What are Minerals

How important are minerals to you? Minerals are very important, actually. Almost everything you own and use was manufacture using as least some minerals. You own or encounter many things made from minerals every day. Ceramic, metallic, and even some paper items are examples of products that are derived from or include minerals. Metal lockers, bookshelves, electronic devices, silverware, plate ware, pencils, cars, machines, sidewalks, paints, musical and precision instruments, materials to construct your home and the glass in windows are all comprised entirely of or at least some minerals. Minerals come from the ground, the rock or earth we walk on.

	
The bike, the building, the bike rake and the color in their clothes and backpacks contain minerals.	Azurite mineral with a blue copper element used for pigment dye and jewelry.

Definition of a Mineral

A mineral is a **naturally occurring**, **inorganic solid** with a definite **chemical composition** and an **orderly geometric arrangement of atoms**. About 4,000 different minerals are found on Earth, and they all share these four characteristics.

Naturally occurring means minerals are found and made in nature, not laboratories.

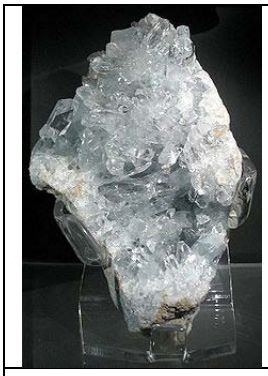
Inorganic means minerals are not alive like a bacteria or frog; they are non-living, not-organic. Inorganic also means minerals are not based on carbon, like living things.

Chemical composition means certain atoms combine to form minerals and each of the 4,000 minerals has its own chemical composition. NaCl is the chemical composition of the mineral salt.

Orderly geometric arrangement of atoms means atoms form a geometric structure on the atomic level. There are 6 such geometric structures that minerals from by. Occasionally a mineral will maintain the atomic structure into a large macroscopic size and you can see the

geometric shape.

These geometric shapes are called crystalline shapes or crystals. Hence a mineral stone with a visible crystalline shape is called a **crystal**.

		
Celestine with chemical composition SrSO4.	Rocks with minerals in them: epidote-green, feldspar-red, quartz-white.	A quartz crystal is a mineral.

Some Minerals look like Crystals (but all minerals are crystalline on the atomic level)
Most minerals maintain their geometric shapes only on a very small scale and you can't see the atomic shapes.

When mineral rocks maintain their geometric-crystalline shape on a large scale so we can see it we refer to these minerals samples as "crystals". In actuality all mineral stones and mineral deposits in the earth have crystalline structure on a very small scale that may require a magnifying glass or microscope to see. If we cannot see the very small crystalline structure of the mineral we refer to it as a stone or rock.

	
This quartz crystal demonstrates to the eyes it atomic crystalline structure.	This lazulite has crystals in it but not big enough to easily see. Some mineral's crystals are small and can't be seen by the eyes.

Rocks actually are made of two or more mineral compositions.

How Minerals Form in the Earth

Minerals are formed by magma cooling, water drying up or precipitating out of solution. Deep in the earth the rock is so heated that it melts in to a molten form called magma. As the magma moves it eventually cools over a long period of time. The elements in the magma form into mineral compositions as it cools. If the magma cools slowly then crystals will appear in the rock formed. If magma cools quickly then the crystals that form are too small to see with our eyes. When magma comes to the surface of the earth by volcanic eruptions it is then called lava. Lava cools so quickly that we cannot see its crystals.

	
Granite is a mineral that formed by magma under the earth cooling slowly so you can see its crystal specs.	Magma on the surface of the earth is called lava. It cools quickly so the minerals in its rock have very small crystals.

Minerals also are contained in microscopic form in water. When the water evaporates the minerals are left behind and can form crystalline minerals. Or if water has such a large concentration of minerals in it then the minerals can just form a crystalline substance right there in the water. This process is called precipitation of minerals.

