

$C2/c$

C_{2h}^6

$2/m$

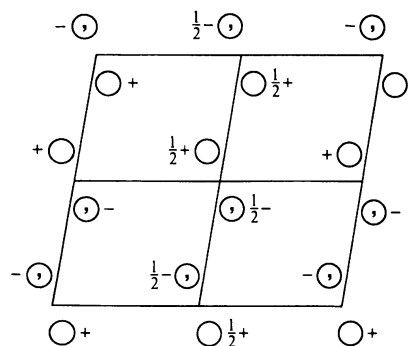
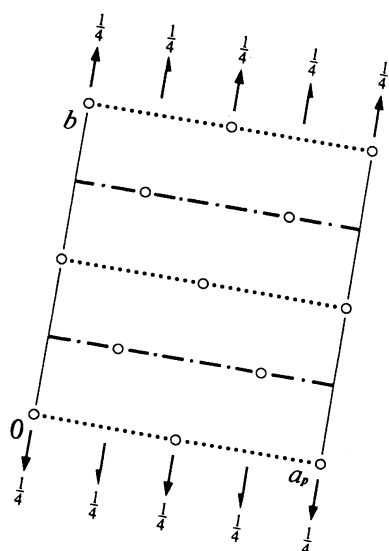
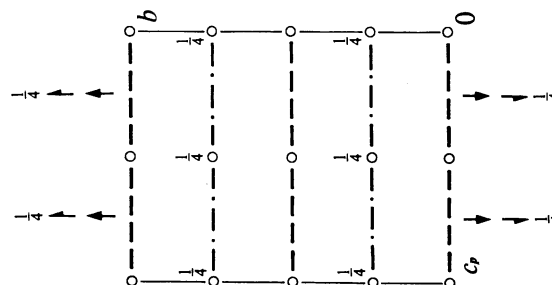
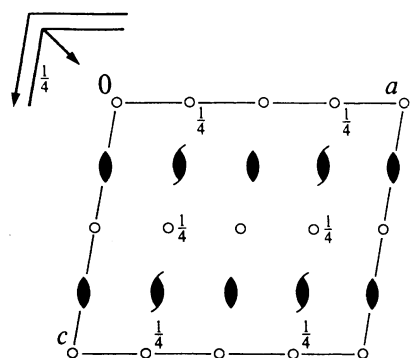
Monoclinic

No. 15

$C12/c1$

Patterson symmetry $C12/m1$

UNIQUE AXIS b , CELL CHOICE 1



Origin at $\bar{1}$ on glide plane c

Asymmetric unit $0 \leq x \leq \frac{1}{2}; 0 \leq y \leq \frac{1}{2}; 0 \leq z \leq \frac{1}{2}$

Symmetry operations

For $(0,0,0)+$ set

- (1) 1 (2) $2 \quad 0, y, \frac{1}{4}$ (3) $\bar{1} \quad 0, 0, 0$ (4) $c \quad x, 0, z$

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

- (1) $t(\frac{1}{2}, \frac{1}{2}, 0)$ (2) $2(0, \frac{1}{2}, 0) \quad \frac{1}{4}, y, \frac{1}{4}$ (3) $\bar{1} \quad \frac{1}{4}, \frac{1}{4}, 0$ (4) $n(\frac{1}{2}, 0, \frac{1}{2}) \quad x, \frac{1}{4}, z$

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)

Positions

Multiplicity,
Wyckoff letter,
Site symmetry

Coordinates

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

Reflection conditions

General:

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

$hkl: h + k = 2n$

$h0l: h, l = 2n$

$0kl: k = 2n$

$hk0: h + k = 2n$

$0k0: k = 2n$

$h00: h = 2n$

$00l: l = 2n$

Special: as above, plus

4 *e* 2 $0, y, \frac{1}{4}$ $0, \bar{y}, \frac{3}{4}$

no extra conditions

4 *d* $\bar{1}$ $\frac{1}{4}, \frac{1}{4}, \frac{1}{2}$ $\frac{3}{4}, \frac{1}{4}, 0$

$hkl: k + l = 2n$

4 *c* $\bar{1}$ $\frac{1}{4}, \frac{1}{4}, 0$ $\frac{3}{4}, \frac{1}{4}, \frac{1}{2}$

