

$C2/c$

No. 15

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

 UNIQUE AXIS b , CELL CHOICE 1

	Axes	Coordinates	Wyckoff positions					
			$4a$	$4b$	$4c$	$4d$	$4e$	$8f$
I Maximal translationengleiche subgroups								
[2] $C1c1$ (9)			$4a$	$4a$	$4a$	$4a$	$4a$	$2 \times 4a$
[2] $C121$ (5)		$x, y, z + \frac{1}{4}$	$4c$	$4c$	$4c$	$4c$	$2a; 2b$	$2 \times 4c$
[2] $P\bar{1}$ (2)		$\frac{1}{2}(\mathbf{a}-\mathbf{b}), \mathbf{b}, \mathbf{c}$	$1a; 1b$	$1c; 1g$	$1e; 1f$	$1d; 1h$	$2i$	$2 \times 2i$
			$1a; 1e$	$1c; 1d$	$1g; 1h$	$1b; 1f$	$2i$	$2 \times 2i \Rightarrow$
			$1a; 1d$	$1b; 1f$	$1c; 1g$	$1e; 1h$	$2i$	$2 \times 2i \Rightarrow \Rightarrow$
II Maximal klassengleiche subgroups								
Loss of centring translations								
[2] $P12_1/n1$ (14)			$2a; 2b$	$2c; 2d$	$4e$	$4e$	$4e$	$2 \times 4e$
[2] $P12_1/c1$ (14)		$x + \frac{1}{4}, y + \frac{1}{4}, z$	$4e$	$4e$	$2a; 2d$	$2b; 2c$	$4e$	$2 \times 4e$
[2] $P12/c1$ (13)			$2a; 2b$	$2c; 2d$	$4g$	$4g$	$2e; 2f$	$2 \times 4g$
[2] $P12/n1$ (13)		$x + \frac{1}{4}, y + \frac{1}{4}, z$	$4g$	$4g$	$2a; 2b$	$2c; 2d$	$2e; 2f$	$2 \times 4g$
Enlarged unit cell, isomorphic								
[3] $C12/c1$	$\mathbf{a}, 3\mathbf{b}, \mathbf{c}$	$x, \frac{1}{3}y, z; \pm(0, \frac{1}{3}, 0)$	$4a; 8f$	$4b; 8f$	$4d; 8f$	$4c; 8f$	$3 \times 4e$	$3 \times 8f$
[p] $C12/c1$	$\mathbf{a}, p\mathbf{b}, \mathbf{c}$	$x, \frac{1}{p}y, z; + (0, \frac{u}{p}, 0)$ $p = \text{prime} > 2; u = 1, \dots, p-1$	$4a; \frac{p-1}{2} \times 8f$	$4b; \frac{p-1}{2} \times 8f$	$4c(d^*);$ $\frac{p-1}{2} \times 8f$	$4d(c^*);$ $\frac{p-1}{2} \times 8f$	$p \times 4e$	$p \times 8f$
[3] $C12/c1$	$3\mathbf{a}, \mathbf{b}, \mathbf{c}$	$\frac{1}{3}x, y, z; \pm(\frac{1}{3}, 0, 0)$	$4a; 8f$	$4b; 8f$	$4d; 8f$	$4c; 8f$	$4e; 8f$	$3 \times 8f$
[3] $C12/c1$	$3\mathbf{a}, \mathbf{b}, 2\mathbf{a}+\mathbf{c}$	$\frac{1}{3}(x-2z), y, z; \pm(\frac{1}{3}, 0, 0)$	$4a; 8f$	$4b; 8f$	$4d; 8f$	$4c; 8f$	$4e; 8f$	$3 \times 8f$
[3] $C12/c1$	$3\mathbf{a}, \mathbf{b}, -2\mathbf{a}+\mathbf{c}$	$\frac{1}{3}(x+2z), y, z; \pm(\frac{1}{3}, 0, 0)$	$4a; 8f$	$4b; 8f$	$4d; 8f$	$4c; 8f$	$4e; 8f$	$3 \times 8f$
[3] $C12/c1$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$	$x, y, \frac{1}{3}z; \pm(0, 0, \frac{1}{3})$	$4a; 8f$	$4b; 8f$	$4c; 8f$	$4d; 8f$	$4e; 8f$	$3 \times 8f$
[p] $C12/c1$	$\mathbf{a}, \mathbf{b}, p\mathbf{c}$	$x, y, \frac{1}{p}z; + (0, 0, \frac{u}{p})$ $p = \text{prime} > 2; u = 1, \dots, p-1;$	$4a; \frac{p-1}{2} \times 8f$	$4b; \frac{p-1}{2} \times 8f$	$4c; \frac{p-1}{2} \times 8f$	$4d; \frac{p-1}{2} \times 8f$	$4e; \frac{p-1}{2} \times 8f$	$p \times 8f$
[p] $C12/c1$	$p\mathbf{a}, \mathbf{b}, 2q\mathbf{a}+\mathbf{c}$	$\frac{1}{p}(x-2qz), y, z; + (\frac{u}{p}, 0, 0)$ $p = \text{prime} > 2; u = 1, \dots, p-1;$ $-\frac{1}{2}(p-1) \leq q \leq \frac{1}{2}(p-1)$	$4a; \frac{p-1}{2} \times 8f$	$4b; \frac{p-1}{2} \times 8f$	$4c(d^*);$ $\frac{p-1}{2} \times 8f$	$4d(c^*);$ $\frac{p-1}{2} \times 8f$	$4e; \frac{p-1}{2} \times 8f$	$p \times 8f$