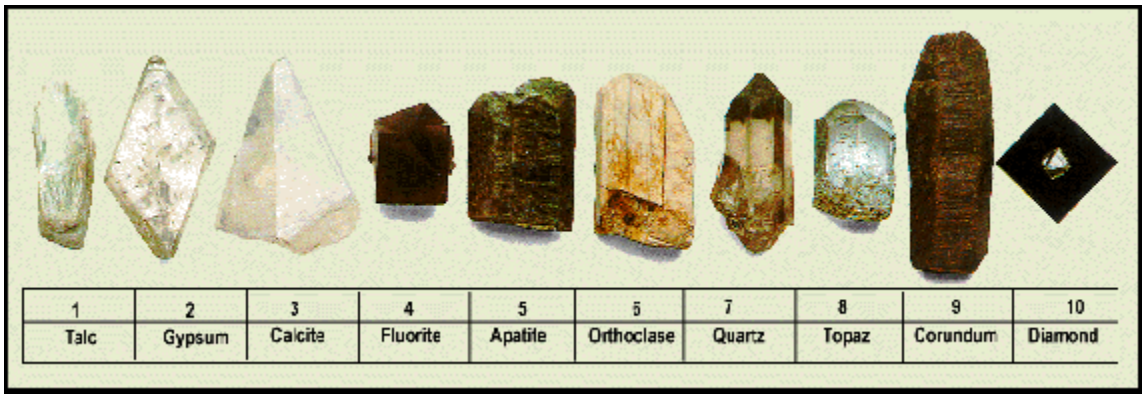
		
Some minerals precipitate from water.	Geode crystals formed from the water once in the space of this geode.	Crystals come from magma cooling or water evaporating or minerals in water forming.

Properties of minerals used for Mineral Identification

Minerals are identified by recognizing their properties. There are five main properties that minerals have that are used to identify them.

Hardness

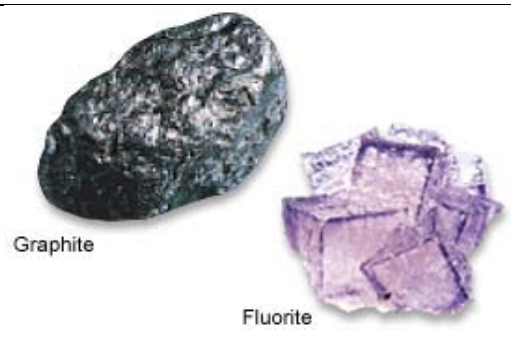
Minerals have a range of hardness from very soft to very hard. This range of hardness is represented by the Mohs Scale. In the Mohs Scale talc which is very soft is rated 1, and diamonds which are the hardest mineral on earth is rated 10.



The hardness of a mineral is determined by scratching it with another know forms of hardness. If a mineral can be scratched by a nail with a hardness of 4 then the mineral has a hardness lower than 4. If the nail can't scratch a mineral then try a harder substance like glass, etc until you figure out the level of hardness of a mineral.

Luster

Luster is a property that refers to the way light shines off the mineral. If light shines off or reflects off the mineral it is metallic in luster. If not, then it is non-metallic. If light can pass through a mineral crystal it is transparent. If light can partially pass through a crystal it is translucent. If light cannot pass through a crystal it is opaque and may be called a mineral rock.




Nonmetallic Luster - Kaolinite

Graphite is shiny and therefore metallic.	Kaolinite has no light reflection and is non-metallic.

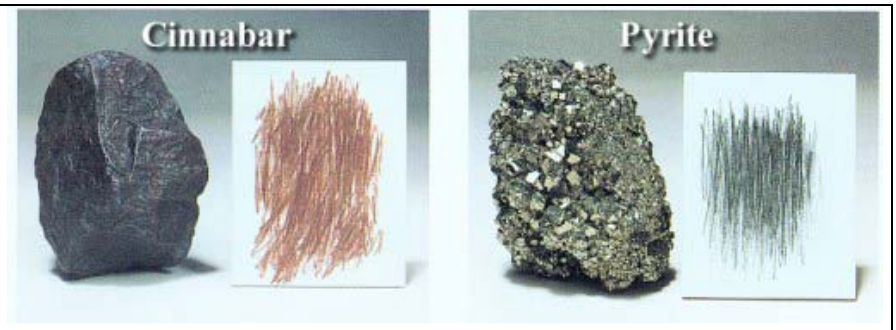
Specific gravity

Specific Gravity refers to the density or weight of the mineral compared to the weight of water. A mineral of a specific size (amount) will weigh more or less than an equal amount of water. If a mineral substance weighs twice as much an equal amount of water then the specific gravity is 2. If the mineral ways 5 times as much as an equal volume of water then the specific gravity is 5.

