

$Fd\bar{3}m$

O_h^7

$m\bar{3}m$

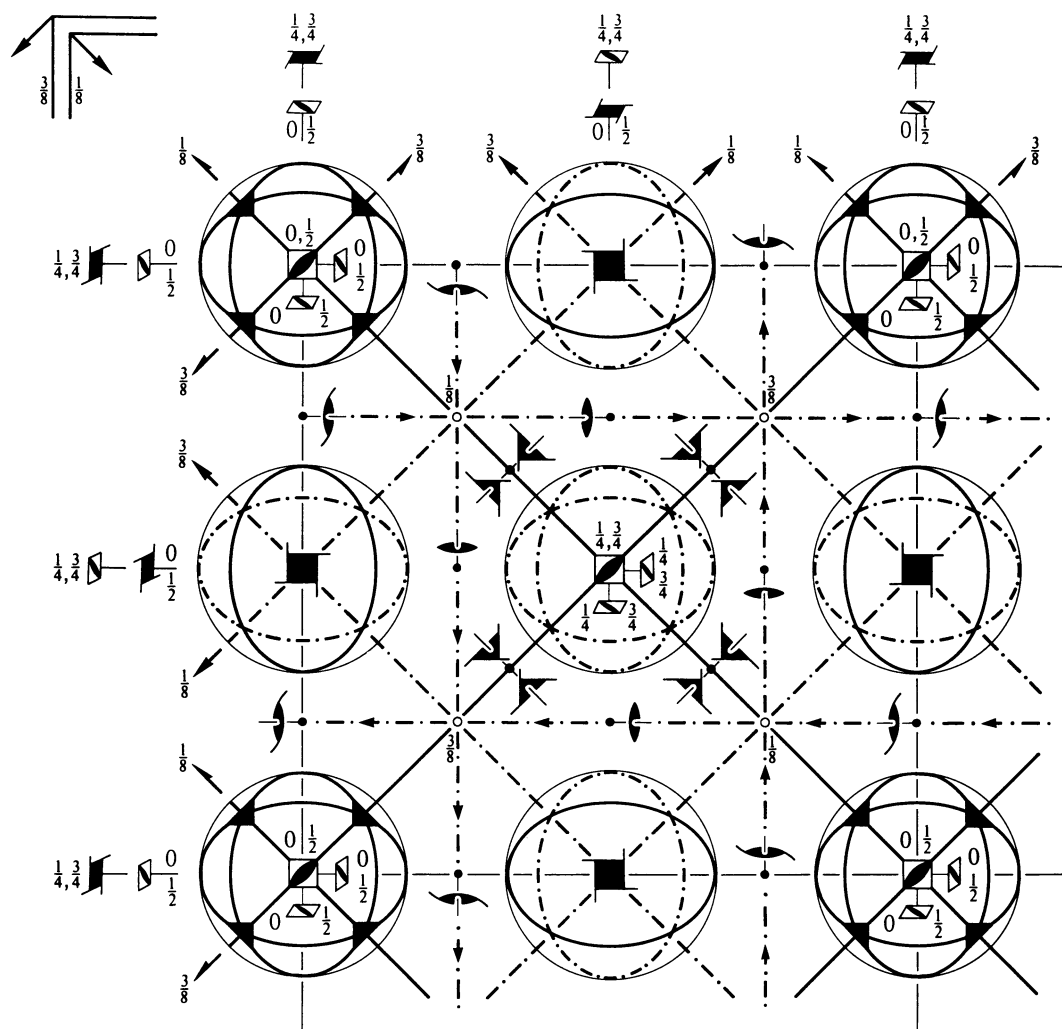
Cubic

No. 227

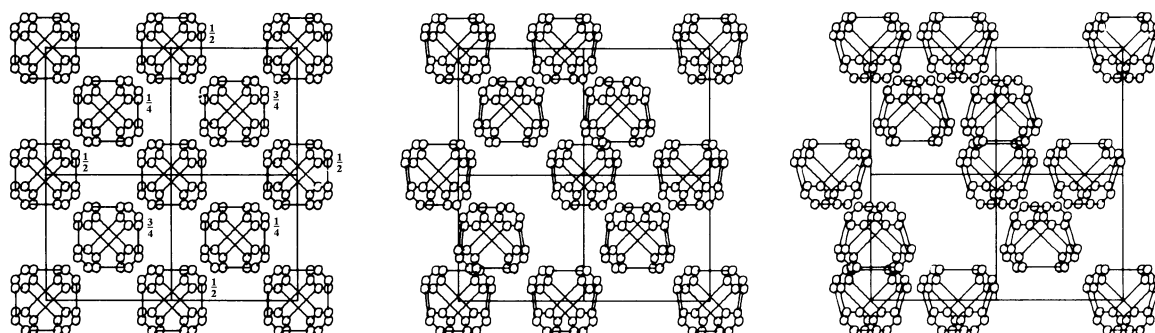
$F 4_1/d \bar{3} 2/m$

Patterson symmetry $Fm\bar{3}m$

ORIGIN CHOICE 1



Upper left quadrant only



Origin at $\bar{4}3m$, at $-\frac{1}{8}, -\frac{1}{8}, -\frac{1}{8}$ from centre ($\bar{3}m$)

Asymmetric unit $0 \leq x \leq \frac{1}{2}; 0 \leq y \leq \frac{1}{8}; -\frac{1}{8} \leq z \leq \frac{1}{8}; y \leq \min(\frac{1}{2}-x, x); -y \leq z \leq y$

Vertices $0, 0, 0 \quad \frac{1}{2}, 0, 0 \quad \frac{3}{8}, \frac{1}{8}, \frac{1}{8} \quad \frac{1}{8}, \frac{1}{8}, \frac{1}{8} \quad \frac{3}{8}, \frac{1}{8}, -\frac{1}{8} \quad \frac{1}{8}, \frac{1}{8}, -\frac{1}{8}$

