

Hands-on demonstrations of mineral properties

Provided for the Mineral Information Institute by Andrew A. Sicree, Ph.D.

An Acidic Reaction

Object: Students will use a **chemical reaction** to test for the **presence of carbonate** in calcite and limestone. By dropping a small amount of an acid on these specimens, they will observe bubbles of carbon dioxide forming from the reaction of the acid with carbonate minerals.

Procedure description: Students test specimens by dropping one or two drops of 10% hydrochloric acid on them.



Production of bubbles of carbon dioxide indicates that the carbonate ion is present. After testing a specimen, use a water-filled squirt bottle to wash off the acid into a basin. (The acid waste in the basin can be treated with baking soda to neutralize it and then disposed of by washing it down a drain.)

Specimens to test

Calcite; limestone; dolomite; dolostone; sandstone; orthoquartzite; strontianite.

Equipment needed

Small plastic dropper bottles containing 10% hydrochloric acid solution; safety glasses or goggles; squirt bottle with water; basin.

Scientific discussion: Upon reaction with 10% hydrochloric acid, carbonate minerals and carbonate-bearing rocks will react to release carbon dioxide gas. The gas appears as bubbles in the solution. This effervescence is often used by geologists to test rocks for the presence of carbonate minerals such as calcite or dolomite.

Calcite reacts strongly with the acid. Limestone, which is mainly composed of calcite (calcium carbonate), will also react strongly. Limestones may contain impurities, however, and less-pure limestones will react less vigorously.

Dolomite is a mineral (calcium magnesium carbonate) that is related to calcite and is likewise often found in sedimentary rocks. Dolostone is the rock that is composed mainly of the mineral dolomite. The term “dolomite” is also used to refer to dolostone rock.

Dolomite/dolostone reacts with acid much less vigorously than limestone; often it is necessary to scratch up the surface of the dolostone to produce a powder that will then be observed to react with the acid. Geologists use this behavioral difference as a field test to discriminate between limestone and dolostone.

Sandstones are composed of grains of quartz sand. Some sandstones (sometimes called orthoquartzites) are cemented together with quartz cement while others will have a calcite cement. The calcite cement will react with hydrochloric acid and those sandstones with calcite cement will display effervescence.

Additional possibilities: It is possible to use other carbonate minerals and produce the characteristic bubbles. Strontianite (strontium carbonate) is another mineral that reacts vigorously with 10% hydrochloric acid.

Notes for demo tables: If you are doing demonstrations for large numbers of visitors (such as at a booth at a trade show), I've found that it is simplest to use calcite and limestone. I do the demo myself – don't want a lot of people handling the acid – in a small basin with a few chips of calcite and a piece of limestone. First, I show the reaction with calcite, next I demonstrate that the same reaction occurs in the limestone. Then, I put away the dropper bottle so kids can't get their hands on it. It is important to stress to visitors that this experiment shows that limestone can be used to neutralize acid – it serves in this role when we use it to treat acid rock drainage and to scrub sulfuric acid from power plant stack gases.

Special note: Use of acid by youngsters should be supervised. Goggles or safety glasses are required and lab coats or aprons may be useful. A 10% solution of hydrochloric acid is not particularly dangerous, but it will irritate the skin and harm your eyes. Promptly wash off any acid on skin or clothes. Baking soda serves as a useful neutralizing agent for spills and waste.