Streak

Streak refers to the color of a powdered form of a mineral. The color of a mineral can be misleading. But when a mineral is crushed or scratched to leave a streak of powder the color of the power is the actual color of the chemical composition of the mineral.
Geologists use a ceramic plate to scratch the mineral on to leave a streak of powder on the plate. **The color of that streak reveals streak property, or the actual color, of the mineral**.

The red-brown streak of the mineral hematite.



Cinnabar leaves a brown streak and Pyrite leaves a black streak. Neither brown nor black is their visible color, but is their steak color.

Breaking: Cleavage or Fracture

When a mineral is chipped or a piece is broken off the result will be either a regular pattern or an irregular form. A brake that forms a regular pattern is called cleavage. A break that forms an irregular shape is called fracture. In mica for example, a broken off piece will always be in the form of a thin layer. In halite a broken piece will always be cubic in shape. Both are examples of a cleavage break. In quartz however, a break will show an irregular shape which has no pattern, and therefore, is a fracture break.

	
Halite breaks in consistent cubic form. Regular patterns in breaking is cleavage.	Mica breaks in thin sheets, also cleavage

When bonds between atoms are approximately the same in all directions within a mineral, breakage occurs either on irregular surfaces (splintery or irregular fracture) or along smooth, curved surfaces (conchoidal fracture), similar to those formed when thick pieces of glass are broken.

Example of fracture where the break is not a regular pattern.

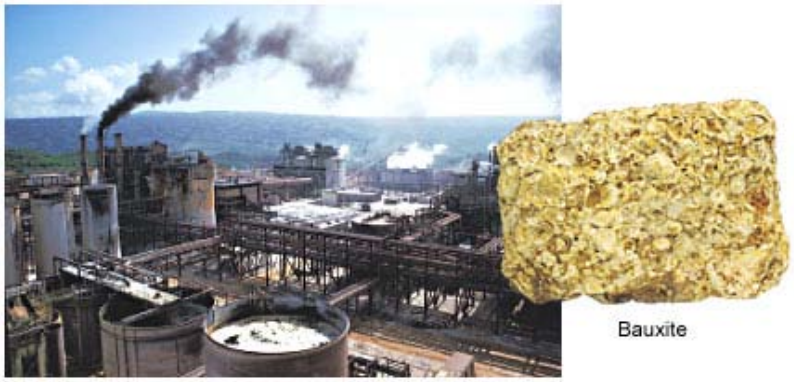
Uses of Minerals

Minerals are dug out of the earth by the mining industry. Mining companies will take huge quantities of earth ore and then process it to get specific elements out of the ore. When we shovel up the earth we are really digging out the minerals. Rocks are made of minerals and minerals are made of elements (types of atoms).

Elements are very valuable because they are used to manufacture and construct all the many types of products we buy and use daily. Almost any man-made thing you buy will have some elements used to manufacture it that were obtained from the mining process.

For example a mining company will dig out the ore of the earth that contains a lot of bauxite mineral. They'll separate the bauxite mineral from the other types of rock and then process it to extract aluminum. The aluminum is sold to manufactures the make many kinds of metallic products. The same is true for titanium. The mineral ilmenite is mined and titanium is

extracted and used for many types of light-weight equipment.



Bauxite is mined from the ground and Aluminum is extracted from it.

		
Ancient and modern buildings are made of rock with minerals.	Statues are made of Marble, a mineral.	Marble statue.

Jewelry and Gems

Some minerals form as crystalline stones and some of these stones are very rare. Rare crystals are called gems and they are expensive to purchase. Gems are used in the jewelry industry and men and especially women love to wear expensive jewelry.

		
Ruby other gems	Hope Diamond	African Star Gem


MINERALS