

$C_s^3$ 
 $C1m1$ 

No. 8

 $Cm$ 

 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)

**General position**

 Multiplicity,  
Wyckoff letter,  
Site symmetry

**Coordinates**

 4  $b$  1

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

 (1)  $x,y,z$  (2)  $x,\bar{y},z$ 
**I Maximal translationengleiche subgroups**

 [2]  $C1 (1, P1)$   $1+$   $1/2(\mathbf{a}-\mathbf{b}), 1/2(\mathbf{a}+\mathbf{b}), \mathbf{c}$ 
**II Maximal klassengleiche subgroups**

 • **Loss of centring translations**

 [2]  $P1a1 (7, P1c1)$   $1; 2+(\frac{1}{2},\frac{1}{2},0)$   $-\mathbf{a}-\mathbf{c}, \mathbf{b}, \mathbf{a}$   $0, 1/4, 0$   
 [2]  $P1m1 (6)$   $1; 2$ 

 • **Enlarged unit cell**

 [2]  $\mathbf{c}' = 2\mathbf{c}$   
 $C1c1 (9)$   $\langle 2+(0,0,1) \rangle$   $\mathbf{a}, \mathbf{b}, 2\mathbf{c}$   
 $I1c1 (9, C1c1)$   $\langle 2+(0,0,1) \rangle$   $\mathbf{a}-2\mathbf{c}, \mathbf{b}, 2\mathbf{c}$   
 $C1m1 (8)$   $\langle 2 \rangle$   $\mathbf{a}, \mathbf{b}, 2\mathbf{c}$   
 $I1m1 (8, C1m1)$   $\langle 2 \rangle$   $\mathbf{a}-2\mathbf{c}, \mathbf{b}, 2\mathbf{c}$   
 [3]  $\mathbf{b}' = 3\mathbf{b}$   
 $C1m1 (8)$   $\langle 2 \rangle$   $\mathbf{a}, 3\mathbf{b}, \mathbf{c}$   
 $C1m1 (8)$   $\langle 2+(0,2,0) \rangle$   $\mathbf{a}, 3\mathbf{b}, \mathbf{c}$   $0, 1, 0$   
 $C1m1 (8)$   $\langle 2+(0,4,0) \rangle$   $\mathbf{a}, 3\mathbf{b}, \mathbf{c}$   $0, 2, 0$ 

 [3]  $\mathbf{c}' = 3\mathbf{c}$   
 $C1m1 (8)$   $\langle 2 \rangle$   $\mathbf{a}, \mathbf{b}, 3\mathbf{c}$   
 [3]  $\mathbf{a}' = \mathbf{a}-2\mathbf{c}, \mathbf{c}' = 3\mathbf{c}$   
 $C1m1 (8)$   $\langle 2 \rangle$   $\mathbf{a}-2\mathbf{c}, \mathbf{b}, 3\mathbf{c}$   
 [3]  $\mathbf{a}' = \mathbf{a}-4\mathbf{c}, \mathbf{c}' = 3\mathbf{c}$   
 $C1m1 (8)$   $\langle 2 \rangle$   $\mathbf{a}-4\mathbf{c}, \mathbf{b}, 3\mathbf{c}$   
 [3]  $\mathbf{a}' = 3\mathbf{a}$   
 $C1m1 (8)$   $\langle 2 \rangle$   $3\mathbf{a}, \mathbf{b}, \mathbf{c}$ 

 • **Series of maximal isomorphic subgroups**

 [p]  $\mathbf{b}' = p\mathbf{b}$   
 $C1m1 (8)$   $\langle 2+(0,2u,0) \rangle$   $\mathbf{a}, p\mathbf{b}, \mathbf{c}$   $0, u, 0$   
 prime  $p > 2; 0 \leq u < p$   
 $p$  conjugate subgroups  
 [p]  $\mathbf{a}' = \mathbf{a}-2q\mathbf{c}, \mathbf{c}' = p\mathbf{c}$   
 $C1m1 (8)$   $\langle 2 \rangle$   $\mathbf{a}-2q\mathbf{c}, \mathbf{b}, p\mathbf{c}$   
 $p$  prime;  $0 \leq q < p$   
 no conjugate subgroups  
 [p]  $\mathbf{a}' = p\mathbf{a}$   
 $C1m1 (8)$   $\langle 2 \rangle$   $p\mathbf{a}, \mathbf{b}, \mathbf{c}$   
 prime  $p > 2$   
 no conjugate subgroups

**I Minimal translationengleiche supergroups**

 [2]  $C12/m1 (12)$ ; [2]  $Cmm2 (35)$ ; [2]  $Cmc2_1 (36)$ ; [2]  $Amm2 (38)$ ; [2]  $Aem2 (39)$ ; [2]  $Fmm2 (42)$ ; [2]  $Imm2 (44)$ ; [2]  $Ima2 (46)$ ;  
 [3]  $P3m1 (156)$ ; [3]  $P31m (157)$ ; [3]  $R3m (160)$ 
**II Minimal non-isomorphic klassengleiche supergroups**