$hkl: k + l = 2n$

4 *b* $\bar{1}$ $0, \frac{1}{2}, 0$ $0, \frac{1}{2}, \frac{1}{2}$

$hkl: l = 2n$

4 *a* $\bar{1}$ $0, 0, 0$ $0, 0, \frac{1}{2}$

$hkl: l = 2n$

Symmetry of special projections

Along [001] $c2mm$

$\mathbf{a}' = \mathbf{a}_p$ $\mathbf{b}' = \mathbf{b}$

Origin at $0, 0, z$

Along [100] $p2gm$

$\mathbf{a}' = \frac{1}{2}\mathbf{b}$ $\mathbf{b}' = \mathbf{c}_p$

Origin at $x, 0, 0$

Along [010] $p2$

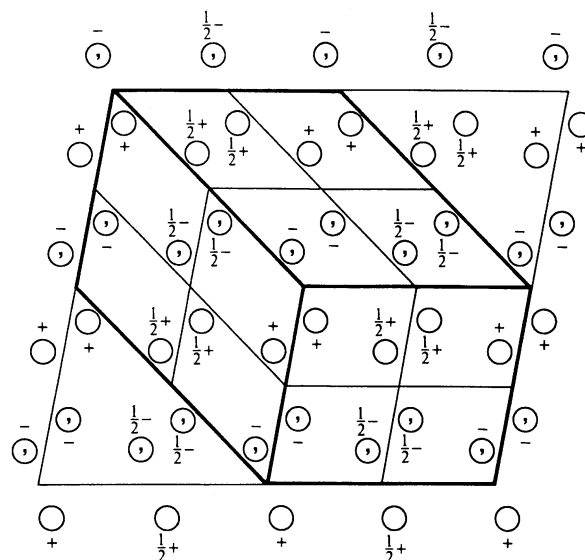
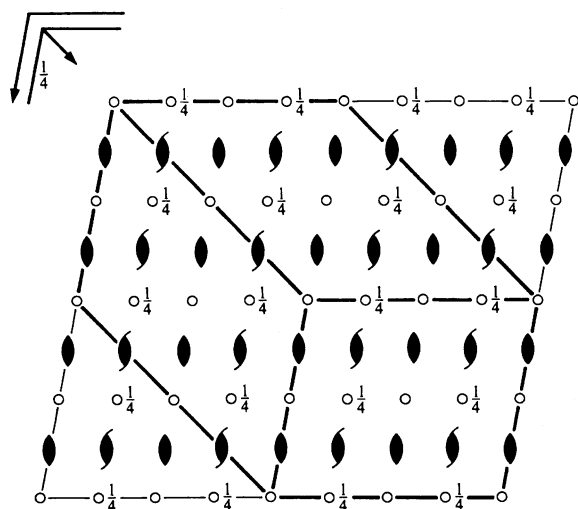
$\mathbf{a}' = \frac{1}{2}\mathbf{c}$ $\mathbf{b}' = \frac{1}{2}\mathbf{a}$

Origin at $0, y, 0$

$C2/c$ C_{2h}^6 $2/m$

Monoclinic

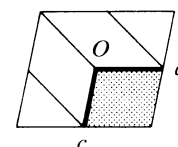
No. 15

UNIQUE AXIS b , DIFFERENT CELL CHOICES $C12/c1$ UNIQUE AXIS b , CELL CHOICE 1Origin at $\bar{1}$ on glide plane c Asymmetric unit $0 \leq x \leq \frac{1}{2}$; $0 \leq y \leq \frac{1}{2}$; $0 \leq z \leq \frac{1}{2}$ 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)

Positions

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) $x, \bar{y}, z + \frac{1}{2}$ 4 e 2 $0, y, \frac{1}{4}$ $0, \bar{y}, \frac{3}{4}$ 4 d $\bar{1}$ $\frac{1}{4}, \frac{1}{4}, \frac{1}{2}$ $\frac{3}{4}, \frac{1}{4}, 0$ 4 c $\bar{1}$ $\frac{1}{4}, \frac{1}{4}, 0$ $\frac{3}{4}, \frac{1}{4}, \frac{1}{2}$ 4 b $\bar{1}$ $0, \frac{1}{2}, 0$ $0, \frac{1}{2}, \frac{1}{2}$ 4 a $\bar{1}$ $0, 0, 0$ $0, 0, \frac{1}{2}$ 

Reflection conditions

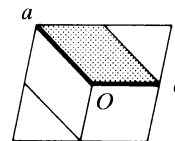
General:

