

$C2/m$

No. 12

 $C12/m1$ C_{2h}^3 UNIQUE AXIS b , CELL CHOICE 1Generators selected (1); $t(1,0,0)$; $t(0,1,0)$; $t(0,0,1)$; $t(\frac{1}{2},\frac{1}{2},0)$; (2); (3)

General position

Multiplicity,
Wyckoff letter,
Site symmetry

Coordinates

8 j 1 $(0,0,0)+ (\frac{1}{2},\frac{1}{2},0)+$ (1) x,y,z (2) \bar{x},y,\bar{z} (3) \bar{x},\bar{y},\bar{z} (4) x,\bar{y},z I Maximal *translationengleiche* subgroups

[2] $C1m1$ (8)	(1; 4)+	
[2] $C121$ (5)	(1; 2)+	
[2] $C\bar{1}$ (2, $P\bar{1}$)	(1; 3)+	$1/2(\mathbf{a}-\mathbf{b}), 1/2(\mathbf{a}+\mathbf{b}), \mathbf{c}$

II Maximal *klassengleiche* subgroups

• Loss of centring translations

[2] $P12_1/a1$ (14, $P12_1/c1$)	1; 3; (2; 4) + $(\frac{1}{2},\frac{1}{2},0)$	$\mathbf{c}, \mathbf{b}, -\mathbf{a}$	
[2] $P12/a1$ (13, $P12/c1$)	1; 2; (3; 4) + $(\frac{1}{2},\frac{1}{2},0)$	$\mathbf{c}, \mathbf{b}, -\mathbf{a}$	$1/4, 1/4, 0$
[2] $P12_1/m1$ (11)	1; 4; (2; 3) + $(\frac{1}{2},\frac{1}{2},0)$	$\mathbf{c}, \mathbf{b}, -\mathbf{a}$	$1/4, 1/4, 0$
[2] $P12/m1$ (10)	1; 2; 3; 4		

