

Symmetry Classification for Serial Crystallography Experiments

Groups with white backgrounds are merohedral and will exhibit indexing ambiguities. Chiral groups are shown in bold, centrosymmetric groups are underlined.

Move downwards or follow grey arrows to find supergroups which can be accessed with only rotation operations. Do not cross vertical or thick black horizontal lines unless following a grey arrow. When you reach a cell with a shaded background, you have found the corresponding "source symmetry". A partial ambiguity resolution could be attempted into any intermediate group you can reach.

Point Groups	Space Groups		
--------------	--------------	--	--

Triclinic lattice

1	<u>$\bar{1}$</u>	P1	<u>$P\bar{1}$</u>
----------	-----------------------------	-----------	------------------------------

Monoclinic lattice

	m		Pm, Pc, Cm, Cc
2	<u>$2/m$</u>	P2, P2₁, C2	<u>$P2/m$, $P2_1/m$, $C2/m$, $P2/c$, $P2_1/c$, $C2/c$</u>

Orthorhombic lattice

	mm2		Pmm2, Pmc2 ₁ , Pcc2, Pma2, Pca2 ₁ , Pnc2, Pmn2 ₁ , Pba2, Pna2 ₁ , Pnn2, Cmm2, Cmc2 ₁ , Ccc2, Amm2, Aem2, Ama2, Aea2, Fmm2, Fdd2, Imm2, Iba2, Ima2
222	<u>mmm</u>	P222, P222₁, P2₁2₁2, P2₁2₁2₁, C222₁, C222, F222, I222, I2₁2₁2₁	<u>Pmmm, Pnnn, Pccm, Pban, Pmma, Pnna, Pmna, Pcca, Pbam, Pccn, Pbcm, Pnnm, Pmmn, Pbcn, Pbca, Pnma, Cmcm, Cmce, Cmmm, Cccm, Cmme, Ccce, Fmmm, Fddd, Immm, Ibam, Ibca, Imma</u>

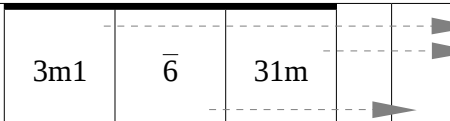
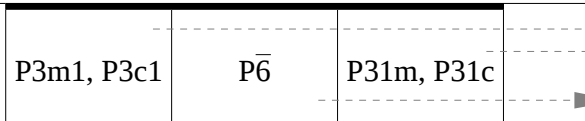
Tetragonal lattice

4	$\bar{4}$			4mm	P4, P4₁, P4₂, P4₃, I4, I4₁	$P\bar{4}, I\bar{4}$			P4mm, P4bm, P4 ₂ cm, P4 ₂ nm, P4cc, P4nc, P4 ₂ mc, P4 ₂ bc, I4mm, I4cm, I4 ₁ md, I4 ₁ cd
	$\bar{4}2m$	$\bar{4}m2$	$\underline{4/m}$			P $\bar{4}2m$, P $\bar{4}2c$, P $\bar{4}2_1m$, P $\bar{4}2_1c$, I $\bar{4}2m$, I $\bar{4}2d$	P $\bar{4}m2$, P $\bar{4}c2$, P $\bar{4}b2$, P $\bar{4}n2$, I $\bar{4}m2$, I $\bar{4}c2$	$\underline{P4/m}$, $\underline{P4_2/m}$, $\underline{P4/n}$, $\underline{P4_2/n}$, $\underline{I4/m}$, $\underline{I4_1/a}$	
422	$\underline{4/mmm}$				P422, P42₁2, P4₁22, P4₁2₁2, P4₂22, P4₂2₁2, P4₃22, P4₃2₁2, I422, I4₁22	$\underline{P4/mmm}$, $\underline{P4/mcc}$, $\underline{P4/nbm}$, $\underline{P4/nnc}$, $\underline{P4/mbm}$, $\underline{P4/mnc}$, $\underline{P4/nmm}$, $\underline{P4/ncc}$, $\underline{P4_2/mmc}$, $\underline{P4_2/mcm}$, $\underline{P4_2/nbc}$, $\underline{P4_2/nnm}$, $\underline{P4_2/mbc}$, $\underline{P4_2/mnm}$, $\underline{P4_2/nmc}$, $\underline{P4_2/ncm}$, $\underline{I4/mmm}$, $\underline{I4/mcm}$, $\underline{I4_1/amd}$, $\underline{I4_1/acd}$			

