Earth Science Reviewer

Minerals

Minerals are building blocks of rocks. To be considered a mineral, it must be the following:

1. **Naturally-occurring.** Man-made materials such as synthetic diamonds cannot be considered as real minerals.
2. **Inorganic**. Organic materials such as pearls or sugar are not minerals.
3. **Homogeneous solid.** Minerals should be crystalline solids. Water is not mineral, whereas ice is considered a mineral. Mercury occurs as a liquid in its natural state and is considered as a mineraloid.
4. **Has definite chemical composition.** You should be able to describe a mineral's composition using a chemical formula.
5. **Ordered crystalline structure.** Atoms in a mineral are placed in a repetitive and orderly manner. Substances that lack this kind of atomic structure such as obsidian (volcanic glass) or plastic are not considered as minerals.

Minerals come in all sorts of appearances. In order to identify different minerals, certain properties are observed in hand specimens. Here are some of the most commonly used properties in describing a mineral's appearance:

1. **Color.** It refers to the wavelengths of light reflected by the minerals. While it can be tempting to identify a mineral based on its color, it is the least useful property because a lot of minerals can occur in different colors.
2. **Luster.** It describes how light is reflected from the mineral's surface. A mineral could have a **metallic luster** or **nonmetallic luster** similar to pearls (pearly), glass (vitreous), resin (resinous), silk (silky), or others. Brilliantly cut gems are described to have an **adamantine luster**.
3. **Crystal Habit or Shape.** This refers to the shape of each individual crystal or an aggregate of crystals. Although a single mineral can occur in a variety of shapes, crystal habit can still be an identifying feature in certain minerals.
4. **Streak.** This is the color of the mineral when it is powdered. Some minerals have different streak colors compared to their apparent color and this becomes a useful property when differentiating similar-looking minerals.
5. **Hardness.** This refers to how resistant a mineral is to scratching. The **Mohs' Hardness Scale** is a tool used to describe a mineral's hardness relative to other minerals.

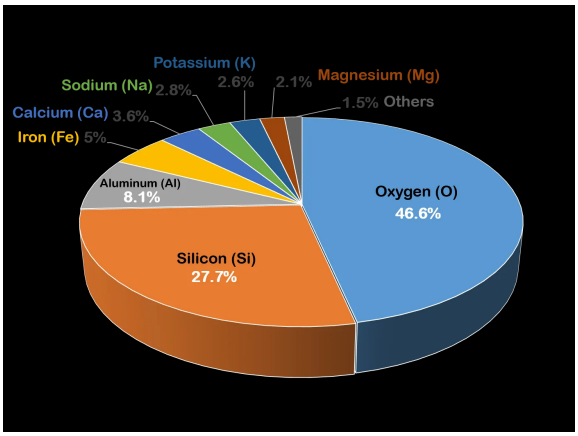
6. **Cleavage or Fracture.** Cleavage refers to the tendency of a mineral to break along preferred planes called zones of weakness. If a mineral doesn't break along zones of weakness, a fracture is produced.
7. **Density or Specific Gravity.** This refers to the ratio between a mineral's weight and the weight of a specific volume of water (Water has a specific gravity of 1). Heavy minerals such as gold or platinum have very high specific gravity whereas light minerals such as graphite have low specific gravity.
8. **Tenacity.** This describes how well a mineral handles stress such as breaking, crushing, bending, or tearing. Minerals that are susceptible to cracking or breaking are called **brittle** (examples: quartz, calcite). A mineral that deforms under stress but snaps back to its original shape after the stress is removed is called **elastic** (examples: mica minerals). On the other hand, if a mineral is deformed under stress but doesn't go back to its

original shape, it is then called **flexible** (example: vermiculite). Metallic minerals such as gold, copper, or silver are called **malleable** due to their ability to be flattened into sheets. Copper is also **ductile** because it can be drawn into thin wires without breaking. **Sectile** minerals such as gold or gypsum can be carved out into thin sheets with a knife.

9. **Diaphaneity.** This refers to how well light travels through a mineral. **Transparent** minerals allow almost all of the light to travel through the mineral (examples: some quartz, some calcite). **Translucent** minerals only allow some of the light to travel and exit the mineral, giving off a cloudy or murky appearance (examples: smoky quartz, gypsum). **Opaque** minerals do not allow light to travel through at all (examples: gold, copper, pyrite).
10. **Magnetism.** This describes the magnetic property of a mineral. **Magnetite** is an example of a strongly magnetic (strongly attracted to magnets) mineral. There are also **moderately and weakly magnetic minerals** such as chromite, ilmenite, columbite, and others. A **lodestone** is a type of magnetized magnetite that has the ability to magnetically attract other materials.
11. **Effervescence.** This describes a mineral's reaction when exposed to a strong acid such as HCl (hydrochloric acid). This is due to the chemical reaction that results between $CaCO_3$ and HCl in carbonate minerals and rocks. Highly effervescent minerals like calcite exhibit intense "fizzing" or "bubbling" when exposed to HCl. Some minerals are weakly effervescent and only show light "fizzing" such as rhodochrosite and azurite.
12. **Odor and Taste.** You may have heard that some geologists lick rocks. While that may seem a bit wacky and weird, it is true that geologists lick and even smell rocks in order to identify them. Halite, more popularly known as "rock salt", is a mineral that gives off a salty taste. Other examples are borax which gives off a sweet taste, epsomite which tastes bitter, and chalcanthite which is sweet tasting but also slightly poisonous. Sulfur and pyrite can be identified by their "rotten egg"-like smell.

To this date, thousands of different minerals have been identified and named– and the list grows every year! However, only a few of these minerals are abundant on the Earth's crust and they are called **rock-forming minerals**.

Out of all the elements, only 8 elements make up the majority of rock-forming minerals.



Since oxygen and silicon are the two most abundant blocks, the most common mineral group called **silicates** uses these two elements as their “building blocks”.

The other less abundant mineral group is called **nonsilicates** and it is further subdivided into groups based on their dominant anion or anionic group. Under nonsilicates are the mineral groups native elements, carbonates, oxides, sulfates, phosphates, and others.