• Enlarged unit cell

[2] $\mathbf{c}' = 2\mathbf{c}$			
$C12/c1$ (15)	$\langle 3; 2 + (0,0,1) \rangle$	$\mathbf{a}, \mathbf{b}, 2\mathbf{c}$	
$C12/c1$ (15)	$\langle 2; 3 + (0,0,1) \rangle$	$\mathbf{a}, \mathbf{b}, 2\mathbf{c}$	$0,0,1/2$
$I12/c1$ (15, $C12/c1$)	$\langle 3; 2 + (0,0,1) \rangle$	$\mathbf{a} - 2\mathbf{c}, \mathbf{b}, 2\mathbf{c}$	
$I12/c1$ (15, $C12/c1$)	$\langle 2; 3 + (0,0,1) \rangle$	$\mathbf{a} - 2\mathbf{c}, \mathbf{b}, 2\mathbf{c}$	$0,0,1/2$
$C12/m1$ (12)	$\langle 2; 3 \rangle$	$\mathbf{a}, \mathbf{b}, 2\mathbf{c}$	
$C12/m1$ (12)	$\langle (2; 3) + (0,0,1) \rangle$	$\mathbf{a}, \mathbf{b}, 2\mathbf{c}$	$0,0,1/2$
$I12/m1$ (12, $C12/m1$)	$\langle 2; 3 \rangle$	$\mathbf{a} - 2\mathbf{c}, \mathbf{b}, 2\mathbf{c}$	
$I12/m1$ (12, $C12/m1$)	$\langle (2; 3) + (0,0,1) \rangle$	$\mathbf{a} - 2\mathbf{c}, \mathbf{b}, 2\mathbf{c}$	$0,0,1/2$
[3] $\mathbf{b}' = 3\mathbf{b}$			
$C12/m1$ (12)	$\langle 2; 3 \rangle$	$\mathbf{a}, 3\mathbf{b}, \mathbf{c}$	
$C12/m1$ (12)	$\langle 2; 3 + (0,2,0) \rangle$	$\mathbf{a}, 3\mathbf{b}, \mathbf{c}$	$0,1,0$
$C12/m1$ (12)	$\langle 2; 3 + (0,4,0) \rangle$	$\mathbf{a}, 3\mathbf{b}, \mathbf{c}$	$0,2,0$
[3] $\mathbf{c}' = 3\mathbf{c}$			
$C12/m1$ (12)	$\langle 2; 3 \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	
$C12/m1$ (12)	$\langle (2; 3) + (0,0,2) \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	$0,0,1$
$C12/m1$ (12)	$\langle (2; 3) + (0,0,4) \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	$0,0,2$
[3] $\mathbf{a}' = \mathbf{a} - 2\mathbf{c}, \mathbf{c}' = 3\mathbf{c}$			
$C12/m1$ (12)	$\langle 2; 3 \rangle$	$\mathbf{a} - 2\mathbf{c}, \mathbf{b}, 3\mathbf{c}$	
$C12/m1$ (12)	$\langle (2; 3) + (0,0,2) \rangle$	$\mathbf{a} - 2\mathbf{c}, \mathbf{b}, 3\mathbf{c}$	$0,0,1$
$C12/m1$ (12)	$\langle (2; 3) + (0,0,4) \rangle$	$\mathbf{a} - 2\mathbf{c}, \mathbf{b}, 3\mathbf{c}$	$0,0,2$
[3] $\mathbf{a}' = \mathbf{a} - 4\mathbf{c}, \mathbf{c}' = 3\mathbf{c}$			
$C12/m1$ (12)	$\langle 2; 3 \rangle$	$\mathbf{a} - 4\mathbf{c}, \mathbf{b}, 3\mathbf{c}$	
$C12/m1$ (12)	$\langle (2; 3) + (0,0,2) \rangle$	$\mathbf{a} - 4\mathbf{c}, \mathbf{b}, 3\mathbf{c}$	$0,0,1$
$C12/m1$ (12)	$\langle (2; 3) + (0,0,4) \rangle$	$\mathbf{a} - 4\mathbf{c}, \mathbf{b}, 3\mathbf{c}$	$0,0,2$
[3] $\mathbf{a}' = 3\mathbf{a}$			
$C12/m1$ (12)	$\langle 2; 3 \rangle$	$3\mathbf{a}, \mathbf{b}, \mathbf{c}$	
$C12/m1$ (12)	$\langle (2; 3) + (2,0,0) \rangle$	$3\mathbf{a}, \mathbf{b}, \mathbf{c}$	$1,0,0$
$C12/m1$ (12)	$\langle (2; 3) + (4,0,0) \rangle$	$3\mathbf{a}, \mathbf{b}, \mathbf{c}$	$2,0,0$

• Series of maximal isomorphic subgroups

[p] $\mathbf{b}' = p\mathbf{b}$			
$C12/m1$ (12)	$\langle 2; 3 + (0,2u,0) \rangle$	$\mathbf{a}, p\mathbf{b}, \mathbf{c}$	$0, u, 0$
	prime $p > 2$; $0 \leq u < p$		
	p conjugate subgroups		
[p] $\mathbf{a}' = \mathbf{a} - 2q\mathbf{c}, \mathbf{c}' = p\mathbf{c}$			
$C12/m1$ (12)	$\langle (2; 3) + (0,0,2u) \rangle$	$\mathbf{a} - 2q\mathbf{c}, \mathbf{b}, p\mathbf{c}$	$0,0,u$
	prime $p > 2$; $0 \leq q < p$; $0 \leq u < p$		
	p conjugate subgroups for each pair of q and p		
[p] $\mathbf{a}' = p\mathbf{a}$			
$C12/m1$ (12)	$\langle (2; 3) + (2u,0,0) \rangle$	$p\mathbf{a}, \mathbf{b}, \mathbf{c}$	$u,0,0$
	prime $p > 2$; $0 \leq u < p$		
	p conjugate subgroups		

I Minimal translationengleiche supergroups

[2] $Cmcm$ (63); [2] $Cmce$ (64); [2] $Cmmm$ (65); [2] $Cmme$ (67); [2] $Fmmm$ (69); [2] $Immm$ (71); [2] $Ibam$ (72); [2] $Imma$ (74);
 [2] $I4/m$ (87); [3] $P\bar{3}12/m$ (162, $P\bar{3}1m$); [3] $P\bar{3}2/m1$ (164, $P\bar{3}m1$); [3] $R\bar{3}2/m$ (166, $R\bar{3}m$)