Rhombohedral lattice

3	$\bar{3}$	3m	R3 (H3)	<u>$R\bar{3} (H\bar{3})$</u>	R3m (H3m), R3c (H3c)
32	<u>$\bar{3}m$</u>		R32 (H32)	<u>$R\bar{3}m (H\bar{3}m)$, $R\bar{3}c (H\bar{3}c)$</u>	

Hexagonal lattice

3			$\bar{3}$					P3, P3 ₁ , P3 ₂			$P\bar{3}$					P6mm, P6cc, P6 ₃ cm, P6 ₃ mc
6	312	321					6mm	P6, P6 ₁ , P6 ₅ , P6 ₂ , P6 ₄ , P6 ₃	P312, P3 ₁ 12, P3 ₂ 12	P321, P3 ₁ 21, P3 ₂ 21						
			$\bar{3}m1$	$\bar{6}m2$	$\bar{6}2m$	$\bar{3}1m$					$\bar{P}3m1, \bar{P}3c1$	$\bar{P}6m2, \bar{P}6c2$	$\bar{P}62m, \bar{P}62c$	$\bar{P}31m, \bar{P}31c$		
			$\underline{6/m}$			$\underline{P6/m}, \underline{P6_3/m}$										
622			$\underline{6/mmm}$					P622, P6 ₁ 22, P6 ₅ 22, P6 ₂ 22, P6 ₄ 22, P6 ₃ 22			$\underline{P6/mmm}, \underline{P6/mcc}, \underline{P6_3/mcm}, \underline{P6_3/mmc}$					

Cubic lattice

23	$\bar{4}3m$	$m\bar{3}$	P23, F23, I23, P2 ₁ 3, I2 ₁ 3	$P\bar{4}3m, F\bar{4}3m, I\bar{4}3m, P\bar{4}3n, F\bar{4}3c, I\bar{4}3d$	$\bar{P}m\bar{3}, \bar{P}n\bar{3}, \bar{F}m\bar{3}, \bar{F}d\bar{3}, \bar{I}m\bar{3}, \bar{P}a\bar{3}, \bar{I}a\bar{3}$
432	$\bar{m}\bar{3}m$		P432, P4 ₂ 32, F432, F4 ₁ 32, I432, P4 ₃ 32, P4 ₁ 32, I4 ₁ 32	$\bar{P}m\bar{3}m, \bar{P}n\bar{3}n, \bar{P}m\bar{3}n, \bar{P}n\bar{3}m, \bar{F}m\bar{3}m, \bar{F}m\bar{3}c, \bar{F}d\bar{3}m, \bar{F}d\bar{3}c, \bar{I}m\bar{3}m, \bar{I}a\bar{3}d$	

Laue Classes

$\bar{1}$	$\bar{1}$			
$\bar{2}/m$	2	m		
mmm	222	mm2		
$\bar{4}/m$	4	$\bar{4}$		
$\bar{4}/mmm$	422	$\bar{4}2m$	$\bar{4}m2$	4mm

$\bar{3}$	3	
$\bar{3}m$	32	3m
$\bar{3}m1$	321	3m1
$\bar{3}1m$	312	31m

$\bar{6}/m$	6	$\bar{6}$	
$\bar{6}/mmm$	622	$\bar{6}m2$	$\bar{6}2m$ 6mm
$\bar{m}\bar{3}$	23		
$\bar{m}\bar{3}m$	432	$\bar{4}3m$	

Pseudo-merohedral Possibilities

Triclinic with $a \approx b, \alpha \approx \beta \approx 90^\circ$	1 = 2	$\bar{1} \Rightarrow 2/m$
Triclinic with $a \approx b \approx c, \alpha \approx \beta \approx \gamma$	1 = 3 _R	$\bar{1} = \bar{3}_R$
Triclinic with $\alpha \approx \beta \approx \gamma \approx 90^\circ$	1 = 222	$\bar{1} \Rightarrow mmm$
Orthorhombic with $a \approx b$	222 = 422	mm2 \Rightarrow 4mm $mmm \Rightarrow 4/mmm$

Monoclinic with $\beta \approx 90^\circ$	2 = 422	m = 4mm	$2/m \Rightarrow 4/mmm$
Monoclinic with $\beta \approx 120^\circ$	2 = 6	m = $\bar{6}$	$2/m \Rightarrow \bar{6}/m$
Tetragonal with $(a=)b \approx c$	422 \Rightarrow 432	$\bar{4}2m \Rightarrow \bar{4}3m$	$4/mmm \Rightarrow \bar{m}\bar{3}m$
Other tetragonal point groups must go via 422 or 4/mmm.			