$$* p = 4n - 1$$

A 12/n 1

CELL CHOICE 2

I 12/a 1

CELL CHOICE 3

CONTINUED **C 2/c**
UNIQUE AXIS **b**

I Maximal *translationengleiche* subgroups

	Axes	Coordinates
[2] A1n1		
[2] A121		$x-\frac{1}{4}, y, z-\frac{1}{4}$
[2] P $\bar{1}$	a, b, $\frac{1}{2}(-b+c)$	$x, y+z, 2z$

	Axes	Coordinates
I1a1		
I121		$x+\frac{1}{4}, y, z$
P $\bar{1}$	a, $\frac{1}{2}(-a+b-c)$, c	$x+y, 2y, y+z$

II Maximal *klassengleiche* subgroups

Loss of centring translations

[2] P12 ₁ /a1		
[2] P12 ₁ /n1		$x, y+\frac{1}{4}, z+\frac{1}{4}$
[2] P12/n1		
[2] P12/a1		$x, y+\frac{1}{4}, z+\frac{1}{4}$

P12 ₁ /c1		
P12 ₁ /a1		$x-\frac{1}{4}, y+\frac{1}{4}, z-\frac{1}{4}$
P12/a1		
P12/c1		$x-\frac{1}{4}, y+\frac{1}{4}, z-\frac{1}{4}$

Enlarged unit cell, isomorphic

[3] A12/n1	a, 3b, c	$x, \frac{1}{3}y, z; \pm(0, \frac{1}{3}, 0)$
[p] A12/n1	a, pb, c $p = \text{prime} > 2; u = 1, \dots, p-1$	$x, \frac{1}{p}y, z; + (0, \frac{u}{p}, 0)$
[3] A12/n1	a-2c, b, 3c	$x, y, \frac{1}{3}(2x+z); \pm(0, 0, \frac{1}{3})$
[3] A12/n1	a+2c, b, 3c	$x, y, \frac{1}{3}(-2x+z); \pm(0, 0, \frac{1}{3})$
[3] A12/n1	a, b, 3c	$x, y, \frac{1}{3}z; \pm(0, 0, \frac{1}{3})$
[3] A12/n1	3a, b, c	$\frac{1}{3}x, y, z; \pm(\frac{1}{3}, 0, 0)$
[p] A12/n1	pa, b, c $p = \text{prime} > 2; u = 1, \dots, p-1;$	$\frac{1}{p}x, y, z; +(\frac{u}{p}, 0, 0)$
[p] A12/n1	a+2qc, b, pc $p = \text{prime} > 2; u = 1, \dots, p-1;$ $-\frac{1}{2}(p-1) \leq q \leq \frac{1}{2}(p-1)$	$x, y, \frac{1}{p}(-2qx+z); + (0, 0, \frac{u}{p})$