II Minimal non-isomorphic klassengleiche supergroups

- Additional centring translations none

- Decreased unit cell

[2] $\mathbf{a}' = \frac{1}{2}\mathbf{a}$, $\mathbf{b}' = \frac{1}{2}\mathbf{b}$ $P12/m1$ (10)

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I Minimal translationengleiche supergroups

[2] $Cmcm$ (63); [2] $Cmce$ (64); [2] $Cmmm$ (65); [2] $Cmme$ (67); [2] $Fmmm$ (69); [2] $Immm$ (71); [2] $Ibam$ (72); [2] $Imma$ (74);
 [2] $I4/m$ (87); [3] $P\bar{3}12/m$ (162, $P\bar{3}1m$); [3] $P\bar{3}2/m1$ (164, $P\bar{3}m1$); [3] $R\bar{3}2/m$ (166, $R\bar{3}m$)

II Minimal non-isomorphic klassengleiche supergroups

- Additional centring translations none

- Decreased unit cell

[2] $\mathbf{b}' = \frac{1}{2}\mathbf{b}$, $\mathbf{c}' = \frac{1}{2}\mathbf{c}$ $P112/m$ (10)

UNIQUE AXIS c , CELL CHOICE 1

Generators selected (1); $t(1,0,0)$; $t(0,1,0)$; $t(0,0,1)$; $t(0, \frac{1}{2}, \frac{1}{2})$; (2); (3)

General position

Multiplicity,
Wyckoff letter,
Site symmetry

Coordinates

8 j 1

$(0,0,0)+ (0, \frac{1}{2}, \frac{1}{2})+$

(1) x, y, z (2) \bar{x}, \bar{y}, z (3) $\bar{x}, \bar{y}, \bar{z}$ (4) x, y, \bar{z}

I Maximal translationengleiche subgroups

[2] $A11m$ (8)	(1; 4)+	
[2] $A112$ (5)	(1; 2)+	
[2] $A\bar{1}$ (2, $P\bar{1}$)	(1; 3)+	$a, 1/2(b-c), 1/2(b+c)$

II Maximal klassengleiche subgroups

• Loss of centring translations

[2] $P112_1/b$ (14, $P112_1/a$)	1; 3; (2; 4) + $(0, \frac{1}{2}, \frac{1}{2})$	$-b, a, c$	
[2] $P112/b$ (13, $P112/a$)	1; 2; (3; 4) + $(0, \frac{1}{2}, \frac{1}{2})$	$-b, a, c$	0, 1/4, 1/4
[2] $P112_1/m$ (11)	1; 4; (2; 3) + $(0, \frac{1}{2}, \frac{1}{2})$	$-b, a, c$	0, 1/4, 1/4
[2] $P112/m$ (10)	1; 2; 3; 4		