 $hkl: h+k=2n$ $0k0: k=2n$
 $h0l: h,l=2n$ $h00: h=2n$
 $0kl: k=2n$ $00l: l=2n$
 $hk0: h+k=2n$

Special: as above, plus

no extra conditions

 $hkl: k+l=2n$ $hkl: l=2n$

A 12/n 1UNIQUE AXIS b , CELL CHOICE 2**Origin** at $\bar{1}$ on glide plane n **Asymmetric unit** $0 \leq x \leq \frac{1}{2}; 0 \leq y \leq 1; 0 \leq z \leq \frac{1}{4}$ **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)**Positions**Multiplicity,
Wyckoff letter,
Site symmetry

Coordinates

Reflection conditions

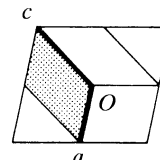
 $(0,0,0)+ (0, \frac{1}{2}, \frac{1}{2})+$

General:

8 f 1 (1) x, y, z (2) $\bar{x} + \frac{1}{2}, y, \bar{z} + \frac{1}{2}$ (3) $\bar{x}, \bar{y}, \bar{z}$ (4) $x + \frac{1}{2}, \bar{y}, z + \frac{1}{2}$
 $hkl: k + l = 2n$ $0k0: k = 2n$
 $h0l: h, l = 2n$ $h00: h = 2n$
 $0kl: k + l = 2n$ $00l: l = 2n$
 $hk0: k = 2n$

Special: as above, plus

no extra conditions

4 e 2 $\frac{3}{4}, y, \frac{3}{4}$ $\frac{1}{4}, \bar{y}, \frac{1}{4}$ $hkl: h = 2n$ 4 d $\bar{1}$ $\frac{1}{2}, \frac{1}{4}, \frac{3}{4}$ $0, \frac{1}{4}, \frac{3}{4}$ 4 c $\bar{1}$ $0, \frac{1}{4}, \frac{1}{4}$ $\frac{1}{2}, \frac{1}{4}, \frac{1}{4}$ $hkl: h + k = 2n$ 4 b $\bar{1}$ $0, \frac{1}{2}, 0$ $\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$ 4 a $\bar{1}$ $0, 0, 0$ $\frac{1}{2}, 0, \frac{1}{2}$ **I 12/a 1**UNIQUE AXIS b , CELL CHOICE 3**Origin** at $\bar{1}$ on glide plane a **Asymmetric unit** $0 \leq x \leq 1; 0 \leq y \leq \frac{1}{2}; 0 \leq z \leq \frac{1}{4}$ **Generators selected** (1); $t(1,0,0)$; $t(0,1,0)$; $t(0,0,1)$; $t(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$; (2); (3)**Positions**Multiplicity,
Wyckoff letter,
Site symmetry

Coordinates

Reflection conditions

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

General:

8 f 1 (1) x, y, z (2) $\bar{x} + \frac{1}{2}, y, \bar{z}$ (3) $\bar{x}, \bar{y}, \bar{z}$ (4) $x + \frac{1}{2}, \bar{y}, z$
 $hkl: h + k + l = 2n$ $0k0: k = 2n$
 $h0l: h, l = 2n$ $h00: h = 2n$
 $0kl: k + l = 2n$ $00l: l = 2n$
 $hk0: h + k = 2n$