Symmetry operations

(given on page 699)

Generators selected (1); $t(1,0,0)$; $t(0,1,0)$; $t(0,0,1)$; $t(0, \frac{1}{2}, \frac{1}{2})$; $t(\frac{1}{2}, 0, \frac{1}{2})$; (2); (3); (5); (13); (25)

Positions

Multiplicity, Wyckoff letter, Site symmetry	Coordinates	Reflection conditions					
	$(0,0,0)+$ $(0, \frac{1}{2}, \frac{1}{2})+$ $(\frac{1}{2}, 0, \frac{1}{2})+$ $(\frac{1}{2}, \frac{1}{2}, 0)+$	h, k, l permutable General:					
192 <i>i</i> 1	(1) x, y, z (5) z, x, y (9) y, z, x (13) $y + \frac{3}{4}, x + \frac{1}{4}, \bar{z} + \frac{3}{4}$ (17) $x + \frac{3}{4}, z + \frac{1}{4}, \bar{y} + \frac{3}{4}$ (21) $z + \frac{3}{4}, y + \frac{1}{4}, \bar{x} + \frac{3}{4}$ (25) $\bar{x} + \frac{1}{4}, \bar{y} + \frac{1}{4}, \bar{z} + \frac{1}{4}$ (29) $\bar{z} + \frac{1}{4}, \bar{x} + \frac{1}{4}, \bar{y} + \frac{1}{4}$ (33) $\bar{y} + \frac{1}{4}, \bar{z} + \frac{1}{4}, \bar{x} + \frac{1}{4}$ (37) $\bar{y} + \frac{1}{2}, \bar{x}, z + \frac{1}{2}$ (41) $\bar{x} + \frac{1}{2}, \bar{z}, y + \frac{1}{2}$ (45) $\bar{z} + \frac{1}{2}, \bar{y}, x + \frac{1}{2}$	(2) $\bar{x}, \bar{y} + \frac{1}{2}, z + \frac{1}{2}$ (6) $z + \frac{1}{2}, \bar{x}, \bar{y} + \frac{1}{2}$ (10) $\bar{y} + \frac{1}{2}, z + \frac{1}{2}, \bar{x}$ (14) $\bar{y} + \frac{1}{4}, \bar{x} + \frac{1}{4}, \bar{z} + \frac{1}{4}$ (18) $\bar{x} + \frac{3}{4}, z + \frac{3}{4}, y + \frac{1}{4}$ (22) $z + \frac{1}{4}, \bar{y} + \frac{3}{4}, x + \frac{3}{4}$ (26) $x + \frac{1}{4}, y + \frac{3}{4}, \bar{z} + \frac{3}{4}$ (30) $\bar{z} + \frac{3}{4}, x + \frac{1}{4}, y + \frac{3}{4}$ (34) $y + \frac{3}{4}, \bar{z} + \frac{3}{4}, x + \frac{1}{4}$ (38) y, x, z (42) $x + \frac{1}{2}, \bar{z} + \frac{1}{2}, \bar{y}$ (46) $\bar{z}, y + \frac{1}{2}, \bar{x} + \frac{1}{2}$	(3) $\bar{x} + \frac{1}{2}, y + \frac{1}{2}, \bar{z}$ (7) $\bar{z}, \bar{x} + \frac{1}{2}, y + \frac{1}{2}$ (11) $y + \frac{1}{2}, \bar{z}, \bar{x} + \frac{1}{2}$ (15) $y + \frac{1}{4}, \bar{x} + \frac{3}{4}, z + \frac{3}{4}$ (19) $\bar{x} + \frac{1}{4}, \bar{z} + \frac{1}{4}, \bar{y} + \frac{1}{4}$ (23) $\bar{z} + \frac{3}{4}, y + \frac{3}{4}, x + \frac{1}{4}$ (27) $x + \frac{3}{4}, \bar{y} + \frac{3}{4}, z + \frac{1}{4}$ (31) $z + \frac{1}{4}, x + \frac{3}{4}, \bar{y} + \frac{3}{4}$ (35) $\bar{y} + \frac{3}{4}, z + \frac{1}{4}, x + \frac{3}{4}$ (39) $\bar{y}, x + \frac{1}{2}, \bar{z} + \frac{1}{2}$ (43) x, z, y (47) $z + \frac{1}{2}, \bar{y} + \frac{1}{2}, \bar{x}$	(4) $x + \frac{1}{2}, \bar{y}, \bar{z} + \frac{1}{2}$ (8) $\bar{z} + \frac{1}{2}, x + \frac{1}{2}, \bar{y}$ (12) $\bar{y}, \bar{z} + \frac{1}{2}, x + \frac{1}{2}$ (16) $\bar{y} + \frac{3}{4}, x + \frac{3}{4}, z + \frac{1}{4}$ (20) $x + \frac{1}{4}, \bar{z} + \frac{3}{4}, y + \frac{3}{4}$ (24) $\bar{z} + \frac{1}{4}, \bar{y} + \frac{1}{4}, \bar{x} + \frac{1}{4}$ (28) $\bar{x} + \frac{3}{4}, y + \frac{1}{4}, z + \frac{3}{4}$ (32) $z + \frac{3}{4}, \bar{x} + \frac{3}{4}, y + \frac{1}{4}$ (36) $y + \frac{1}{4}, z + \frac{3}{4}, \bar{x} + \frac{3}{4}$ (40) $y + \frac{1}{2}, \bar{x} + \frac{1}{2}, \bar{z}$ (44) $\bar{x}, z + \frac{1}{2}, \bar{y} + \frac{1}{2}$ (48) z, y, x	$hkl : h + k = 2n$ and $h + l, k + l = 2n$ $OkI : k + l = 4n$ and $k, l = 2n$ $hhl : h + l = 2n$ $h00 : h = 4n$		
