

$C\bar{2}/m$ 

No. 12

 $C12/m1$  $C_{2h}^3$ 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 symmetry8       $j$       1**Coordinates** $(0,0,0) + (\frac{1}{2}, \frac{1}{2}, 0) +$ (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) + $(\frac{1}{2}, \frac{1}{2}, 0)$	$\mathbf{c}, \mathbf{b}, -\mathbf{a}$
[2] $P12_1/m1$ (11)	1; 4; (2; 3) + $(\frac{1}{2}, \frac{1}{2}, 0)$	$\mathbf{c}, \mathbf{b}, -\mathbf{a}$
[2] $P12/m1$ (10)	1; 2; 3; 4	$1/4, 1/4, 0$

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

**• Series of maximal isomorphic subgroups**

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

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No. 12

UNIQUE AXIS  $b$   $C2/m$

**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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No. 12

UNIQUE AXIS  $c$   $C2/m$

**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)