

Cleaving and Fracturing

When minerals break, they can either split leaving a clean, flat face called a cleaving plane, or fracture leaving a more rough, uneven surface. We can find out more about a mineral by looking at the way it breaks.

Cleaving planes form along the weakest area of mineral's structure. This means it breaks where the atoms' bonds are weakest. If you break a mineral with a hammer it will always split along its weakest points. This is quite important, and gives some minerals a characteristic shape.



The mineral calcite has three cleaving planes. The result is a shape called rhombohedron.

How do you know if a mineral cleaves? You can find this out for most minerals simply by looking at the mineral. If it appears geometric, there is a high probability that it cleaves. However, this is not always reliable. For example, quartz has a very well known geometric shape, but it does not cleave. It fractures. So how do we determine if a mineral cleaves? Pull out the hammer!

Breaking off a small piece of the mineral will tell you if it cleaves or fractures. After you break the mineral, observe the spot where the piece came from. If there are smooth surfaces and no rough edges in the spot where the piece came from, then the mineral cleaves.

Mica, for example, has only one really good cleaving plane, it splits easily into very thin layers. A mineral with two cleaving planes, feldspar, will form prismatic shapes such as rectangular prisms. Calcite will split along three cleaving planes giving a 'diamond' shape called a rhombohedron.



The mineral copper has fracture. It does not have a smooth surface where it breaks and its edges are jagged.

If a mineral's structure is equally strong in all directions it will not have any cleavage planes. Instead it will break unevenly, or fracture. There are different types of fracture. Quartz has a conchoidal (shell-shaped) fracture. Copper can have a jagged, hackly fracture. Most metallic minerals have fracture.

Answer the following questions.

1. Describe the two ways in which a mineral can break. _____

2. Where do cleaving planes form in a mineral? _____

3. Describe the shape rhombohedron. _____
4. You have a mineral with two cleaving planes. What shape will it have where it breaks? _____
5. Will the mineral gold cleave or fracture? How do you know? _____

6. Below is a picture of a naturally formed diamond. It has a well-defined shape and crystal structure. The atoms are bonded equally strong in all directions. Predict if this mineral will cleave or fracture. Explain how you know.



Sources

- *Diamond image:* http://www.crystalclassics.co.uk/UserFiles/old-site/Image/articles/diamonds/654_001_crop.jpg
- *Article text:* <http://www.oum.ox.ac.uk/thezone/minerals/detect/fracture.htm>