Special: as above, plus

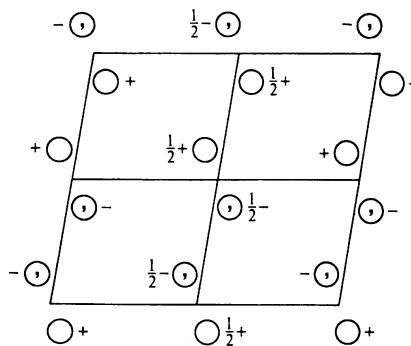
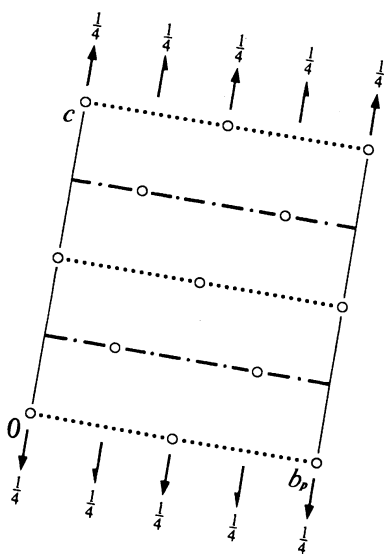
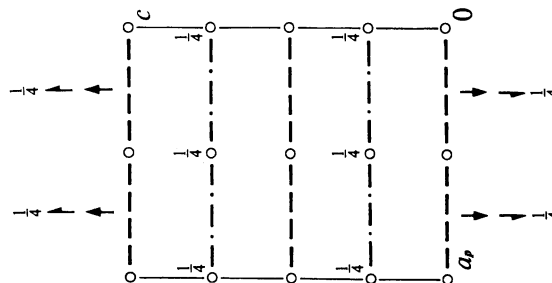
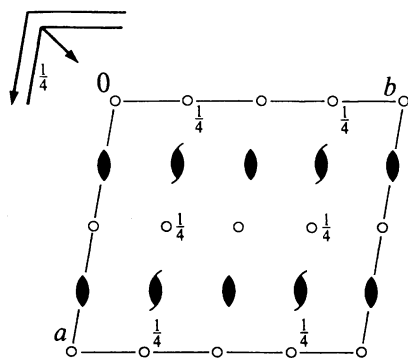
no extra conditions

4 e 2 $\frac{1}{4}, y, 0$ $\frac{3}{4}, \bar{y}, 0$ $hkl: l = 2n$ 4 d $\bar{1}$ $\frac{1}{4}, \frac{1}{4}, \frac{3}{4}$ $\frac{1}{4}, \frac{1}{4}, \frac{1}{4}$ 4 c $\bar{1}$ $\frac{3}{4}, \frac{1}{4}, \frac{3}{4}$ $\frac{3}{4}, \frac{1}{4}, \frac{1}{4}$ $hkl: h = 2n$ 4 b $\bar{1}$ $0, \frac{1}{2}, 0$ $\frac{1}{2}, \frac{1}{2}, 0$ 4 a $\bar{1}$ $0, 0, 0$ $\frac{1}{2}, 0, 0$

$C2/c$ C_{2h}^6 $2/m$

Monoclinic

No. 15

 $A112/a$ Patterson symmetry $A112/m$ UNIQUE AXIS c , CELL CHOICE 1**Origin** at $\bar{1}$ on glide plane a **Asymmetric unit** $0 \leq x \leq \frac{1}{2}; 0 \leq y \leq \frac{1}{2}; 0 \leq z \leq \frac{1}{2}$ **Symmetry operations**For $(0,0,0)+$ set

- (1) 1 (2) $2 \frac{1}{4}, 0, z$ (3) $\bar{1} 0, 0, 0$ (4) $a x, y, 0$

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

- (1) $t(0, \frac{1}{2}, \frac{1}{2})$ (2) $2(0, 0, \frac{1}{2}) \frac{1}{4}, \frac{1}{4}, z$ (3) $\bar{1} 0, \frac{1}{4}, \frac{1}{4}$ (4) $n(\frac{1}{2}, \frac{1}{2}, 0) x, y, \frac{1}{4}$

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)

Positions

Multiplicity,
Wyckoff letter,
Site symmetry

Coordinates

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

Reflection conditions

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

General:

$$hkl: k + l = 2n$$

$$hk0: h, k = 2n$$

$$0kl: k + l = 2n$$

$$h0l: l = 2n$$

$$00l: l = 2n$$

$$h00: h = 2n$$

$$0k0: k = 2n$$

Special: as above, plus

no extra conditions

4 *e* 2 $\frac{1}{4}, 0, z$ $\frac{3}{4}, 0, \bar{z}$

$$hkl: h + k = 2n$$

4 *d* $\bar{1}$ $\frac{1}{2}, \frac{1}{4}, \frac{1}{4}$ $0, \frac{3}{4}, \frac{1}{4}$

$$hkl: h + k = 2n$$

4 *c* $\bar{1}$ $0, \frac{1}{4}, \frac{1}{4}$ $\frac{1}{2}, \frac{3}{4}, \frac{1}{4}$

$$hkl: h = 2n$$

4 *b* $\bar{1}$ $0, 0, \frac{1}{2}$ $\frac{1}{2}, 0, \frac{1}{2}$

$$hkl: h = 2n$$

4 *a* $\bar{1}$ $0, 0, 0$ $\frac{1}{2}, 0, 0$

Symmetry of special projections

Along [001] $p2$

$$\mathbf{a}' = \frac{1}{2}\mathbf{a} \quad \mathbf{b}' = \frac{1}{2}\mathbf{b}$$

