

C_{2h}^6
 $C12/c1$

No. 15

 $C2/c$

 UNIQUE AXIS b , CELL CHOICE 1

Generators 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

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

 8 f 1

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

[2] $C1c1$ (9)	(1; 4)+		
[2] $C121$ (5)	(1; 2)+		0, 0, 1/4
[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] $P12_1/n1$ (14, $P12_1/c1$)	$1; 3; (2; 4)+(\frac{1}{2},\frac{1}{2},0)$	$\mathbf{c}, \mathbf{b}, -\mathbf{a}-\mathbf{c}$	
[2] $P12_1/c1$ (14)	$1; 4; (2; 3)+(\frac{1}{2},\frac{1}{2},0)$		1/4, 1/4, 0
[2] $P12/c1$ (13)	1; 2; 3; 4		
[2] $P12/n1$ (13, $P12/c1$)	$1; 2; (3; 4)+(\frac{1}{2},\frac{1}{2},0)$	$\mathbf{c}, \mathbf{b}, -\mathbf{a}-\mathbf{c}$	1/4, 1/4, 0

• Enlarged unit cell

[3] $\mathbf{b}' = 3\mathbf{b}$			
$\left\{ \begin{array}{l} C12/c1 (15) \\ C12/c1 (15) \\ C12/c1 (15) \end{array} \right.$	$\langle 2; 3 \rangle$ $\langle 2; 3 + (0, 2, 0) \rangle$ $\langle 2; 3 + (0, 4, 0) \rangle$	$\mathbf{a}, 3\mathbf{b}, \mathbf{c}$ $\mathbf{a}, 3\mathbf{b}, \mathbf{c}$ $\mathbf{a}, 3\mathbf{b}, \mathbf{c}$	0, 1, 0 0, 2, 0
[3] $\mathbf{c}' = 3\mathbf{c}$			
$\left\{ \begin{array}{l} C12/c1 (15) \\ C12/c1 (15) \\ C12/c1 (15) \end{array} \right.$	$\langle 3; 2 + (0, 0, 1) \rangle$ $\langle 2 + (0, 0, 3); 3 + (0, 0, 2) \rangle$ $\langle 2 + (0, 0, 5); 3 + (0, 0, 4) \rangle$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$ $\mathbf{a}, \mathbf{b}, 3\mathbf{c}$ $\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	0, 0, 1 0, 0, 2
[3] $\mathbf{a}' = \mathbf{a} - 2\mathbf{c}, \mathbf{c}' = 3\mathbf{c}$			
$\left\{ \begin{array}{l} C12/c1 (15) \\ C12/c1 (15) \\ C12/c1 (15) \end{array} \right.$	$\langle 3; 2 + (0, 0, 1) \rangle$ $\langle 2 + (0, 0, 3); 3 + (0, 0, 2) \rangle$ $\langle 2 + (0, 0, 5); 3 + (0, 0, 4) \rangle$	$\mathbf{a} - 2\mathbf{c}, \mathbf{b}, 3\mathbf{c}$ $\mathbf{a} - 2\mathbf{c}, \mathbf{b}, 3\mathbf{c}$ $\mathbf{a} - 2\mathbf{c}, \mathbf{b}, 3\mathbf{c}$	0, 0, 1 0, 0, 2
[3] $\mathbf{a}' = \mathbf{a} - 4\mathbf{c}, \mathbf{c}' = 3\mathbf{c}$			
$\left\{ \begin{array}{l} C12/c1 (15) \\ C12/c1 (15) \\ C12/c1 (15) \end{array} \right.$	$\langle 3; 2 + (0, 0, 1) \rangle$ $\langle 2 + (0, 0, 3); 3 + (0, 0, 2) \rangle$ $\langle 2 + (0, 0, 5); 3 + (0, 0, 4) \rangle$	$\mathbf{a} - 4\mathbf{c}, \mathbf{b}, 3\mathbf{c}$ $\mathbf{a} - 4\mathbf{c}, \mathbf{b}, 3\mathbf{c}$ $\mathbf{a} - 4\mathbf{c}, \mathbf{b}, 3\mathbf{c}$	0, 0, 1 0, 0, 2
[3] $\mathbf{a}' = 3\mathbf{a}$			
$\left\{ \begin{array}{l} C12/c1 (15) \\ C12/c1 (15) \\ C12/c1 (15) \end{array} \right.$	$\langle 2; 3 \rangle$ $\langle (2; 3) + (2, 0, 0) \rangle$ $\langle (2; 3) + (4, 0, 0) \rangle$	$3\mathbf{a}, \mathbf{b}, \mathbf{c}$ $3\mathbf{a}, \mathbf{b}, \mathbf{c}$ $3\mathbf{a}, \mathbf{b}, \mathbf{c}$	1, 0, 0 2, 0, 0