I12/a1	a, 3b, c	$x, \frac{1}{3}y, z; \pm(0, \frac{1}{3}, 0)$
I12/a1	a, pb, c $p = \text{prime} > 2; u = 1, \dots, p-1$	$x, \frac{1}{p}y, z; + (0, \frac{u}{p}, 0)$
I12/a1	a, b, 2a+3c	$x-\frac{2}{3}z, y, \frac{1}{3}z; \pm(0, 0, \frac{1}{3})$
I12/a1	3a, b, 2a+c	$\frac{1}{3}(x-2z), y, z; \pm(\frac{1}{3}, 0, 0)$
I12/a1	3a, b, c	$\frac{1}{3}x, y, z; \pm(\frac{1}{3}, 0, 0)$
I12/a1	a-2c, b, 3c	$x, y, \frac{1}{3}(2x+z); \pm(0, 0, \frac{1}{3})$
I12/a1	pa, b, c $p = \text{prime} > 2; u = 1, \dots, p-1;$	$\frac{1}{p}x, y, z; +(\frac{u}{p}, 0, 0)$
I12/a1	a+2qc, b, pc $p = \text{prime} > 2; u = 1, \dots, p-1;$ $-\frac{1}{2}(p-1) \leq q \leq \frac{1}{2}(p-1)$	$x, y, \frac{1}{p}(-2qx+z); + (0, 0, \frac{u}{p})$

Space groups of the series of isomorphic subgroups appear in different sequences for cell choices 1, 2 and 3

	Axes	Coordinates	Wyckoff positions					
			4a	4b	4c	4d	4e	8f
I Maximal translationengleiche subgroups								
[2] A11a (9)			4a	4a	4a	4a	4a	2×4a
[2] A112 (5)		$x+\frac{1}{4}, y, z$	4c	4c	4c	4c	2a; 2b	2×4c
[2] P $\bar{1}$ (2)	a, $\frac{1}{2}(\mathbf{b}-\mathbf{c}), \mathbf{c}$	$x, 2y, y+z$	1a; 1d 1a; 1g 1a; 1c	1b; 1f 1b; 1c 1d; 1e	1e; 1g 1f; 1h 1b; 1f	1c; 1h 1d; 1e 1g; 1h	2i 2i 2i	2×2i 2×2i 2×2i

II Maximal klassengleiche subgroups

Loss of centring translations

[2] P112 ₁ /n (14)			2a; 2b	2c; 2d	4e	4e	4e	2×4e
[2] P112 ₁ /a (14)		$x, y+\frac{1}{4}, z+\frac{1}{4}$	4e	4e	2a; 2d	2b; 2c	4e	2×4e
[2] P112/a (13)			2a; 2b	2c; 2d	4g	4g	2e; 2f	2×4g
[2] P112/n (13)		$x, y+\frac{1}{4}, z+\frac{1}{4}$	4g	4g	2a; 2b	2c; 2d	2e; 2f	2×4g

