










1.4. GRAPHICAL SYMBOLS FOR SYMMETRY ELEMENTS

1.4.5. Symmetry axes normal to the plane of projection and symmetry points in the plane of the figure

Symmetry axis or symmetry point	Graphical symbol*	Screw vector of a right-handed screw rotation in units of the shortest lattice translation vector parallel to the axis	Printed symbol (partial elements in parentheses)
Identity	None	None	1
Twofold rotation axis Twofold rotation point (two dimensions) } Twofold screw axis: '2 sub 1'		None $\frac{1}{2}$	2 2 ₁
Threefold rotation axis Threefold rotation point (two dimensions) } Threefold screw axis: '3 sub 1' Threefold screw axis: '3 sub 2'		None $\frac{1}{3}$ $\frac{2}{3}$	3 3 ₁ 3 ₂
Fourfold rotation axis Fourfold rotation point (two dimensions) } Fourfold screw axis: '4 sub 1' Fourfold screw axis: '4 sub 2' Fourfold screw axis: '4 sub 3'		None $\frac{1}{4}$ $\frac{1}{2}$ $\frac{3}{4}$	4 (2) 4 ₁ (2 ₁) 4 ₂ (2) 4 ₃ (2 ₁)
Sixfold rotation axis Sixfold rotation point (two dimensions) } Sixfold screw axis: '6 sub 1' Sixfold screw axis: '6 sub 2' Sixfold screw axis: '6 sub 3' Sixfold screw axis: '6 sub 4' Sixfold screw axis: '6 sub 5'		None $\frac{1}{6}$ $\frac{1}{3}$ $\frac{1}{2}$ $\frac{2}{3}$ $\frac{5}{6}$	6 (3,2) 6 ₁ (3 ₁ , 2 ₁) 6 ₂ (3 ₂ , 2) 6 ₃ (3, 2 ₁) 6 ₄ (3 ₁ , 2) 6 ₅ (3 ₂ , 2 ₁)
Centre of symmetry, inversion centre: '1 bar' Reflection point, mirror point (one dimension) }		None	$\bar{1}$
Inversion axis: '3 bar' Inversion axis: '4 bar' Inversion axis: '6 bar'		None None None	$\bar{3}$ (3, $\bar{1}$) $\bar{4}$ (2) $\bar{6} \equiv 3/m$
Twofold rotation axis with centre of symmetry Twofold screw axis with centre of symmetry		None $\frac{1}{2}$	2/m ($\bar{1}$) 2 ₁ /m ($\bar{1}$)
Fourfold rotation axis with centre of symmetry '4 sub 2' screw axis with centre of symmetry		None $\frac{1}{2}$	4/m ($\bar{4}$, 2, $\bar{1}$) 4 ₂ /m ($\bar{4}$, 2, $\bar{1}$)
Sixfold rotation axis with centre of symmetry '6 sub 3' screw axis with centre of symmetry		None $\frac{1}{2}$	6/m ($\bar{6}$, $\bar{3}$, 3, 2, $\bar{1}$) 6 ₃ /m ($\bar{6}$, $\bar{3}$, 3, 2 ₁ , $\bar{1}$)

* Notes on the 'heights' h of symmetry points $\bar{1}$, $\bar{3}$, $\bar{4}$ and $\bar{6}$:

- (1) Centres of symmetry $\bar{1}$ and $\bar{3}$, as well as inversion points $\bar{4}$ and $\bar{6}$ on $\bar{4}$ and $\bar{6}$ axes parallel to [001], occur in pairs at 'heights' h and $h + \frac{1}{2}$. In the space-group diagrams, only one fraction h is given, e.g. $\frac{1}{4}$ stands for $h = \frac{1}{4}$ and $\frac{3}{4}$. No fraction means $h = 0$ and $\frac{1}{2}$. In cubic space groups, however, both fractions are given for vertical $\bar{4}$ axes, including $h = 0$ and $\frac{1}{2}$.
- (2) Symmetries $4/m$ and $6/m$ contain vertical $\bar{4}$ and $\bar{6}$ axes; their $\bar{4}$ and $\bar{6}$ inversion points coincide with the centres of symmetry. This is not indicated in the space-group diagrams.
- (3) Symmetries $4_2/m$ and $6_3/m$ also contain vertical $\bar{4}$ and $\bar{6}$ axes, but their $\bar{4}$ and $\bar{6}$ inversion points alternate with the centres of symmetry; i.e. $\bar{1}$ points at h and $h + \frac{1}{2}$ interleave with $\bar{4}$ or $\bar{6}$ points at $h + \frac{1}{4}$ and $h + \frac{3}{4}$. In the tetragonal and hexagonal space-group diagrams, only one fraction for $\bar{1}$ and one for $\bar{4}$ or $\bar{6}$ is given. In the cubic diagrams, all four fractions are listed for $4_2/m$; e.g. $Pm\bar{3}n$ (No. 223): $\bar{1}$: 0, $\frac{1}{2}$; $\bar{4}$: $\frac{1}{4}$, $\frac{3}{4}$.