Origin at $0, 0, z$

Along [100] $c2mm$

$$\mathbf{a}' = \mathbf{b}_p \quad \mathbf{b}' = \mathbf{c}$$

Origin at $x, 0, 0$

Along [010] $p2gm$

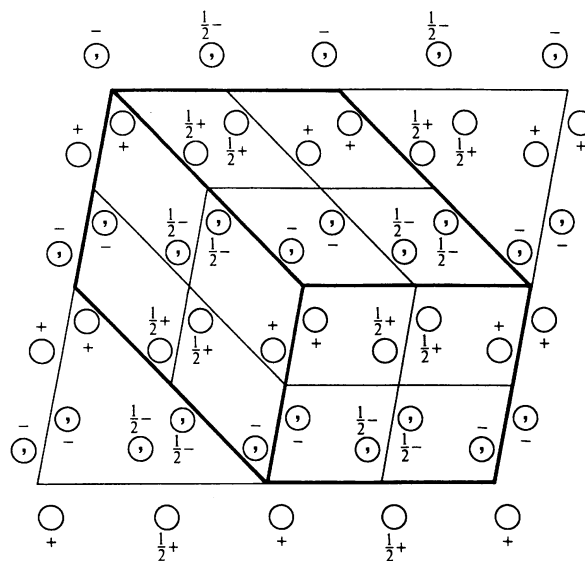
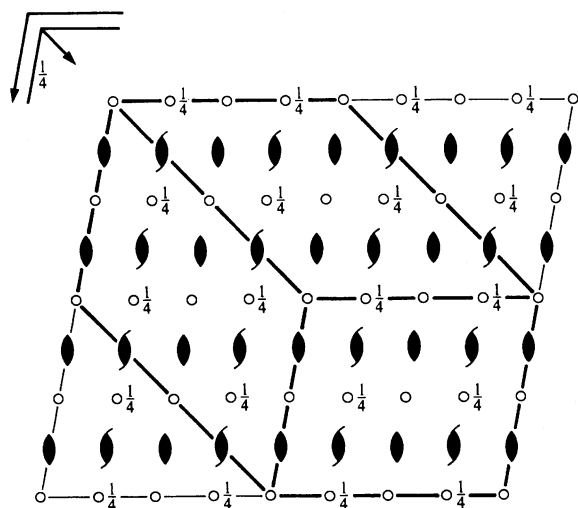
$$\mathbf{a}' = \frac{1}{2}\mathbf{c} \quad \mathbf{b}' = \mathbf{a}_p$$

Origin at $0, y, 0$

$C2/c$ C_{2h}^6 $2/m$

Monoclinic

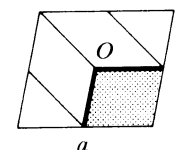
No. 15

UNIQUE AXIS c , DIFFERENT CELL CHOICES $A112/a$ UNIQUE AXIS c , CELL CHOICE 1Origin at $\bar{1}$ on glide plane a Asymmetric unit $0 \leq x \leq \frac{1}{2}$; $0 \leq y \leq \frac{1}{2}$; $0 \leq z \leq \frac{1}{2}$ 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)

Positions

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) $x + \frac{1}{2}, y, \bar{z}$ 4 e 2 $\frac{1}{4}, 0, z$ $\frac{3}{4}, 0, \bar{z}$ 4 d $\bar{1}$ $\frac{1}{2}, \frac{1}{4}, \frac{1}{4}$ $0, \frac{3}{4}, \frac{1}{4}$ 4 c $\bar{1}$ $0, \frac{1}{4}, \frac{1}{4}$ $\frac{1}{2}, \frac{3}{4}, \frac{1}{4}$ 4 b $\bar{1}$ $0, 0, \frac{1}{2}$ $\frac{1}{2}, 0, \frac{1}{2}$ 4 a $\bar{1}$ $0, 0, 0$ $\frac{1}{2}, 0, 0$ 

Reflection conditions

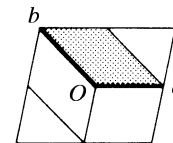
General:

 $hkl: k+l=2n$ $00l: l=2n$
 $hk0: h,k=2n$ $h00: h=2n$
 $0kl: k+l=2n$ $0k0: k=2n$
 $h0l: l=2n$