 • **Additional centring translations**

none

 • **Decreased unit cell**

 [2]  $\mathbf{a}' = \frac{1}{2}\mathbf{a}, \mathbf{b}' = \frac{1}{2}\mathbf{b}$   $P1m1 (6)$

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)

**General position**

Multiplicity,  
Wyckoff letter,  
Site symmetry

**Coordinates**

4 *b* 1

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

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

**I Maximal translationengleiche subgroups**

[2] *A1* (1, *P1*) 1+  $\mathbf{a}, 1/2(\mathbf{b}-\mathbf{c}), 1/2(\mathbf{b}+\mathbf{c})$

**II Maximal klassengleiche subgroups**

• **Loss of centring translations**

[2] *P11b* (7, *P11a*)  $1; 2+(0, \frac{1}{2}, \frac{1}{2})$   $\mathbf{b}, -\mathbf{a}-\mathbf{b}, \mathbf{c}$  0,0,1/4  
 [2] *P11m* (6) 1; 2

• **Enlarged unit cell**

[2]  $\mathbf{a}' = 2\mathbf{a}$   
*A11a* (9)  $\langle 2+(1,0,0) \rangle$   $2\mathbf{a}, \mathbf{b}, \mathbf{c}$   
*I11a* (9, *A11a*)  $\langle 2+(1,0,0) \rangle$   $2\mathbf{a}, -2\mathbf{a}+\mathbf{b}, \mathbf{c}$   
*A11m* (8)  $\langle 2 \rangle$   $2\mathbf{a}, \mathbf{b}, \mathbf{c}$   
*I11m* (8, *A11m*)  $\langle 2 \rangle$   $2\mathbf{a}, -2\mathbf{a}+\mathbf{b}, \mathbf{c}$   
 [3]  $\mathbf{c}' = 3\mathbf{c}$   
 { *A11m* (8)  $\langle 2 \rangle$   $\mathbf{a}, \mathbf{b}, 3\mathbf{c}$   
   *A11m* (8)  $\langle 2+(0,0,2) \rangle$   $\mathbf{a}, \mathbf{b}, 3\mathbf{c}$  0,0,1  
   *A11m* (8)  $\langle 2+(0,0,4) \rangle$   $\mathbf{a}, \mathbf{b}, 3\mathbf{c}$  0,0,2

[3]  $\mathbf{a}' = 3\mathbf{a}$   
*A11m* (8)  $\langle 2 \rangle$   $3\mathbf{a}, \mathbf{b}, \mathbf{c}$   
 [3]  $\mathbf{a}' = 3\mathbf{a}, \mathbf{b}' = -2\mathbf{a}+\mathbf{b}$   
*A11m* (8)  $\langle 2 \rangle$   $3\mathbf{a}, -2\mathbf{a}+\mathbf{b}, \mathbf{c}$   
 [3]  $\mathbf{a}' = 3\mathbf{a}, \mathbf{b}' = -4\mathbf{a}+\mathbf{b}$   
*A11m* (8)  $\langle 2 \rangle$   $3\mathbf{a}, -4\mathbf{a}+\mathbf{b}, \mathbf{c}$   
 [3]  $\mathbf{b}' = 3\mathbf{b}$   
*A11m* (8)  $\langle 2 \rangle$   $\mathbf{a}, 3\mathbf{b}, \mathbf{c}$

• **Series of maximal isomorphic subgroups**

[*p*]  $\mathbf{c}' = p\mathbf{c}$   
*A11m* (8)  $\langle 2+(0,0,2u) \rangle$   $\mathbf{a}, \mathbf{b}, p\mathbf{c}$  0,0,*u*  
 prime  $p > 2$ ;  $0 \leq u < p$   
*p* conjugate subgroups  
 [*p*]  $\mathbf{a}' = p\mathbf{a}, \mathbf{b}' = -2q\mathbf{a}+\mathbf{b}$   
*A11m* (8)  $\langle 2 \rangle$   $p\mathbf{a}, -2q\mathbf{a}+\mathbf{b}, \mathbf{c}$   
*p* prime;  $0 \leq q < p$   
 no conjugate subgroups  
 [*p*]  $\mathbf{b}' = p\mathbf{b}$   
*A11m* (8)  $\langle 2 \rangle$   $\mathbf{a}, p\mathbf{b}, \mathbf{c}$   
 prime  $p > 2$   
 no conjugate subgroups

**I Minimal translationengleiche supergroups**

[2] *A112/m* (12); [2] *Cmm2* (35); [2] *Cmc2<sub>1</sub>* (36); [2] *Amm2* (38); [2] *Aem2* (39); [2] *Fmm2* (42); [2] *Imm2* (44); [2] *Ima2* (46);  
 [3] *P3m1* (156); [3] *P31m* (157); [3] *R3m* (160)

**II Minimal non-isomorphic klassengleiche supergroups**

• **Additional centring translations**

none

• **Decreased unit cell**

[2]  $\mathbf{b}' = \frac{1}{2}\mathbf{b}, \mathbf{c}' = \frac{1}{2}\mathbf{c}$  *P11m* (6)