96 <i>h</i> .. 2	$\frac{1}{8}, y, \bar{y} + \frac{1}{4}$ $\bar{y} + \frac{1}{4}, \frac{1}{8}, y$ $y, \bar{y} + \frac{1}{4}, \frac{1}{8}$ $\frac{1}{8}, \bar{y} + \frac{1}{4}, y$ $y, \frac{1}{8}, \bar{y} + \frac{1}{4}$ $\bar{y} + \frac{1}{4}, y, \frac{1}{8}$	$\frac{7}{8}, \bar{y} + \frac{1}{2}, \bar{y} + \frac{3}{4}$ $\bar{y} + \frac{3}{4}, \frac{7}{8}, \bar{y} + \frac{1}{2}$ $\bar{y} + \frac{1}{2}, \bar{y} + \frac{3}{4}, \frac{7}{8}$ $\frac{3}{8}, y + \frac{3}{4}, y + \frac{1}{2}$ $y + \frac{1}{2}, \frac{3}{8}, y + \frac{3}{4}$ $y + \frac{3}{4}, y + \frac{1}{2}, \frac{3}{8}$	$\frac{3}{8}, y + \frac{1}{2}, y + \frac{3}{4}$ $y + \frac{3}{4}, \frac{3}{8}, y + \frac{1}{2}$ $y + \frac{1}{2}, y + \frac{3}{4}, \frac{3}{8}$ $\frac{7}{8}, \bar{y} + \frac{3}{4}, \bar{y} + \frac{1}{2}$ $\bar{y} + \frac{1}{2}, \frac{7}{8}, \bar{y} + \frac{3}{4}$ $\bar{y} + \frac{3}{4}, \bar{y} + \frac{1}{2}, \frac{7}{8}$	$\frac{5}{8}, \bar{y}, y + \frac{1}{4}$ $y + \frac{1}{4}, \frac{5}{8}, \bar{y}$ $\bar{y}, y + \frac{1}{4}, \frac{5}{8}$ $\frac{5}{8}, y + \frac{1}{4}, \bar{y}$ $\bar{y}, \frac{5}{8}, y + \frac{1}{4}$ $y + \frac{1}{4}, \bar{y}, \frac{5}{8}$	no extra conditions		
96 <i>g</i> .. <i>m</i>	x, x, z z, x, x x, z, x $x + \frac{3}{4}, x + \frac{1}{4}, \bar{z} + \frac{3}{4}$ $x + \frac{3}{4}, z + \frac{1}{4}, \bar{x} + \frac{3}{4}$ $z + \frac{3}{4}, x + \frac{1}{4}, \bar{x} + \frac{3}{4}$	$\bar{x}, \bar{x} + \frac{1}{2}, z + \frac{1}{2}$ $z + \frac{1}{2}, \bar{x}, \bar{x} + \frac{1}{2}$ $\bar{x} + \frac{1}{2}, z + \frac{1}{2}, \bar{x}$ $\bar{x} + \frac{1}{4}, \bar{x} + \frac{1}{4}, \bar{z} + \frac{1}{4}$ $\bar{x} + \frac{3}{4}, z + \frac{3}{4}, x + \frac{1}{4}$ $z + \frac{1}{4}, \bar{x} + \frac{3}{4}, x + \frac{3}{4}$	$\bar{x} + \frac{1}{2}, x + \frac{1}{2}, \bar{z}$ $\bar{z}, \bar{x} + \frac{1}{2}, x + \frac{1}{2}$ $x + \frac{1}{2}, \bar{z}, \bar{x} + \frac{1}{2}$ $x + \frac{1}{4}, \bar{x} + \frac{3}{4}, z + \frac{3}{4}$ $\bar{x} + \frac{1}{4}, \bar{z} + \frac{1}{4}, \bar{x} + \frac{1}{4}$ $\bar{z} + \frac{3}{4}, x + \frac{3}{4}, x + \frac{1}{4}$	$x + \frac{1}{2}, \bar{x}, \bar{z} + \frac{1}{2}$ $\bar{z} + \frac{1}{2}, x + \frac{1}{2}, \bar{x}$ $\bar{x}, \bar{z} + \frac{1}{2}, x + \frac{1}{2}$ $\bar{x} + \frac{3}{4}, x + \frac{3}{4}, z + \frac{1}{4}$ $x + \frac{1}{4}, \bar{z} + \frac{3}{4}, x + \frac{3}{4}$ $\bar{z} + \frac{1}{4}, \bar{x} + \frac{1}{4}, \bar{x} + \frac{1}{4}$	no extra conditions		
48 <i>f</i> 2. <i>mm</i>	$x, 0, 0$ $\frac{3}{4}, x + \frac{1}{4}, \frac{3}{4}$	$\bar{x}, \frac{1}{2}, \frac{1}{2}$ $\frac{1}{4}, \bar{x} + \frac{1}{4}, \frac{1}{4}$	$0, x, 0$ $x + \frac{3}{4}, \frac{1}{4}, \frac{3}{4}$	$\frac{1}{2}, \bar{x}, \frac{1}{2}$ $\bar{x} + \frac{3}{4}, \frac{3}{4}, \frac{1}{4}$	$0, 0, x$ $\frac{3}{4}, \frac{1}{4}, \bar{x} + \frac{3}{4}$	$\frac{1}{2}, \frac{1}{2}, \bar{x}$ $\frac{1}{4}, \frac{3}{4}, x + \frac{3}{4}$	$hkl : h = 2n + 1$ or $h + k + l = 4n$
32 <i>e</i> . 3 <i>m</i>	x, x, x $\bar{x} + \frac{1}{2}, x + \frac{1}{2}, \bar{x}$ $x + \frac{3}{4}, x + \frac{1}{4}, \bar{x} + \frac{3}{4}$ $x + \frac{1}{4}, \bar{x} + \frac{3}{4}, x + \frac{3}{4}$	$\bar{x}, \bar{x} + \frac{1}{2}, x + \frac{1}{2}$ $x + \frac{1}{2}, \bar{x}, \bar{x} + \frac{1}{2}$ $\bar{x} + \frac{1}{4}, \bar{x} + \frac{1}{4}, \bar{x} + \frac{1}{4}$ $\bar{x} + \frac{3}{4}, x + \frac{3}{4}, x + \frac{1}{4}$				no extra conditions	
16 <i>d</i> . $\bar{3}m$	$\frac{5}{8}, \frac{5}{8}, \frac{5}{8}$ $\frac{1}{8}, \frac{1}{8}, \frac{1}{8}$	$\frac{3}{8}, \frac{7}{8}, \frac{1}{8}$ $\frac{7}{8}, \frac{3}{8}, \frac{5}{8}$	$\frac{7}{8}, \frac{1}{8}, \frac{3}{8}$ $\frac{3}{8}, \frac{5}{8}, \frac{7}{8}$	$\frac{1}{8}, \frac{3}{8}, \frac{7}{8}$ $\frac{5}{8}, \frac{7}{8}, \frac{3}{8}$		$hkl : h = 2n + 1$ or $h, k, l = 4n + 2$ or $h, k, l = 4n$	
16 <i>c</i> . $\bar{3}m$	$\frac{1}{8}, \frac{1}{8}, \frac{1}{8}$	$\frac{7}{8}, \frac{3}{8}, \frac{5}{8}$	$\frac{3}{8}, \frac{5}{8}, \frac{7}{8}$	$\frac{5}{8}, \frac{7}{8}, \frac{3}{8}$		$hkl : h = 2n + 1$ or $h + k + l = 4n$	
8 <i>b</i> $\bar{4}3m$	$\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$	$\frac{1}{4}, \frac{3}{4}, \frac{1}{4}$				$hkl : h = 2n + 1$ or $h + k + l = 4n$	
8 <i>a</i> $\bar{4}3m$	$0, 0, 0$	$\frac{3}{4}, \frac{1}{4}, \frac{3}{4}$					

