

Objectives

- Identify the characteristics of minerals.
- Explain how minerals are classified into groups.
- Identify characteristics of mineral groups.

The BIG Idea

- Minerals are basic building blocks of earth.

Key Concepts

- Minerals have four characteristics.
- Minerals are grouped according to composition.

Minerals have four characteristics

- Minerals are important because we use minerals all the time.
- Every time you turn on a microwave oven or a TV, you depend on minerals.
- The copper in the wires that carry electricity to the device is a mineral. Table salt, or halite, is another mineral that you use in your everyday life.
- Minerals have four characteristics. A mineral is a substance that:
 1. Forms in **nature**
 2. Is a **solid**
 3. Has a definite **chemical composition**
 4. Has a **crystal structure**
- Many textbooks have a fifth characteristic of minerals. They say that they are **inorganic**. This means that they did not come from a living organism. Some minerals form by organic means and inorganic means. For example, **calcite** forms both organically and inorganically.
- You might think that minerals and rocks are the same thing. But, a mineral must have the four characteristics listed above.
- A rock only has **two** of these characteristics. It is a **solid** and forms **naturally**.
- A rock usually contains two or more types of minerals.
- Two samples of the same type of rock may vary greatly in the amounts of different minerals they contain.

- Minerals, however, are always made up of the same **materials** in the same **proportions**.
- Therefore, a ruby found in India has the same makeup as a ruby found in Australia.
- Let's look at each of the four properties of minerals more in depth.
 1. Formed in Nature
 - All minerals are formed by **natural processes**.
 - Every type of mineral can form in nature by processes that do not involve **living organisms**.
 - A few minerals can be produced by living organisms, but they can also be produced without them.
 - Minerals form in many ways.
 - For example, the mineral halite (salt) forms where water **evaporates** in a hot, shallow part of the ocean, leaving behind the salt it contained.
 - Many other minerals form when molten rock cools.
 2. Solid
 - A mineral is a solid—that is, it has a **definite volume** and a rigid **shape**. Remember that volume refers to the amount of **space** an object takes up.
 - A substance that is a liquid or a gas is not a mineral. However, some liquid or gas substances that solidify become minerals.
 3. Definite Chemical Makeup
 - Each mineral has a definite chemical makeup: it consists of specific combinations of atoms of certain elements.
 - Remember that an element is a substance that contains only one type of **atom**. An atom is the smallest particle an element can be divided into.
 - Everything you can see or touch is made up of atoms. Some substances consist of just one element, such as **gold** or **copper**.

- However, most substances contain atoms of more than one element. Most minerals are **compounds** consisting of several elements. For example, halite consists of one atom of **sodium** for each atom of **chlorine**.
- The types of atoms that make up a mineral are part of what makes the mineral unique.
- The way that the atoms are **bonded**, or joined together, is also important. Many properties of minerals are related to how strong or weak the bonds are.

4. Crystal Structure

- If you look closely at a grain of halite, you'll notice that it is very cubic in shape. This shape is the result of the arrangement of the **atoms** in the halite.
- It is the structure of a **crystal**, a solid in which atoms are arranged in an **orderly, repeating** three-dimensional pattern.
- Each mineral has a type of crystal structure. In some cases, two minerals have the same **chemical composition** but different crystal structures.
- For example, both graphite and diamond are made of just one element, **carbon**. However, they have different crystal structures.
- In nature, a perfect crystal is rare. Most crystals have imperfect shapes because their **growth** was limited by **space** and other crystals forming next to them.



How are minerals different from rocks? _____

What makes a mineral solid? _____

How can two minerals have the same chemical composition and still be different minerals? _____

Minerals are grouped according to composition.

- Scientists classify minerals into groups on the basis of their **chemical composition**.
- The most common group is the **silicates**.
- All the minerals in this group contain **oxygen** and **silicon**—the two most common elements in Earth’s crust—joined together.
- Though there are thousands of different minerals, only about **thirty** are common in Earth’s crust.
- These 30 minerals make up most rocks in the crust.
- For that reason, they are called **rock-forming** minerals.
- Silicates, which make up about **90 percent** of the rocks in Earth’s crust, are the most common rock-forming minerals.
- Examples of common silicates include **quartz**, **feldspar**, and **mica**.
- The second most common group of rock-forming minerals is the **carbonates**.
- All minerals in this group contain **carbon** and **oxygen** joined together.
- **Calcite**, which is common in seashells, is a carbonate mineral.
- There are many other mineral groups. All are important.
- For instance, the mineral group known as **oxides** contains the minerals from which most **metals** such as tin and copper, are refined.
- An oxide consists of an element, usually a **metal** joined to **oxygen**.



Which mineral group do most rock-forming minerals belong to?

Name three of the mineral groups. _____



Why is the oxide group so important? _____

Notes Review

Use your notes to answer the following questions. The answers may be found anywhere in the notes!



What are the four characteristics of minerals? _____

On what basis do scientists classify minerals? _____

What is the most common group of minerals? What percentage of the crust do they make up? _____