulfur, which is abundant in the Earth's crust.

The more minerals we use, the more we need to mine. This can be an environmental problem. Reclaiming land and planting trees are ways to help. Also, in many cases it is proving to be more efficient to recycle previously used materials rather than producing them from raw ores. For example, there are now companies that strip old computers of gold used in the electronics components. Renewable resources are increasingly important as the world's nations consume larger and larger quantities of all commodities.

How Are Minerals Used?

It is said that if a resource is not grown, it is mined. Many of the commodities we consume every day are mined from rocks and minerals. Many are physically processed to be useful. For instance, gypsum is used to make wallboard for buildings. It is cleaned and processed into plaster that is then formed into the wallboards.

A white rectangular box with an orange border containing a preview message. It features the NewPath Learning logo, the word 'PREVIEW' in blue, and text asking the user to login or register to download a printable version of the study guide, with the website URL www.newpathlearning.com.

 **PREVIEW**

Please login or register to download the printable version of this study guide.

www.newpathlearning.com



On the other hand, many minerals are chemically processed for desired elements or compounds within the mineral. For example, the element fluorine found in the mineral fluorite is removed and combined with other compounds to make fluoride for toothpaste. Zinc is chemically removed from the mineral zincite. Copper is removed from a variety of copper ore minerals including malachite and cuprite. Lead is removed from galena. Sulfur is sometimes mined as a pure element, but more often it is removed from sulfide minerals like pyrite ("Fool's Gold").

Minerals

If you were to look at a long list of minerals, you would find many different materials.

- Copper and cuprite are used to make electrical wires.
- The steel used in cars is a mixture of iron and other metals to make it strong. The iron comes from hematite and magnetite.
- Glass windows and drinking glasses are made from quartz sand which is melted and mixed with other materials to give the glass its desired properties.
- Gold is used in computers, cell phones and other electronic equipment because electrical connections made from gold conduct electricity extremely well and do not corrode.
- Items made out of aluminum, like pots and pans, come from the mineral bauxite.
- Table salt is the mineral halite.
- The paint on the walls contains many minerals including talc, hematite, magnetite, mica, kaolin, and barite.
- A television set alone contains about 35 different minerals and mineral products including quartz (for glass and for silicon for computer chips), copper (wire), gold (electrical connections and circuit boards), and the elements strontium and yttrium (from the minerals strontianite and the rare mineral gadolinite, respectively).



Please login or register to download the printable version of this study guide.

www.newpathlearning.com

This is only a small list of the minerals around you every day in your home.

Even more minerals are consumed by industry to make the products you use at home, at school, and at work. Sulfur is one of the most important industrial minerals. It is used to make rubber for tires and to make sulfuric acid. Sulfuric acid is important in many manufacturing processes. Sulfur is also used in making paper, fertilizer, plastics, drugs, and insecticides. Fluorite is used as a flux when making steel. A flux is a substance that lowers the melting point of another substance. Steel is made from iron and other metals to make cars, buildings, bridges, and machinery. Galena is the most important source of lead which is used to make batteries and solder. Feldspar is used to make ceramics and electrical insulators, and is used in the manufacture of glass, roofing materials, and some abrasives. Talc is used to make paint, ceramics, wall tile, and baby powder. As you can see, nearly every aspect of our lives relies in some measure on minerals.



PREVIEW

Please login or register to download the printable version of this study guide.

www.newpathlearning.com