Enlarged unit cell, isomorphic

[3] A112/a	a, b, 3c	$x, y, \frac{1}{3}z; \pm(0, 0, \frac{1}{3})$	4a; 8f	4b; 8f	4d; 8f	4c; 8f	3×4e	3×8f
[p] A112/a	a, b, pc	$x, y, \frac{1}{p}z; +(0, 0, \frac{u}{p})$ $p = \text{prime} > 2; u = 1, \dots, p-1$	$4a; \frac{p-1}{2} \times 8f$	$4b; \frac{p-1}{2} \times 8f$	$4c(d^*); \frac{p-1}{2} \times 8f$	$4d(c^*); \frac{p-1}{2} \times 8f$	$p \times 4e$	$p \times 8f$
[3] A112/a	a, 3b, c	$x, \frac{1}{3}y, z; \pm(0, \frac{1}{3}, 0)$	4a; 8f	4b; 8f	4d; 8f	4c; 8f	4e; 8f	3×8f
[3] A112/a	a+2b, 3b, c	$x, \frac{1}{3}(-2x+y), z; \pm(0, \frac{1}{3}, 0)$	4a; 8f	4b; 8f	4d; 8f	4c; 8f	4e; 8f	3×8f
[3] A112/a	a-2b, 3b, c	$x, \frac{1}{3}(2x+y), z; \pm(0, \frac{1}{3}, 0)$	4a; 8f	4b; 8f	4d; 8f	4c; 8f	4e; 8f	3×8f
[3] A112/a	3a, b, c	$\frac{1}{3}x, y, z; \pm(\frac{1}{3}, 0, 0)$	4a; 8f	4b; 8f	4c; 8f	4d; 8f	4e; 8f	3×8f
[p] A112/a	pa, b, c	$\frac{1}{p}x, y, z; +(\frac{u}{p}, 0, 0)$ $p = \text{prime} > 2; u = 1, \dots, p-1;$	$4a; \frac{p-1}{2} \times 8f$	$4b; \frac{p-1}{2} \times 8f$	$4c; \frac{p-1}{2} \times 8f$	$4d; \frac{p-1}{2} \times 8f$	$4e; \frac{p-1}{2} \times 8f$	$p \times 8f$
[p] A112/a	a+2qb, pb, c	$x, \frac{1}{p}(-2qx+y), z; +(0, \frac{u}{p}, 0)$ $p = \text{prime} > 2; u = 1, \dots, p-1;$ $-\frac{1}{2}(p-1) \leq q \leq \frac{1}{2}(p-1)$	$4a; \frac{p-1}{2} \times 8f$	$4b; \frac{p-1}{2} \times 8f$	$4c(d^*); \frac{p-1}{2} \times 8f$	$4d(c^*); \frac{p-1}{2} \times 8f$	$4e; \frac{p-1}{2} \times 8f$	$p \times 8f$

