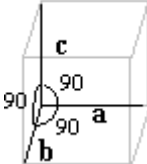
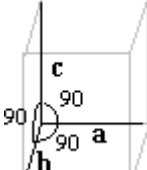
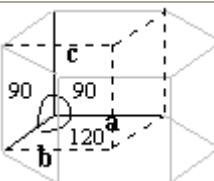
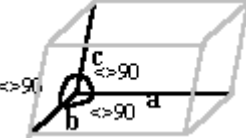
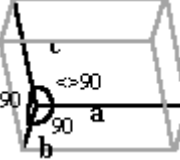
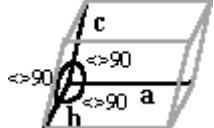


## Triple phosphate crystals

A characteristic of crystals is that their form is predictable from the elementary structure. There are 230 possible geometrical forms that are grouped in 32 classes, based upon the arrangement of elements of symmetry. These elements of symmetry are axes of symmetry, planes of symmetry, the center of symmetry. These 32 classes are further regrouped in 6 crystalline systems. Crystallographic constants of these crystalline systems are described by a system of coordinate, 3 axes (a, b, c), and by the angles formed by these axes between them.

System	axes	Bases	Examples
Cubic	$a = b = c$ $\alpha = \beta = \gamma = 90^\circ$		Apatite
Tetragonal	$a = b \neq c$ $\alpha = \beta = \gamma = 90^\circ$		Calcium oxalate 2(H2O) « Weddellite »
Hexagonal	$a = b \neq c$ $\alpha = 120^\circ \beta = \gamma = 90^\circ$		Cystine Tricalcium phosphate Apatite
Orthorhombic	$a \neq b \neq c$ $\alpha = \beta = \gamma \neq 90^\circ$		Triple phosphate Uric acid
Monoclinic	$a \neq b \neq c$ $\alpha = \beta = 90^\circ \neq \gamma \neq 90^\circ$		Calcium oxalate (H2O) « Whewellite » Calcium hydrogen phosphate Sodium acid urate
Triclinic	$a \neq b \neq c$ $\alpha \neq \beta \neq \gamma \neq 90^\circ$		Sodium acid urate

## *Birefringent*

Crystals of the cubic system are said to be isotropic, since these have the same properties in all direction. One of these properties is the refractive index. Crystals of the other systems are said to be anisotropic, having two (birefringent) or even three refractive indexes. Anisotropic crystals subdivide into two groups: uniaxial (two refractive indexes) and biaxial (three refractive indexes). Crystals of the tetragonal system and the hexagonal system are uniaxial while the orthorhombic, monoclinic and the triclinic are biaxial.

Some anisotropic crystals form interference patterns when viewed under polarized light. Uric acid is polychromatic, and cholesterol ester in a liquid crystal state generates a Maltese cross pattern.

### *Birefringent is a crystal property*

The following table shows the birefringent behavior of some crystals found in urine.

<b>Birefringent characteristics of crystals found in urine</b>		
<b>None to light</b>	<b>Moderate</b>	<b>Strong</b>
Amorphous phosphates	Cystine	Uric acid
Triple phosphates	Calcium oxalates 2(H <sub>2</sub> O) Weddelite	Urates
Tricalcium phosphates		Calcium oxalates (H <sub>2</sub> O) Whewellite
		Leucine

Urine is a complex medium which influences the crystallization process. The same substance can crystallize into different shapes depending on the urine composition. Crystals found in urine are often truncated and eroded. Spherical crystals are frequent.

Slow crystallization tends to give larger crystals.