• Enlarged unit cell

[2] $a' = 2a$			
$A112/a$ (15)	$\langle 3; 2 + (1,0,0) \rangle$	$2a, b, c$	
$A112/a$ (15)	$\langle 2; 3 + (1,0,0) \rangle$	$2a, b, c$	1/2, 0, 0
$I112/a$ (15, $A112/a$)	$\langle 3; 2 + (1,0,0) \rangle$	$2a, -2a + b, c$	
$I112/a$ (15, $A112/a$)	$\langle 2; 3 + (1,0,0) \rangle$	$2a, -2a + b, c$	1/2, 0, 0
$A112/m$ (12)	$\langle 2; 3 \rangle$	$2a, b, c$	
$A112/m$ (12)	$\langle (2; 3) + (1,0,0) \rangle$	$2a, b, c$	1/2, 0, 0
$I112/m$ (12, $A112/m$)	$\langle 2; 3 \rangle$	$2a, -2a + b, c$	
$I112/m$ (12, $A112/m$)	$\langle (2; 3) + (1,0,0) \rangle$	$2a, -2a + b, c$	1/2, 0, 0
[3] $c' = 3c$			
$A112/m$ (12)	$\langle 2; 3 \rangle$	$a, b, 3c$	
$A112/m$ (12)	$\langle 2; 3 + (0,0,2) \rangle$	$a, b, 3c$	0, 0, 1
$A112/m$ (12)	$\langle 2; 3 + (0,0,4) \rangle$	$a, b, 3c$	0, 0, 2
[3] $a' = 3a$			
$A112/m$ (12)	$\langle 2; 3 \rangle$	$3a, b, c$	
$A112/m$ (12)	$\langle (2; 3) + (2,0,0) \rangle$	$3a, b, c$	1, 0, 0
$A112/m$ (12)	$\langle (2; 3) + (4,0,0) \rangle$	$3a, b, c$	2, 0, 0
[3] $a' = 3a, b' = -2a + b$			
$A112/m$ (12)	$\langle 2; 3 \rangle$	$3a, -2a + b, c$	
$A112/m$ (12)	$\langle (2; 3) + (2,0,0) \rangle$	$3a, -2a + b, c$	1, 0, 0
$A112/m$ (12)	$\langle (2; 3) + (4,0,0) \rangle$	$3a, -2a + b, c$	2, 0, 0
[3] $a' = 3a, b' = -4a + b$			
$A112/m$ (12)	$\langle 2; 3 \rangle$	$3a, -4a + b, c$	
$A112/m$ (12)	$\langle (2; 3) + (2,0,0) \rangle$	$3a, -4a + b, c$	1, 0, 0
$A112/m$ (12)	$\langle (2; 3) + (4,0,0) \rangle$	$3a, -4a + b, c$	2, 0, 0
[3] $b' = 3b$			
$A112/m$ (12)	$\langle 2; 3 \rangle$	$a, 3b, c$	
$A112/m$ (12)	$\langle (2; 3) + (0,2,0) \rangle$	$a, 3b, c$	0, 1, 0
$A112/m$ (12)	$\langle (2; 3) + (0,4,0) \rangle$	$a, 3b, c$	0, 2, 0

• Series of maximal isomorphic subgroups

[p] $c' = pc$			
$A112/m$ (12)	$\langle 2; 3 + (0,0,2u) \rangle$ prime $p > 2$; $0 \leq u < p$ p conjugate subgroups	a, b, pc	0, 0, u
[p] $a' = pa, b' = -2qa + b$			
$A112/m$ (12)	$\langle (2; 3) + (2u,0,0) \rangle$ prime $p > 2$; $0 \leq q < p$; $0 \leq u < p$ p conjugate subgroups for each pair of q and p	$pa, -2qa + b, c$	$u, 0, 0$
[p] $b' = pb$			
$A112/m$ (12)	$\langle (2; 3) + (0,2u,0) \rangle$ prime $p > 2$; $0 \leq u < p$ p conjugate subgroups	a, pb, c	0, $u, 0$

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I Minimal translationengleiche supergroups

[2] $Cmcm$ (63); [2] $Cmce$ (64); [2] $Cmmm$ (65); [2] $Cmme$ (67); [2] $Fmmm$ (69); [2] $Immm$ (71); [2] $Ibam$ (72); [2] $Imma$ (74);
 [2] $I4/m$ (87); [3] $P\bar{3}12/m$ (162, $P\bar{3}1m$); [3] $P\bar{3}2/m1$ (164, $P\bar{3}m1$); [3] $R\bar{3}2/m$ (166, $R\bar{3}m$)

II Minimal non-isomorphic klassengleiche supergroups

- Additional centring translations none

- Decreased unit cell

[2] $\mathbf{a}' = \frac{1}{2}\mathbf{a}$, $\mathbf{b}' = \frac{1}{2}\mathbf{b}$ $P12/m1$ (10)

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I Minimal translationengleiche supergroups

[2] $Cmcm$ (63); [2] $Cmce$ (64); [2] $Cmmm$ (65); [2] $Cmme$ (67); [2] $Fmmm$ (69); [2] $Immm$ (71); [2] $Ibam$ (72); [2] $Imma$ (74);
 [2] $I4/m$ (87); [3] $P\bar{3}12/m$ (162, $P\bar{3}1m$); [3] $P\bar{3}2/m1$ (164, $P\bar{3}m1$); [3] $R\bar{3}2/m$ (166, $R\bar{3}m$)

II Minimal non-isomorphic klassengleiche supergroups

- Additional centring translations none

- Decreased unit cell

[2] $\mathbf{b}' = \frac{1}{2}\mathbf{b}$, $\mathbf{c}' = \frac{1}{2}\mathbf{c}$ $P112/m$ (10)