Symmetry of special projections

Along [001] $p4mm$

$\mathbf{a}' = \frac{1}{4}(\mathbf{a} - \mathbf{b})$ $\mathbf{b}' = \frac{1}{4}(\mathbf{a} + \mathbf{b})$

Origin at 0, 0, z

Along [111] $p6mm$

$\mathbf{a}' = \frac{1}{6}(2\mathbf{a} - \mathbf{b} - \mathbf{c})$ $\mathbf{b}' = \frac{1}{6}(-\mathbf{a} + 2\mathbf{b} - \mathbf{c})$

Origin at x, x, x

Along [110] $c2mm$

$\mathbf{a}' = \frac{1}{2}(-\mathbf{a} + \mathbf{b})$ $\mathbf{b}' = \mathbf{c}$

Origin at x, x, $\frac{1}{8}$

ORIGIN CHOICE 1

Maximal non-isomorphic subgroups

I	[2] $F \bar{4} 3 m$ (216)	(1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 37; 38; 39; 40; 41; 42; 43; 44; 45; 46; 47; 48)+
	[2] $F 4_1 3 2$ (210)	(1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19; 20; 21; 22; 23; 24)+
	[2] $F d \bar{3} 1$ ($F d \bar{3}$, 203)	(1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 25; 26; 27; 28; 29; 30; 31; 32; 33; 34; 35; 36)+
	{ [3] $F 4_1/d 1 2/m$ ($I 4_1/am d$, 141)	(1; 2; 3; 4; 13; 14; 15; 16; 25; 26; 27; 28; 37; 38; 39; 40)+
	{ [3] $F 4_1/d 1 2/m$ ($I 4_1/am d$, 141)	(1; 2; 3; 4; 17; 18; 19; 20; 25; 26; 27; 28; 41; 42; 43; 44)+
	{ [3] $F 4_1/d 1 2/m$ ($I 4_1/am d$, 141)	(1; 2; 3; 4; 21; 22; 23; 24; 25; 26; 27; 28; 45; 46; 47; 48)+
	{ [4] $F 1 \bar{3} 2/m$ ($R \bar{3} m$, 166)	(1; 5; 9; 14; 19; 24; 25; 29; 33; 38; 43; 48)+
	{ [4] $F 1 \bar{3} 2/m$ ($R \bar{3} m$, 166)	(1; 6; 12; 13; 18; 24; 25; 30; 36; 37; 42; 48)+
	{ [4] $F 1 \bar{3} 2/m$ ($R \bar{3} m$, 166)	(1; 7; 10; 13; 19; 22; 25; 31; 34; 37; 43; 46)+
	{ [4] $F 1 \bar{3} 2/m$ ($R \bar{3} m$, 166)	(1; 8; 11; 14; 18; 22; 25; 32; 35; 38; 42; 46)+

IIa none

IIb none

Maximal isomorphic subgroups of lowest index

IIc [27] $F d \bar{3} m$ ($\mathbf{a}' = 3\mathbf{a}, \mathbf{b}' = 3\mathbf{b}, \mathbf{c}' = 3\mathbf{c}$) (227)

