

Rocks and minerals

What's in a rock?

Rocks tell us many things. Depending on the type of rock, they tell us about the Earth's history; about extinct animals and plants whose fossils lie preserved within them; about explosive volcanoes; about earthquakes; about rivers that washed them away to be deposited elsewhere; and about what it is like inside the Earth.

Some of the particles that make rocks are called minerals. A mineral is a naturally occurring compound with a fixed composition and internal atomic structure. For example, quartz is a mineral with a chemical composition of SiO_2 .

Rocks are mixtures of minerals called aggregates. For example, sandstone is composed of minerals such as quartz and feldspar.

Some minerals are useful or valuable. Commonly used metals like iron, copper, aluminium and zinc are contained within certain minerals. For example, copper (Cu) occurs in the mineral chalcopyrite (CuFeS_2), which is mined in locations such as Mount Isa, Queensland and Olympic Dam, South Australia.

Industrial minerals are commonly used in industry for building and construction. These include limestone, gypsum, sandstone, greywacke, slate and marble.

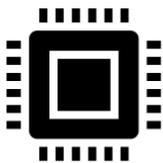
Minerals are all around us. However, they occur rarely in ore deposits. An ore deposit is an economic term used to describe high concentrations of minerals and can be mined profitably.



The fuels used in fireworks and explosives include **aluminium**, **magnesium** and **titanium**



The 'lead' found in most pencils is not actually made from lead. It is made from **graphite**.



Computer chips contain **silica**. The wiring is made from **copper** and the solder from **tin** and **lead**.



Gemstones, **gold**, **silver** and **copper** are all used to make jewellery.

- Australia is one of the world's leading mineral producers.
- It is the largest global producer of minerals, such as bauxite, iron ore, lithium and rutile.
- Australia has the world's largest economic resources of gold, iron ore, lead, rutile, tantalum, uranium, zinc and zirconium
- Gemstone production in Australia includes diamond, opal, sapphire, ruby, emerald, garnet, topaz and jade.

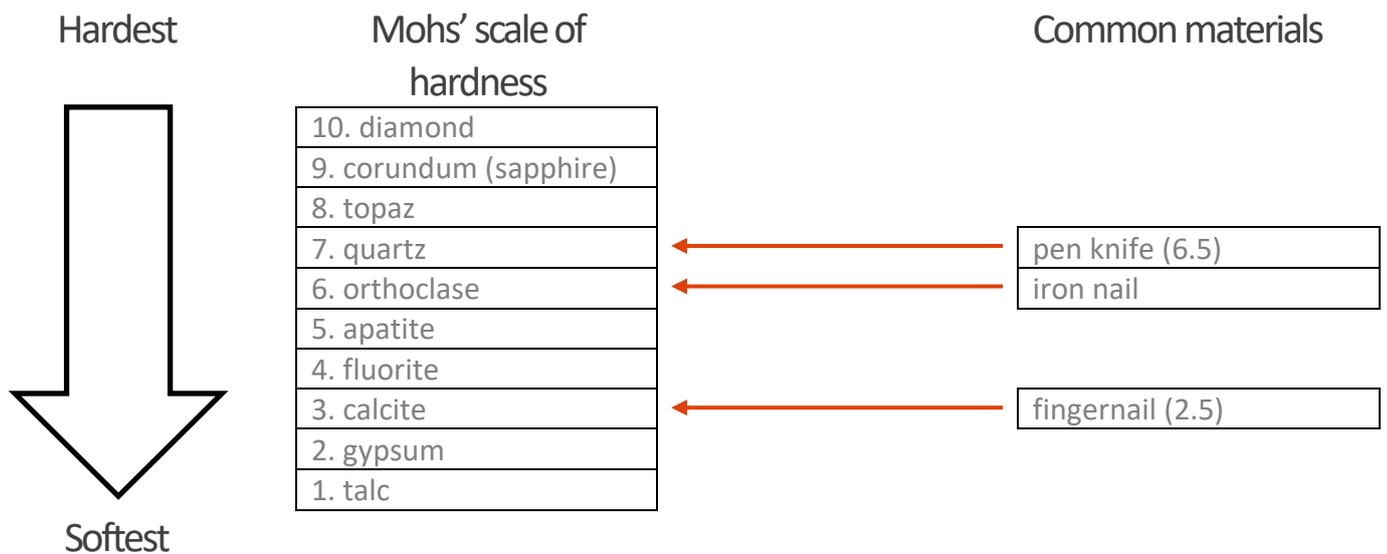


Identifying minerals

Minerals have several different physical properties, which can be used to help identify them.

1. **Colour.** This is unreliable because many minerals have similar colours, or the same mineral can have several different colours; for example, quartz can be pink, violet, black, yellow, white or green.
2. **Lustre.** This is the shininess of a mineral's surface. Lustre can be described in many ways; for example, dull, pearly, waxy, metallic, glassy or brilliant.
3. **Streak.** This is the colour of the powdery mark left when a mineral is scraped across a hard surface such as an unglazed white tile.
4. **Hardness.** This can be found by trying to scratch one mineral with another. The harder mineral leaves a scratch on the softer mineral. Mohs' scale is used to determine a mineral's hardness. For example, a mineral that can be scratched by topaz, but not by quartz, has a hardness of between seven and eight.

Friedrich Mohs developed a scale of hardness in which 10 minerals were ranked in order of hardness. The higher numbers correspond to harder minerals. The diagram below shows Mohs' scale. Common materials can be used in their place to determine a mineral's hardness.



5. **Crystal shape.** When minerals form, the atoms that join to make them often make up regular geometric shapes. For example, quartz crystals are hexagonal.

Minerals

Remember

Read and answer the questions below; then use pages 1 and 2 to check your memory.

1. What is a mineral?
2. What is an ore?
3. What are at least five properties that would help you identify a mineral?
4. What is the approximate hardness on Mohs' scale (to the nearest whole number) of a mineral that a pen knife can scratch, but an iron nail can't?

Think

Apply the information in pages 1 and 2 to help you answer these questions.

1. What is the difference between a rock and a mineral?
2. You have a sample of two minerals, but no other equipment to test them for hardness. How can you tell which mineral is harder?
3. A mineral can be scratched by a pen knife but not by a fingernail. You know that the mineral is one of quartz or fluorite. Which mineral is it?
4. Why is colour not a good property to use when trying to identify a mineral?
5. Which of these pairs of minerals is the harder?
 - a. calcite and talc
 - b. gypsum and apatite
 - c. quartz and fluorite
 - d. quartz and topaz

Research

Using the internet, find reliable sources to answer the following three questions. Reliable sources include government departments, industry bodies and academic sources:

1. What are three uses for each industrial mineral listed on page 1?
2. What is the value of production of five of these commodities produced in Australia?

Bauxite	Coal
Gemstones	Lead concentrate
Magnetite	Copper concentrate
Silica	Zinc concentrate
Limestone	Gold bullion
3. Each of these minerals contains an important metal mined in Australia. What does each contain:
 - a. galena
 - b. ilmenite
 - c. phalerite

Create

Imagine that you are a rock lying by the side of a newly made road and imagine you were magically given the ability to walk and talk. Write a speech that you could deliver to your class about your life—from your formation to the present time.

This information sheet is an extract of the publication *The Science of Mining*, published by the Queensland Resources Council and the Queensland Department of Natural Resources, Mines and Energy, 2004.