• Series of maximal isomorphic subgroups

[p] $\mathbf{b}' = p\mathbf{b}$			
$C12/c1$ (15)	$\langle 2; 3 + (0, 2u, 0) \rangle$ $p > 2; 0 \leq u < p$ p conjugate subgroups for the prime p	$\mathbf{a}, p\mathbf{b}, \mathbf{c}$	0, u , 0
[p] $\mathbf{a}' = \mathbf{a} - 2q\mathbf{c}, \mathbf{c}' = p\mathbf{c}$			
$C12/c1$ (15)	$\langle 2 + (0, 0, \frac{p}{2} - \frac{1}{2} + 2u); 3 + (0, 0, 2u) \rangle$ $p > 2; 0 \leq q < p; 0 \leq u < p$ p conjugate subgroups for each pair of q and prime p	$\mathbf{a} - 2q\mathbf{c}, \mathbf{b}, p\mathbf{c}$	0, 0, u
[p] $\mathbf{a}' = p\mathbf{a}$			
$C12/c1$ (15)	$\langle (2; 3) + (2u, 0, 0) \rangle$ $p > 2; 0 \leq u < p$ p conjugate subgroups for the prime p	$p\mathbf{a}, \mathbf{b}, \mathbf{c}$	u , 0, 0

I Minimal translationengleiche supergroups

[2] $Cmcm$ (63); [2] $Cmce$ (64); [2] $Cccm$ (66); [2] $Ccce$ (68); [2] $Fddd$ (70); [2] $Ibam$ (72); [2] $Ibca$ (73); [2] $Imma$ (74); [2] $I4_1/a$ (88);
[3] $P\bar{3}12/c$ (163, $P\bar{3}1c$); [3] $P\bar{3}2/c1$ (165, $P\bar{3}c1$); [3] $R\bar{3}2/c$ (167, $R\bar{3}c$)

II Minimal non-isomorphic klassengleiche supergroups

• Additional centring translations

[2] $F12/m1$ (12, $C12/m1$)

• Decreased unit cell

[2] $\mathbf{c}' = \frac{1}{2}\mathbf{c}$ $C12/m1$ (12); [2] $\mathbf{a}' = \frac{1}{2}\mathbf{a}$, $\mathbf{b}' = \frac{1}{2}\mathbf{b}$ $P12/c1$ (13)

I Minimal translationengleiche supergroups

[2] $Cmcm$ (63); [2] $Cmce$ (64); [2] $Cccm$ (66); [2] $Ccce$ (68); [2] $Fddd$ (70); [2] $Ibam$ (72); [2] $Ibca$ (73); [2] $Imma$ (74); [2] $I4_1/a$ (88);
[3] $P\bar{3}12/c$ (163, $P\bar{3}1c$); [3] $P\bar{3}2/c1$ (165, $P\bar{3}c1$); [3] $R\bar{3}2/c$ (167, $R\bar{3}c$)

II Minimal non-isomorphic klassengleiche supergroups

• Additional centring translations

[2] $F112/m$ (12, $A112/m$)

• Decreased unit cell

[2] $\mathbf{a}' = \frac{1}{2}\mathbf{a}$ $A112/m$ (12); [2] $\mathbf{b}' = \frac{1}{2}\mathbf{b}$, $\mathbf{c}' = \frac{1}{2}\mathbf{c}$ $P112/a$ (13)

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

[2] A11a (9)	(1; 4)+		
[2] A112 (5)	(1; 2)+		1/4, 0, 0
[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 /n (14, P112 ₁ /a)	1; 3; (2; 4) + $(0, \frac{1}{2}, \frac{1}{2})$	-a - b, a, c	
[2] P112 ₁ /a (14)	1; 4; (2; 3) + $(0, \frac{1}{2}, \frac{1}{2})$		0, 1/4, 1/4
[2] P112/a (13)	1; 2; 3; 4		
[2] P112/n (13, P112/a)	1; 2; (3; 4) + $(0, \frac{1}{2}, \frac{1}{2})$	-a - b, a, c	0, 1/4, 1/4