Minimal non-isomorphic supergroups

I none

II [2] $P n \bar{3} m$ ($\mathbf{a}' = \frac{1}{2}\mathbf{a}, \mathbf{b}' = \frac{1}{2}\mathbf{b}, \mathbf{c}' = \frac{1}{2}\mathbf{c}$) (224)

Symmetry operations

For (0,0,0)+ set

- | | | | |
|---|---|--|---|
| (1) 1 | (2) $2(0,0,\frac{1}{2})$ $0,\frac{1}{4},z$ | (3) $2(0,\frac{1}{2},0)$ $\frac{1}{4},y,0$ | (4) $2(\frac{1}{2},0,0)$ $x,0,\frac{1}{4}$ |
| (5) $3^+ x,x,x$ | (6) $3^+(\frac{1}{3},-\frac{1}{3},\frac{1}{3})$ $\bar{x}+\frac{1}{6},x+\frac{1}{6},\bar{x}$ | (7) $3^+(-\frac{1}{3},\frac{1}{3},\frac{1}{3})$ $x+\frac{1}{3},\bar{x}-\frac{1}{6},\bar{x}$ | (8) $3^+(\frac{1}{3},\frac{1}{3},-\frac{1}{3})$ $\bar{x}+\frac{1}{6},\bar{x}+\frac{1}{3},x$ |
| (9) $3^- x,x,x$ | (10) $3^- x,\bar{x}+\frac{1}{2},\bar{x}$ | (11) $3^- \bar{x}+\frac{1}{2},\bar{x},x$ | (12) $3^- \bar{x}-\frac{1}{2},x+\frac{1}{2},\bar{x}$ |
| (13) $2(\frac{1}{2},\frac{1}{2},0)$ $x,x-\frac{1}{4},\frac{3}{8}$ | (14) $2 x,\bar{x}+\frac{1}{4},\frac{1}{8}$ | (15) $4^-(0,0,\frac{3}{4})$ $\frac{1}{2},\frac{1}{4},z$ | (16) $4^+(0,0,\frac{1}{4})$ $0,\frac{3}{4},z$ |
| (17) $4^-(\frac{3}{4},0,0)$ $x,\frac{1}{2},\frac{1}{4}$ | (18) $2(0,\frac{1}{2},\frac{1}{2})$ $\frac{3}{8},y+\frac{1}{4},y$ | (19) $2 \frac{1}{8},y+\frac{1}{4},\bar{y}$ | (20) $4^+(\frac{1}{4},0,0)$ $x,0,\frac{3}{4}$ |
| (21) $4^+(0,\frac{1}{4},0)$ $\frac{3}{4},y,0$ | (22) $2(\frac{1}{2},0,\frac{1}{2})$ $x-\frac{1}{4},\frac{3}{8},x$ | (23) $4^-(0,\frac{3}{4},0)$ $\frac{1}{4},y,\frac{1}{2}$ | (24) $2 \bar{x}+\frac{1}{4},\frac{1}{8},x$ |
| (25) $\bar{1} \frac{1}{8},\frac{1}{8},\frac{1}{8}$ | (26) $d(\frac{1}{4},\frac{3}{4},0)$ $x,y,\frac{3}{8}$ | (27) $d(\frac{3}{4},0,\frac{1}{4})$ $x,\frac{3}{8},z$ | (28) $d(0,\frac{1}{4},\frac{3}{4})$ $\frac{3}{8},y,z$ |
| (29) $\bar{3}^+ x,x,x;$ $\frac{1}{8},\frac{1}{8},\frac{1}{8}$ | (30) $\bar{3}^+ \bar{x}-1,x+1,\bar{x};$ $-\frac{1}{8},\frac{1}{8},\frac{7}{8}$ | (31) $\bar{3}^+ x,\bar{x}+1,\bar{x};$ $\frac{1}{8},\frac{7}{8},-\frac{1}{8}$ | (32) $\bar{3}^+ \bar{x}+1,\bar{x},x;$ $\frac{7}{8},-\frac{1}{8},\frac{1}{8}$ |
| (33) $\bar{3}^- x,x,x;$ $\frac{1}{8},\frac{1}{8},\frac{1}{8}$ | (34) $\bar{3}^- x+\frac{3}{2},\bar{x}-1,\bar{x};$ $\frac{5}{8},-\frac{1}{8},\frac{7}{8}$ | (35) $\bar{3}^- \bar{x}+\frac{1}{2},\bar{x}+\frac{3}{2},x;$ $-\frac{1}{8},\frac{7}{8},\frac{5}{8}$ | (36) $\bar{3}^- \bar{x}+1,x+\frac{1}{2},\bar{x};$ $\frac{7}{8},\frac{5}{8},-\frac{1}{8}$ |
| (37) $g(\frac{1}{4},-\frac{1}{4},\frac{1}{2})$ $x+\frac{1}{4},\bar{x},z$ | (38) $m x,x,z$ | (39) $\bar{4}^- -\frac{1}{4},\frac{1}{4},z;$ $-\frac{1}{4},\frac{1}{4},\frac{1}{4}$ | (40) $\bar{4}^+ \frac{1}{2},0,z;$ $\frac{1}{2},0,0$ |
| (41) $\bar{4}^- x,-\frac{1}{4},\frac{1}{4};$ $\frac{1}{4},-\frac{1}{4},\frac{1}{4}$ | (42) $g(\frac{1}{2},\frac{1}{4},-\frac{1}{4})$ $x,y+\frac{1}{4},\bar{y}$ | (43) $m x,y,y$ | (44) $\bar{4}^+ x,\frac{1}{2},0;$ $0,\frac{1}{2},0$ |
| (45) $\bar{4}^+ 0,y,\frac{1}{2};$ $0,0,\frac{1}{2}$ | (46) $g(-\frac{1}{4},\frac{1}{2},\frac{1}{4})$ $\bar{x}+\frac{1}{4},y,x$ | (47) $\bar{4}^- \frac{1}{4},y,-\frac{1}{4};$ $\frac{1}{4},\frac{1}{4},-\frac{1}{4}$ | (48) $m x,y,x$ |