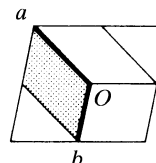
Special: as above, plus

no extra conditions

 $hkl: h+k=2n$ $hkl: h=2n$

B112/nUNIQUE AXIS c , CELL CHOICE 2**Origin** at $\bar{1}$ on glide plane n **Asymmetric unit** $0 \leq x \leq \frac{1}{4}$; $0 \leq y \leq \frac{1}{2}$; $0 \leq z \leq 1$ **Generators selected** (1); $t(1,0,0)$; $t(0,1,0)$; $t(0,0,1)$; $t(\frac{1}{2},0,\frac{1}{2})$; (2); (3)**Positions**

Multiplicity, Wyckoff letter, Site symmetry	Coordinates				Reflection conditions	
	$(0,0,0)+ (\frac{1}{2},0,\frac{1}{2})+$				General:	
8 <i>f</i> 1	(1) x,y,z	(2) $\bar{x}+\frac{1}{2},\bar{y}+\frac{1}{2},z$	(3) \bar{x},\bar{y},\bar{z}	(4) $x+\frac{1}{2},y+\frac{1}{2},\bar{z}$	$hkl: h+l=2n$	$00l: l=2n$
					$hk0: h,k=2n$	$h00: h=2n$
					$0kl: l=2n$	$0k0: k=2n$
					$h0l: h+l=2n$	
					Special: as above, plus	
					no extra conditions	
4 <i>e</i> 2	$\frac{3}{4},\frac{3}{4},z$	$\frac{1}{4},\frac{1}{4},\bar{z}$			$hkl: k=2n$	
4 <i>d</i> $\bar{1}$	$\frac{3}{4},\frac{1}{2},\frac{1}{4}$	$\frac{3}{4},0,\frac{1}{4}$	4 <i>c</i> $\bar{1}$	$\frac{1}{4},0,\frac{1}{4}$	$\frac{1}{4},\frac{1}{2},\frac{1}{4}$	
4 <i>b</i> $\bar{1}$	$0,0,\frac{1}{2}$	$\frac{1}{2},\frac{1}{2},\frac{1}{2}$	4 <i>a</i> $\bar{1}$	$0,0,0$	$\frac{1}{2},\frac{1}{2},0$	$hkl: h+k=2n$

I112/bUNIQUE AXIS c , CELL CHOICE 3**Origin** at $\bar{1}$ on glide plane b **Asymmetric unit** $0 \leq x \leq \frac{1}{4}$; $0 \leq y \leq 1$; $0 \leq z \leq \frac{1}{2}$ **Generators selected** (1); $t(1,0,0)$; $t(0,1,0)$; $t(0,0,1)$; $t(\frac{1}{2},\frac{1}{2},\frac{1}{2})$; (2); (3)**Positions**

Multiplicity, Wyckoff letter, Site symmetry	Coordinates				Reflection conditions	
	$(0,0,0)+ (\frac{1}{2},\frac{1}{2},\frac{1}{2})+$				General:	
8 <i>f</i> 1	(1) x,y,z	(2) $\bar{x},\bar{y}+\frac{1}{2},z$	(3) \bar{x},\bar{y},\bar{z}	(4) $x,y+\frac{1}{2},\bar{z}$	$hkl: h+k+l=2n$	$00l: l=2n$
					$hk0: h,k=2n$	$h00: h=2n$
					$0kl: k+l=2n$	$0k0: k=2n$
					$h0l: h+l=2n$	
					Special: as above, plus	
					no extra conditions	
4 <i>e</i> 2	$0,\frac{1}{4},z$	$0,\frac{3}{4},\bar{z}$			$hkl: h=2n$	
4 <i>d</i> $\bar{1}$	$\frac{3}{4},\frac{1}{4},\frac{1}{4}$	$\frac{1}{4},\frac{1}{4},\frac{1}{4}$	4 <i>c</i> $\bar{1}$	$\frac{3}{4},\frac{3}{4},\frac{1}{4}$	$\frac{1}{4},\frac{3}{4},\frac{1}{4}$	
4 <i>b</i> $\bar{1}$	$0,0,\frac{1}{2}$	$0,\frac{1}{2},\frac{1}{2}$	4 <i>a</i> $\bar{1}$	$0,0,0$	$0,\frac{1}{2},0$	$hkl: k=2n$