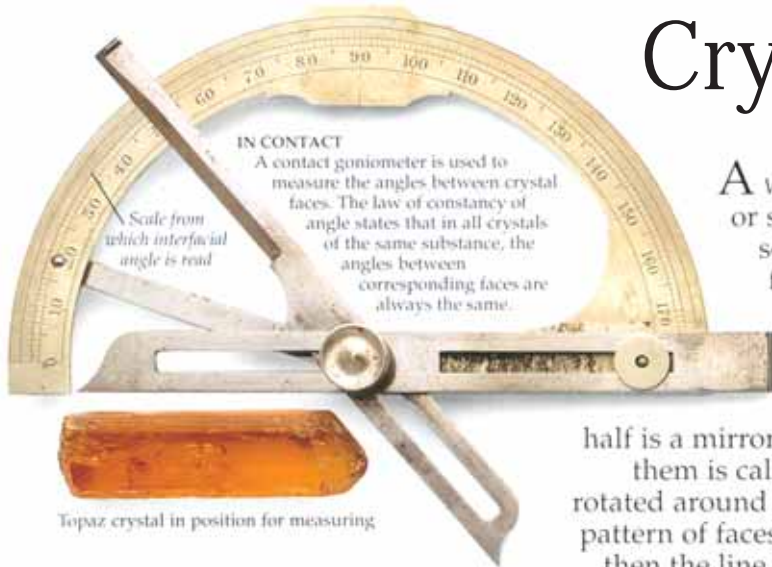


Crystal Classes...



Topaz crystal in position for measuring

A WELL-FORMED CRYSTAL has certain regular or symmetrical features. One feature is that sets of faces have parallel edges. Another feature of many crystals is that for every face, there is a parallel face on the opposite side. Crystals may have three types of symmetry. If a crystal can be divided into two, so that each half is a mirror image of the other, the line that divides them is called a "plane of symmetry." If a crystal is rotated around an imaginary straight line and the same pattern of faces appears a number of times in one turn, then the line is an "axis of symmetry." Depending on how many times the pattern appears, symmetry around an axis is described as twofold, threefold, fourfold, or sixfold. If a crystal is entirely bounded by pairs of parallel faces then it has a "center of symmetry."

Cubic system represented by galena. Essential symmetry element: four threefold axes.

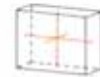


SEVEN SYSTEMS

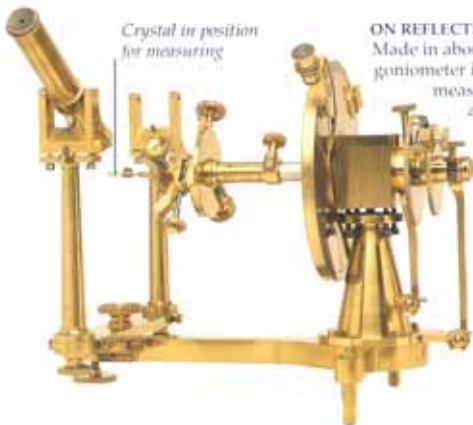
Crystals have differing amounts of symmetry and are placed, according to this, in one of seven major categories called systems. Crystals in the cubic system have the highest symmetry. The most symmetrical have 9 planes, 12 axes, and a center of symmetry. Crystals in the triclinic system have the least symmetry with only a center of symmetry or no symmetry at all.



Tetragonal system represented by idocrase. Essential symmetry element: one fourfold axis.



Orthorhombic system represented by barite. Essential symmetry element: three twofold axes.



Crystal in position for measuring

ON REFLECTION
Made in about 1860, this optical goniometer is designed to measure the interfacial angles of small crystals by the reflection of light from their faces. The crystal is rotated until a reflection of light is seen from two adjacent faces. The angle between the two faces is read off the graduated circle on the right.



Monoclinic system represented by orthoclase (twinned). Essential symmetry element: one twofold axis.



Triclinic system represented by axinite. No axis of symmetry.

SAME BUT DIFFERENT

Some crystallographers consider the trigonal system part of the hexagonal system. Both systems have the same set of axes, but the trigonal has only threefold symmetry. This is seen in the terminal faces.



Hexagonal system represented by beryl. Essential symmetry: one sixfold axis.



Trigonal system represented by calcite. Essential symmetry: one threefold axis.



MODEL CRYSTALS
Crystal models were made to help crystallographers understand symmetry. These glass models were made in about 1900 in Germany. They contain cotton threads strung between the faces to show axes of rotation.



Form

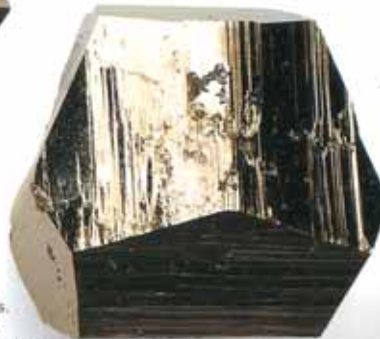
Crystals of the same mineral may not look alike. The same faces on two crystals may be different sizes and therefore form different-shaped crystals. Crystals may also grow with a variation of "form." Shown here are three forms found in the cubic crystal system, illustrated by pyrite.



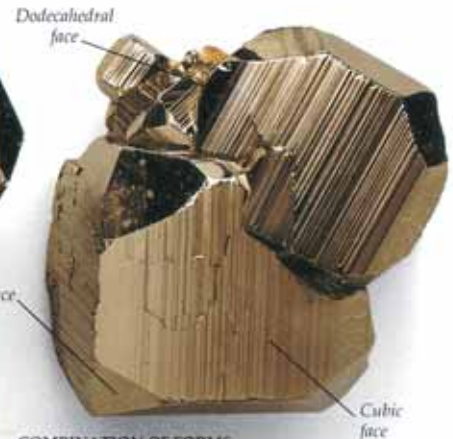
CUBE
A form of six square faces that make 90° angles with each other. Each face intersects one of the fourfold axes and is parallel to the other two.



OCTAHEDRON
A form of eight equilateral triangular faces, each of which intersects all three of the fourfold axes equally.

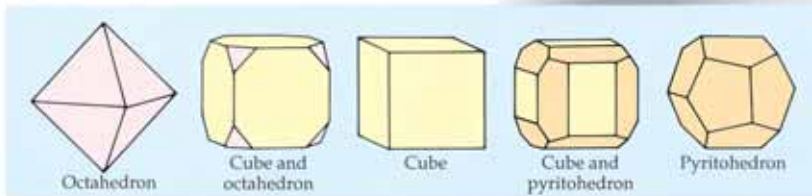


PYRITOHEDRON
This form consists of 12 five-sided faces. It is also known as a pentagonal dodecahedron.



COMBINATION OF FORMS
These crystals show cubic faces combined with octahedral faces with poorly developed dodecahedral faces blending into the cubic faces.

Below: Diagram to show the relationship between different cubic forms



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