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

- | | | | |
|---|--|--|--|
| (1) $t(0,\frac{1}{2},\frac{1}{2})$ | (2) 2 0,0,z | (3) 2 $\frac{1}{4},y,\frac{1}{4}$ | (4) $2(\frac{1}{2},0,0)$ $x,\frac{1}{4},0$ |
| (5) $3^+(\frac{1}{3},\frac{1}{3},\frac{1}{3})$ $x-\frac{1}{3},x-\frac{1}{6},x$ | (6) $3^+ \bar{x}+\frac{1}{2},x,\bar{x}$ | (7) $3^+ x,\bar{x},\bar{x}$ | (8) $3^+ \bar{x}+\frac{1}{2},\bar{x}+\frac{1}{2},x$ |
| (9) $3^-(\frac{1}{3},\frac{1}{3},\frac{1}{3})$ $x-\frac{1}{6},x+\frac{1}{6},x$ | (10) $3^- x+\frac{1}{2},\bar{x},\bar{x}$ | (11) $3^-(\frac{1}{3},\frac{1}{3},-\frac{1}{3})$ $\bar{x}+\frac{1}{3},\bar{x}+\frac{1}{6},x$ | (12) $3^- \bar{x},x,\bar{x}$ |
| (13) $2(\frac{3}{4},\frac{3}{4},0)$ $x,x,\frac{1}{8}$ | (14) $2(-\frac{1}{4},\frac{1}{4},0)$ $x,\bar{x}+\frac{1}{2},\frac{3}{8}$ | (15) $4^-(0,0,\frac{1}{4})$ $\frac{1}{4},0,z$ | (16) $4^+(0,0,\frac{3}{4})$ $\frac{1}{4},\frac{1}{2},z$ |
| (17) $4^-(\frac{3}{4},0,0)$ $x,\frac{1}{2},-\frac{1}{4}$ | (18) $2(0,\frac{1}{2},\frac{1}{2})$ $\frac{3}{8},y-\frac{1}{4},y$ | (19) $2 \frac{1}{8},y+\frac{3}{4},\bar{y}$ | (20) $4^+(\frac{1}{4},0,0)$ $x,0,\frac{1}{4}$ |
| (21) $4^+(0,\frac{3}{4},0)$ $\frac{1}{2},y,-\frac{1}{4}$ | (22) $2(\frac{1}{4},0,\frac{1}{4})$ $x,\frac{1}{8},x$ | (23) $4^-(0,\frac{1}{4},0)$ $0,y,\frac{3}{4}$ | (24) $2(-\frac{1}{4},0,\frac{1}{4})$ $\bar{x}+\frac{1}{2},\frac{3}{8},x$ |
| (25) $\bar{1} \frac{1}{8},\frac{3}{8},\frac{3}{8}$ | (26) $d(\frac{1}{4},\frac{1}{4},0)$ $x,y,\frac{1}{8}$ | (27) $d(\frac{3}{4},0,\frac{3}{4})$ $x,\frac{1}{8},z$ | (28) $d(0,\frac{3}{4},\frac{1}{4})$ $\frac{3}{8},y,z$ |
| (29) $\bar{3}^+ x,x+\frac{1}{2},x;$ $\frac{1}{8},\frac{5}{8},\frac{1}{8}$ | (30) $\bar{3}^+ \bar{x}-1,x+\frac{3}{2},\bar{x};$ $-\frac{1}{8},\frac{5}{8},\frac{7}{8}$ | (31) $\bar{3}^+ x,\bar{x}+\frac{1}{2},\bar{x};$ $\frac{1}{8},\frac{3}{8},-\frac{1}{8}$ | (32) $\bar{3}^+ \bar{x}+1,\bar{x}-\frac{1}{2},x;$ $\frac{7}{8},-\frac{5}{8},\frac{1}{8}$ |
| (33) $\bar{3}^- x-\frac{1}{2},x-\frac{1}{2},x;$ $\frac{1}{8},\frac{1}{8},\frac{5}{8}$ | (34) $\bar{3}^- x+1,\bar{x}-\frac{3}{2},\bar{x};$ $\frac{1}{8},-\frac{5}{8},\frac{7}{8}$ | (35) $\bar{3}^- \bar{x},\bar{x}+1,x;$ $-\frac{1}{8},\frac{7}{8},\frac{1}{8}$ | (36) $\bar{3}^- \bar{x}+\frac{1}{2},x,\bar{x};$ $\frac{3}{8},\frac{1}{8},-\frac{1}{8}$ |
| (37) $m x+\frac{1}{2},\bar{x},z$ | (38) $g(\frac{1}{4},\frac{1}{4},\frac{1}{2})$ $x-\frac{1}{4},x,z$ | (39) $\bar{4}^- 0,0,z;$ $0,0,0$ | (40) $\bar{4}^+ \frac{1}{4},-\frac{1}{4},z;$ $\frac{1}{4},-\frac{1}{4},\frac{1}{4}$ |
| (41) $\bar{4}^- x,\frac{1}{4},\frac{1}{4};$ $\frac{1}{4},\frac{1}{4},\frac{1}{4}$ | (42) $g(\frac{1}{2},-\frac{1}{4},\frac{1}{4})$ $x,y+\frac{1}{4},\bar{y}$ | (43) $g(0,\frac{1}{2},\frac{1}{2})$ x,y,y | (44) $\bar{4}^+ x,0,0;$ $0,0,0$ |
| (45) $\bar{4}^+ \frac{1}{4},y,\frac{1}{4};$ $\frac{1}{4},\frac{1}{4},\frac{1}{4}$ | (46) $m \bar{x},y,x$ | (47) $\bar{4}^- \frac{1}{2},y,0;$ $\frac{1}{2},0,0$ | (48) $g(\frac{1}{4},\frac{1}{2},\frac{1}{4})$ $x-\frac{1}{4},y,x$ |

