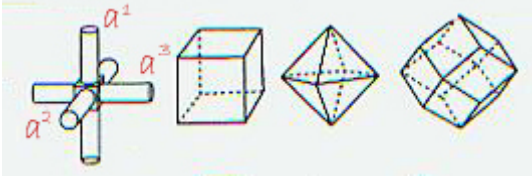
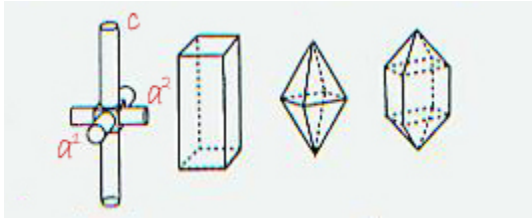
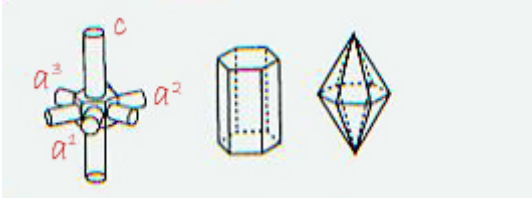
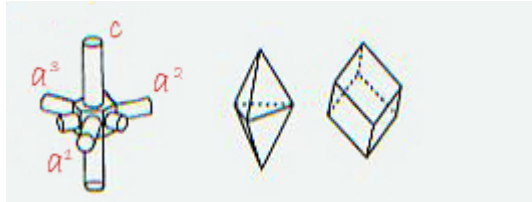
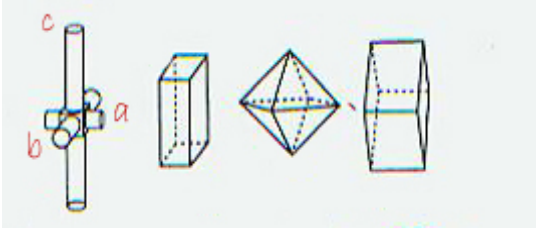
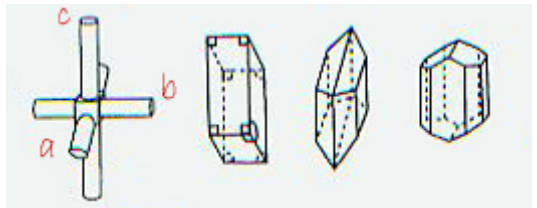
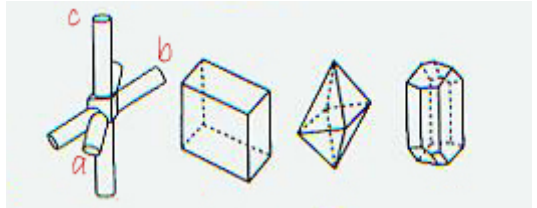


# The Seven Crystal Systems

<b>Crystal System</b> in order of descending symmetry	<b>Symmetry</b> Shows relationship of crystal faces and their relative angles	<b>Axes and Typical Forms</b>	<b>Optical Nature</b>	<b>Gem Examples</b>
Cubic  <i>Highest order of symmetry</i>	4 3-fold $a^1 = a^2 = a^3$ all at $90^\circ$	 <p style="text-align: center;">cube (fluorite), octahedron (spinel, diamond), dodecahedron (garnet)</p>	Isotropic  1 RI  No Pleochroism	Diamond, Garnet, Spinel, Fluorite, Sphalerite, Sodalite, Chromite, Pyrite, CZ, Strontium Titanate, Yag
Tetragonal	1 4-fold $a^1 = a^2 \neq c$ all at $90^\circ$  c is longer or shorter than laterals	 <p style="text-align: center;">Often 4 sided prism with square cross-section</p>	Anisotropic Uniaxial  2 RIs $\omega$ & $\epsilon$  Dichroic	Zircon, Scapolite, Idocrase, Rutile
Hexagonal	1 6-fold $a^1 = a^2 = a^3 \neq c$ all at $120^\circ$  c is longer or shorter than laterals	 <p style="text-align: center;">6 sided prism, hexagonal cross-section</p>	Anisotropic Uniaxial  2 RIs $\omega$ & $\epsilon$  Dichroic	Beryl, Apatite, Benitoite, Painite, Moissanite
Trigonal	1 3-fold $a^1 = a^2 = a^3 \neq c$ all at $120^\circ$  c is longer or shorter than laterals	 <p style="text-align: center;">3 sided prism, rhombohedra</p>	Anisotropic Uniaxial  2 RIs $\omega$ & $\epsilon$  Dichroic	Calcite, Corundum, Quartz, Tourmaline, Rhodochrosite, Hematite, Diopase

<p>Orthorhombic</p>	<p>3 2-fold</p> <p><math>a \neq b \neq c</math> all at <math>90^\circ</math></p> <p>c is longest; b macro axis longer than a brachy axis</p>	 <p>Rectangular prism, bi-pyramid, rectangular cross-section</p>	<p>Anisotropic Biaxial</p> <p>3 RIs <math>\alpha, \beta, \gamma</math></p> <p>Trichroic</p>	<p>Topaz, Peridot, Chrysoberyl, Andalusite, Sinhaitite, Zoisite (Tanzanite), Danburite, Sillimanite, Kornerupine, Iolite, Aragonite</p>
<p>Monoclinic</p>	<p>1 2-fold</p> <p><math>a \neq b \neq c</math> a is inclined to c, b is at <math>90^\circ</math> to c</p> <p>b ortho axis, a clino axis</p>	 <p>Prisms and pinacoids</p>	<p>Anisotropic Biaxial</p> <p>3 RIs <math>\alpha, \beta, \gamma</math></p> <p>Trichroic</p>	<p>Orthoclase Feldspar (Moonstone), Spodumene (Kunsite), Diopside, Gypsum, Jadeite, Nephrite, Sphene, Epidote</p>
<p>Triclinic</p> <p><i>Lowest order of symmetry</i></p>	<p>No axes of symmetry</p> <p><math>a \neq b \neq c</math> All 3 axes inclined none at <math>90^\circ</math></p> <p>c is longest; b macro axis longer than a brachy axis</p>	 <p>Prism tilted backwards and sideways with pinacoids</p>	<p>Anisotropic Biaxial</p> <p>3 RIs <math>\alpha, \beta, \gamma</math></p> <p>Trichroic</p>	<p>Microcline Feldspar (Amazonite), Oligoclase Feldspar, Plagioclase Feldspar (Labradorite), Rhodonite, Turquoise, Kyanite</p>

Adapted with permission by Elise Skalwold.

The above started as a chart which Dick Hughes sent me some time ago with a challenge to know what it all means to gemology. Taking that challenge to Bangkok, I kept revising his chart to my own purpose, though I refer you back to his original below. The images are courtesy of Dr. Brad Amos with additions in red added by me.

- Hughes, Richard W: [http://www.ruby-sapphire.com/crystal\\_optics.htm](http://www.ruby-sapphire.com/crystal_optics.htm) Overview of the crystal systems and their optical properties chart
- See also: <http://www.nordskip.com/notes/refractometer.pdf> Optic character and sign on the refractometer.

Return to Gemology Resources: <http://www.nordskip.com/resources.html>