• **Enlarged unit cell**

[3] c' = 3c			
{ A112/a (15)	{ 2; 3	a, b, 3c	
{ A112/a (15)	{ 2; 3 + (0, 0, 2)	a, b, 3c	0, 0, 1
{ A112/a (15)	{ 2; 3 + (0, 0, 4)	a, b, 3c	0, 0, 2
[3] a' = 3a			
{ A112/a (15)	{ 3; 2 + (1, 0, 0)	3a, b, c	
{ A112/a (15)	{ 2 + (3, 0, 0); 3 + (2, 0, 0)	3a, b, c	1, 0, 0
{ A112/a (15)	{ 2 + (5, 0, 0); 3 + (4, 0, 0)	3a, b, c	2, 0, 0
[3] a' = 3a, b' = -2a + b			
{ A112/a (15)	{ 3; 2 + (1, 0, 0)	3a, -2a + b, c	
{ A112/a (15)	{ 2 + (3, 0, 0); 3 + (2, 0, 0)	3a, -2a + b, c	1, 0, 0
{ A112/a (15)	{ 2 + (5, 0, 0); 3 + (4, 0, 0)	3a, -2a + b, c	2, 0, 0
[3] a' = 3a, b' = -4a + b			
{ A112/a (15)	{ 3; 2 + (1, 0, 0)	3a, -4a + b, c	
{ A112/a (15)	{ 2 + (3, 0, 0); 3 + (2, 0, 0)	3a, -4a + b, c	1, 0, 0
{ A112/a (15)	{ 2 + (5, 0, 0); 3 + (4, 0, 0)	3a, -4a + b, c	2, 0, 0
[3] b' = 3b			
{ A112/a (15)	{ 2; 3	a, 3b, c	
{ A112/a (15)	{ (2; 3) + (0, 2, 0)	a, 3b, c	0, 1, 0
{ A112/a (15)	{ (2; 3) + (0, 4, 0)	a, 3b, c	0, 2, 0

• **Series of maximal isomorphic subgroups**

[<i>p</i>] c' = pc			
A112/a (15)	{ 2; 3 + (0, 0, 2 <i>u</i>)	a, b, pc	0, 0, <i>u</i>
	<i>p</i> > 2; 0 ≤ <i>u</i> < <i>p</i>		
	<i>p</i> conjugate subgroups for the prime <i>p</i>		
[<i>p</i>] a' = pa, b' = -2qa + b			
A112/a (15)	{ 2 + ($\frac{p}{2} - \frac{1}{2} + 2u, 0, 0$); 3 + (2 <i>u</i> , 0, 0)	pa, -2qa + b, c	<i>u</i> , 0, 0
	<i>p</i> > 2; 0 ≤ <i>q</i> < <i>p</i> ; 0 ≤ <i>u</i> < <i>p</i>		
	<i>p</i> conjugate subgroups for each pair of <i>q</i> and prime <i>p</i>		
[<i>p</i>] b' = pb			
A112/a (15)	{ (2; 3) + (0, 2 <i>u</i> , 0)	a, pb, c	0, <i>u</i> , 0
	<i>p</i> > 2; 0 ≤ <i>u</i> < <i>p</i>		
	<i>p</i> conjugate subgroups for the prime <i>p</i>		

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I Minimal translationengleiche supergroups

[2] $Cmcm$ (63); [2] $Cmce$ (64); [2] $Cccm$ (66); [2] $Ccce$ (68); [2] $Fddd$ (70); [2] $Ibam$ (72); [2] $Ibca$ (73); [2] $Imma$ (74); [2] $I4_1/a$ (88); [3] $P\bar{3}12/c$ (163, $P\bar{3}1c$); [3] $P\bar{3}2/c1$ (165, $P\bar{3}c1$); [3] $R\bar{3}2/c$ (167, $R\bar{3}c$)

II Minimal non-isomorphic klassengleiche supergroups• **Additional centring translations**

[2] $F12/m1$ (12, $C12/m1$)

• **Decreased unit cell**

[2] $\mathbf{c}' = \frac{1}{2}\mathbf{c}$ $C12/m1$ (12); [2] $\mathbf{a}' = \frac{1}{2}\mathbf{a}$, $\mathbf{b}' = \frac{1}{2}\mathbf{b}$ $P12/c1$ (13)

I Minimal translationengleiche supergroups

[2] $Cmcm$ (63); [2] $Cmce$ (64); [2] $Cccm$ (66); [2] $Ccce$ (68); [2] $Fddd$ (70); [2] $Ibam$ (72); [2] $Ibca$ (73); [2] $Imma$ (74); [2] $I4_1/a$ (88); [3] $P\bar{3}12/c$ (163, $P\bar{3}1c$); [3] $P\bar{3}2/c1$ (165, $P\bar{3}c1$); [3] $R\bar{3}2/c$ (167, $R\bar{3}c$)

II Minimal non-isomorphic klassengleiche supergroups• **Additional centring translations**

[2] $F112/m$ (12, $A112/m$)

• **Decreased unit cell**

[2] $\mathbf{a}' = \frac{1}{2}\mathbf{a}$ $A112/m$ (12); [2] $\mathbf{b}' = \frac{1}{2}\mathbf{b}$, $\mathbf{c}' = \frac{1}{2}\mathbf{c}$ $P112/a$ (13)