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

- | | | | |
|---|--|--|--|
| (1) $t(\frac{1}{2},0,\frac{1}{2})$ | (2) 2 $\frac{1}{4},\frac{1}{4},z$ | (3) $2(0,\frac{1}{2},0)$ $0,y,\frac{1}{4}$ | (4) 2 $x,0,0$ |
| (5) $3^+(\frac{1}{3},\frac{1}{3},\frac{1}{3})$ $x+\frac{1}{6},x-\frac{1}{6},x$ | (6) $3^+ \bar{x},x,\bar{x}$ | (7) $3^+ x+\frac{1}{2},\bar{x},\bar{x}$ | (8) $3^+ \bar{x},\bar{x}+\frac{1}{2},x$ |
| (9) $3^-(\frac{1}{3},\frac{1}{3},\frac{1}{3})$ $x-\frac{1}{6},x-\frac{1}{3},x$ | (10) $3^-(-\frac{1}{3},\frac{1}{3},\frac{1}{3})$ $x+\frac{1}{6},\bar{x}+\frac{1}{6},\bar{x}$ | (11) $3^- \bar{x},\bar{x},x$ | (12) $3^- \bar{x},x+\frac{1}{2},\bar{x}$ |
| (13) $2(\frac{1}{4},\frac{1}{4},0)$ $x,x,\frac{1}{8}$ | (14) $2(\frac{1}{4},-\frac{1}{4},0)$ $x,\bar{x}+\frac{1}{2},\frac{3}{8}$ | (15) $4^-(0,0,\frac{1}{4})$ $\frac{3}{4},0,z$ | (16) $4^+(0,0,\frac{3}{4})$ $-\frac{1}{4},\frac{1}{2},z$ |
| (17) $4^-(\frac{1}{4},0,0)$ $x,\frac{1}{4},0$ | (18) $2(0,\frac{3}{4},\frac{3}{4})$ $\frac{1}{8},y,y$ | (19) $2(0,-\frac{1}{4},\frac{1}{4})$ $\frac{3}{8},y+\frac{1}{2},\bar{y}$ | (20) $4^+(\frac{3}{4},0,0)$ $x,\frac{1}{4},\frac{1}{2}$ |
| (21) $4^+(0,\frac{1}{4},0)$ $\frac{1}{4},y,0$ | (22) $2(\frac{1}{2},0,\frac{1}{2})$ $x+\frac{1}{4},\frac{3}{8},x$ | (23) $4^-(0,\frac{3}{4},0)$ $-\frac{1}{4},y,\frac{1}{2}$ | (24) $2 \bar{x}+\frac{3}{4},\frac{1}{8},x$ |
| (25) $\bar{1} \frac{3}{8},\frac{1}{8},\frac{3}{8}$ | (26) $d(\frac{3}{4},\frac{3}{4},0)$ $x,y,\frac{1}{8}$ | (27) $d(\frac{1}{4},0,\frac{3}{4})$ $x,\frac{3}{8},z$ | (28) $d(0,\frac{1}{4},\frac{1}{4})$ $\frac{1}{8},y,z$ |
| (29) $\bar{3}^+ x-\frac{1}{2},x-\frac{1}{2},x;$ $\frac{1}{8},\frac{1}{8},\frac{5}{8}$ | (30) $\bar{3}^+ \bar{x}-\frac{1}{2},x+\frac{1}{2},\bar{x};$ $-\frac{1}{8},\frac{1}{8},\frac{3}{8}$ | (31) $\bar{3}^+ x-\frac{1}{2},\bar{x}+\frac{3}{2},\bar{x};$ $\frac{1}{8},\frac{7}{8},-\frac{5}{8}$ | (32) $\bar{3}^+ \bar{x}+\frac{3}{2},\bar{x}+\frac{1}{2},x;$ $\frac{7}{8},-\frac{1}{8},\frac{5}{8}$ |
| (33) $\bar{3}^- x+\frac{1}{2},x,x;$ $\frac{5}{8},\frac{1}{8},\frac{1}{8}$ | (34) $\bar{3}^- x+1,\bar{x}-1,\bar{x};$ $\frac{1}{8},-\frac{1}{8},\frac{7}{8}$ | (35) $\bar{3}^- \bar{x},\bar{x}+\frac{1}{2},x;$ $-\frac{1}{8},\frac{3}{8},\frac{1}{8}$ | (36) $\bar{3}^- \bar{x}+\frac{3}{2},x-\frac{1}{2},\bar{x};$ $\frac{7}{8},\frac{1}{8},-\frac{5}{8}$ |
| (37) $m x,\bar{x},z$ | (38) $g(\frac{1}{4},\frac{1}{4},\frac{1}{2})$ $x+\frac{1}{4},x,z$ | (39) $\bar{4}^- 0,\frac{1}{2},z;$ $0,\frac{1}{2},0$ | (40) $\bar{4}^+ \frac{1}{4},\frac{1}{4},z;$ $\frac{1}{4},\frac{1}{4},\frac{1}{4}$ |
| (41) $\bar{4}^- x,0,0;$ $0,0,0$ | (42) $m x,y+\frac{1}{2},\bar{y}$ | (43) $g(\frac{1}{2},\frac{1}{4},\frac{1}{4})$ $x,y-\frac{1}{4},y$ | (44) $\bar{4}^+ x,\frac{1}{4},-\frac{1}{4};$ $\frac{1}{4},\frac{1}{4},-\frac{1}{4}$ |
| (45) $\bar{4}^+ 0,y,0;$ $0,0,0$ | (46) $g(\frac{1}{4},\frac{1}{2},-\frac{1}{4})$ $\bar{x}+\frac{1}{4},y,x$ | (47) $\bar{4}^- \frac{1}{4},y,\frac{1}{4};$ $\frac{1}{4},\frac{1}{4},\frac{1}{4}$ | (48) $g(\frac{1}{2},0,\frac{1}{2})$ x,y,x |

