Geology

Lancaster High School

Name
Date
Block

Cleavage and Fracture Lab

Background Information:

Some day when you are collecting minerals, you may try to use your hammer and chisel to remove a nice crystal from a rock, only to have the crystal break into a dozen or more fragments. This is usually a great disappointment. However, if you look at each of these fragments closely, you will see that they appear to have sharp, straight edges and smooth, flat surfaces where they broke apart. It might even seem as if the crystal had been sawn, ground, and polished on some of these surfaces.

This amazing manner of breaking is common to many minerals. If a mineral breaks along a smooth, even surface, it is said to have cleavage. Its presence and form will enable you to distinguish many different minerals. Some minerals, like quartz and serpentine, will not break with flat surfaces. Any type of break that is irregular and uneven is called fracture.

Seven specimens of minerals have been selected for you to work with in today's activity. Four of them have good cleavage; the other three have no cleavage, but possess typical fracture forms. As before, follow the steps outlined to correctly identify each of the numbered samples.

Materials

For this experiment you will need:

- mineral samples 7-13 of your mineral set
- Pencil (or colored pencils)
- Hand Lens

Procedure

1. Carefully look at each mineral sample provided. Make a pencil sketch of the sample in the data table below. Fill out the data table for the remainder of the blocks.
2. Examine each sample with the hand lens and count the number of pairs of flat surfaces you can see. Only count each directional face one time. (The top and the bottom count only once.) Record them in the data table.
3. Estimate the angles that these pairs intersect each other and record it in the data table.
4. To name the samples, first pick out the four minerals that appear to have flat surfaces. One of these is quite thin. This mineral has only one cleavage direction. It is mica. Whether the mica you find is black, brown, green, or colorless, it will only have one direction of cleavage. Record the name in the data table with the sample number.
5. Next, pick out two samples that are nearly white and partially clear. One of these is cubic, or looks as if it were built of small cubes. This sample displays cubic cleavage, or cleavage in 3 directions that are at 90°, or right angles, to each other. This mineral is halite (common rock salt). Record the name in the data table with the sample number.
6. The other mineral that may look similar to halite also has three good directions of cleavage. However, no two adjacent surfaces are at 90° to each other. In fact, the mineral may look like a lop-sided cube. It is calcite. Its particular type of cleavage is called rhombohedral cleavage. You can recognize it even if the mineral sample is white, pink, blue, or clear. Record the name in the data table with the sample number.
7. The fourth sample has only two good directions of cleavage that appear to be at nearly 90° to each other. All other surfaces of the mineral are quite rough and uneven. This sample represents one of the most common rock-forming minerals, feldspar. Record the name in the data table with the sample number.

Name
Date
Block

Cleavage and Fracture Lab

8. The three remaining specimens in the set lack cleavage. The black shiny sample will have at least one surface that displays a series of curved concentric ridges, similar to broken glass. We refer to this type of fracture as conchoidal. This sample, obsidian, is not really a mineral, but an igneous rock composed of "volcanic glass". Record the name in the data table with the sample number.
9. Of the two remaining samples one looks like a clear crystal. This sample also displays conchoidal fracture when broken, but has three pairs of smooth surfaces as well. These surfaces are not cleavage planes but rather crystal surfaces. They appeared when the crystal was formed. If it were to break it would not have those smooth surfaces but would more closely resemble the sample of obsidian. It is a quartz crystal. Record the name quartz in the data table with the sample number.
10. Only one specimen remains to be identified. Its surface, as you can see, is quite rough and uneven. Remarkably enough, this type of fracture is referred to as uneven. This last sample is serpentine. Record the name in the data table with the sample number.

Sample #	Sketch of sample.	Color & Texture	How many pairs of flat surfaces does it show? What angles?	Mineral Name
7				
8				
9				
10				
11				
12				
13				

Name
Date
Block

Cleavage and Fracture Lab

Analysis and Conclusion

1. Name the type of breakage described below.
    a. Breaks along smooth planes: _____
    b. Breaks with concentric lines: _____
    c. Breaks with no specific pattern: _____
2. Describe the shape of a mineral that has three directions of cleavage that intersect at 90°. _____
3. Name two minerals you identified that have good cleavage. Describe the cleavage of each mineral.
    a. Mineral:_____; Cleavage_____
    b. Mineral:_____; Cleavage_____
4. How many directions do typical feldspar minerals have? _____
5. Are the properties of cleavage and fracture more dependant on chemical composition or crystalline structure? Explain. _____

    _____

    _____
6. What about a mineral would control its property to cleave or fracture?_____

    _____

    _____