* $p = 4n - 1$

B 1 1 2/n

CELL CHOICE 2

I 1 1 2/b

CELL CHOICE 3

CONTINUED C 2/c

UNIQUE AXIS C

	Axes	Coordinates		Axes	Coordinates
I Maximal translationengleiche subgroups					
[2]	B_{11n}			I_{11b}	
[2]	B_{112}	$x-\frac{1}{4}, y-\frac{1}{4}, z$		I_{112}	$x, y+\frac{1}{4}, z$
[2]	$P\bar{1}$	$\frac{1}{2}(\mathbf{a}-\mathbf{c}), \mathbf{b}, \mathbf{c}$		$P\bar{1}$	$\mathbf{a}, \mathbf{b}, \frac{1}{2}(-\mathbf{a}-\mathbf{b}+\mathbf{c})$
II Maximal klassengleiche subgroups					
Loss of centring translations					
[2]	$P_{112_1/b}$			$P_{112_1/a}$	
[2]	$P_{112_1/n}$	$x+\frac{1}{4}, y, z+\frac{1}{4}$		$P_{112_1/b}$	$x-\frac{1}{4}, y-\frac{1}{4}, z+\frac{1}{4}$
[2]	$P_{112/n}$			$P_{112/b}$	
[2]	$P_{112/b}$	$x+\frac{1}{4}, y, z+\frac{1}{4}$		$P_{112/a}$	$x-\frac{1}{4}, y-\frac{1}{4}, z+\frac{1}{4}$
Enlarged unit cell, isomorphic					
[3]	$B_{112/n}$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$		$I_{112/b}$	$\mathbf{a}, \mathbf{b}, 3\mathbf{c}$
		$x, y, \frac{1}{3}z; \pm(0, 0, \frac{1}{3})$			$x, y, \frac{1}{3}z; \pm(0, 0, \frac{1}{3})$
[p]	$B_{112/n}$	$\mathbf{a}, \mathbf{b}, p\mathbf{c}$		$I_{112/b}$	$\mathbf{a}, \mathbf{b}, p\mathbf{c}$
		$x, y, \frac{1}{p}z; + (0, 0, \frac{u}{p})$			$x, y, \frac{1}{p}z; + (0, 0, \frac{u}{p})$
		$p = \text{prime} > 2; u = 1, \dots, p-1$			$p = \text{prime} > 2; u = 1, \dots, p-1$
[3]	$B_{112/n}$	$3\mathbf{a}, -2\mathbf{a}+\mathbf{b}, \mathbf{c}$		$I_{112/b}$	$3\mathbf{a}+2\mathbf{b}, \mathbf{b}, \mathbf{c}$
		$\frac{1}{3}(x+2y), y, z; \pm(\frac{1}{3}, 0, 0)$			$\frac{1}{3}x, -\frac{2}{3}x+y, z; \pm(\frac{1}{3}, 0, 0)$
[3]	$B_{112/n}$	$3\mathbf{a}, 2\mathbf{a}+\mathbf{b}, \mathbf{c}$		$I_{112/b}$	$\mathbf{a}+2\mathbf{b}, 3\mathbf{b}, \mathbf{c}$
		$\frac{1}{3}(x-2y), y, z; \pm(\frac{1}{3}, 0, 0)$			$x, \frac{1}{3}(-2x+y), z; \pm(0, \frac{1}{3}, 0)$
[3]	$B_{112/n}$	$3\mathbf{a}, \mathbf{b}, \mathbf{c}$		$I_{112/b}$	$\mathbf{a}, 3\mathbf{b}, \mathbf{c}$
		$\frac{1}{3}z, y, z; \pm(\frac{1}{3}, 0, 0)$			$x, \frac{1}{3}y, z; \pm(0, \frac{1}{3}, 0)$
[3]	$B_{112/n}$	$\mathbf{a}, 3\mathbf{b}, \mathbf{c}$		$I_{112/b}$	$3\mathbf{a}, -2\mathbf{a}+\mathbf{b}, \mathbf{c}$
		$x, \frac{1}{3}y, z; \pm(0, \frac{1}{3}, 0)$			$\frac{1}{3}(x+2y), y, z; \pm(\frac{1}{3}, 0, 0)$
[p]	$B_{112/n}$	$\mathbf{a}, p\mathbf{b}, \mathbf{c}$		$I_{112/b}$	$\mathbf{a}, p\mathbf{b}, \mathbf{c}$
		$x, \frac{1}{p}y, z; + (0, \frac{u}{p}, 0)$			$x, \frac{1}{p}y, z; + (0, \frac{u}{p}, 0)$
		$p = \text{prime} > 2; u = 1, \dots, p-1;$			$p = \text{prime} > 2; u = 1, \dots, p-1;$
[p]	$B_{112/n}$	$p\mathbf{a}, 2q\mathbf{a}+\mathbf{b}, \mathbf{c}$		$I_{112/b}$	$p\mathbf{a}, 2q\mathbf{a}+\mathbf{b}, \mathbf{c}$
		$\frac{1}{p}(x-2qy), y, z; + (\frac{u}{p}, 0, 0)$			$\frac{1}{p}(x-2qy), y, z; + (\frac{u}{p}, 0, 0)$
		$p = \text{prime} > 2; u = 1, \dots, p-1;$			$p = \text{prime} > 2; u = 1, \dots, p-1;$
		$-\frac{1}{2}(p-1) \leq q \leq \frac{1}{2}(p-1)$			$-\frac{1}{2}(p-1) \leq q \leq \frac{1}{2}(p-1)$

Space groups of the series of isomorphic subgroups appear in different sequences for cell choices 1, 2 and 3