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

- | | | | |
|---|--|--|---|
| (1) $t(\frac{1}{2},\frac{1}{2},0)$ | (2) $2(0,0,\frac{1}{2})$ $\frac{1}{4},0,z$ | (3) 2 0,y,0 | (4) 2 $x,\frac{1}{4},\frac{1}{4}$ |
| (5) $3^+(\frac{1}{3},\frac{1}{3},\frac{1}{3})$ $x+\frac{1}{6},x+\frac{1}{3},x$ | (6) $3^+ \bar{x},x+\frac{1}{2},\bar{x}$ | (7) $3^+ x+\frac{1}{2},\bar{x}-\frac{1}{2},\bar{x}$ | (8) $3^+ \bar{x},\bar{x},x$ |
| (9) $3^-(\frac{1}{3},\frac{1}{3},\frac{1}{3})$ $x+\frac{1}{3},x+\frac{1}{6},x$ | (10) $3^- x,\bar{x},\bar{x}$ | (11) $3^- \bar{x}+\frac{1}{2},\bar{x}+\frac{1}{2},x$ | (12) $3^-(-\frac{1}{3},-\frac{1}{3},\frac{1}{3})$ $\bar{x}-\frac{1}{6},x+\frac{1}{3},\bar{x}$ |
| (13) $2(\frac{1}{2},\frac{1}{2},0)$ $x,x+\frac{1}{4},\frac{3}{8}$ | (14) $2 x,\bar{x}+\frac{3}{4},\frac{1}{8}$ | (15) $4^-(0,0,\frac{3}{4})$ $\frac{1}{2},-\frac{1}{4},z$ | (16) $4^+(0,0,\frac{1}{4})$ $0,\frac{1}{4},z$ |
| (17) $4^-(\frac{1}{4},0,0)$ $x,\frac{3}{4},0$ | (18) $2(0,\frac{1}{4},\frac{1}{4})$ $\frac{1}{8},y,y$ | (19) $2(0,\frac{1}{4},-\frac{1}{4})$ $\frac{3}{8},y+\frac{1}{2},\bar{y}$ | (20) $4^+(\frac{3}{4},0,0)$ $x,-\frac{1}{4},\frac{1}{2}$ |
| (21) $4^+(0,\frac{3}{4},0)$ $\frac{1}{2},y,\frac{1}{4}$ | (22) $2(\frac{3}{4},0,\frac{3}{4})$ $x,\frac{1}{8},x$ | (23) $4^-(0,\frac{1}{4},0)$ $0,y,\frac{1}{4}$ | (24) $2(\frac{1}{4},0,-\frac{1}{4})$ $\bar{x}+\frac{1}{2},\frac{3}{8},x$ |
| (25) $\bar{1} \frac{3}{8},\frac{3}{8},\frac{1}{8}$ | (26) $d(\frac{3}{4},\frac{1}{4},0)$ $x,y,\frac{3}{8}$ | (27) $d(\frac{1}{4},0,\frac{1}{4})$ $x,\frac{1}{8},z$ | (28) $d(0,\frac{3}{4},\frac{3}{4})$ $\frac{1}{8},y,z$ |
| (29) $\bar{3}^+ x+\frac{1}{2},x,x;$ $\frac{5}{8},\frac{1}{8},\frac{1}{8}$ | (30) $\bar{3}^+ \bar{x}-\frac{3}{2},x+1,\bar{x};$ $-\frac{5}{8},\frac{1}{8},\frac{7}{8}$ | (31) $\bar{3}^+ x+\frac{1}{2},\bar{x}+1,\bar{x};$ $\frac{5}{8},\frac{7}{8},-\frac{1}{8}$ | (32) $\bar{3}^+ \bar{x}+\frac{1}{2},\bar{x},x;$ $\frac{3}{8},-\frac{1}{8},\frac{1}{8}$ |
| (33) $\bar{3}^- x,x+\frac{1}{2},x;$ $\frac{1}{8},\frac{5}{8},\frac{1}{8}$ | (34) $\bar{3}^- x+\frac{1}{2},\bar{x}-\frac{1}{2},\bar{x};$ $\frac{1}{8},-\frac{1}{8},\frac{3}{8}$ | (35) $\bar{3}^- \bar{x}-\frac{1}{2},\bar{x}+1,x;$ $-\frac{5}{8},\frac{7}{8},\frac{1}{8}$ | (36) $\bar{3}^- \bar{x}+1,x,\bar{x};$ $\frac{7}{8},\frac{1}{8},-\frac{1}{8}$ |
| (37) $g(-\frac{1}{4},\frac{1}{4},\frac{1}{2})$ $x+\frac{1}{4},\bar{x},z$ | (38) $g(\frac{1}{2},\frac{1}{2},0)$ x,x,z | (39) $\bar{4}^- \frac{1}{4},\frac{1}{4},z;$ $\frac{1}{4},\frac{1}{4},\frac{1}{4}$ | (40) $\bar{4}^+ 0,0,z;$ $0,0,0$ |
| (41) $\bar{4}^- x,0,\frac{1}{2};$ $0,0,\frac{1}{2}$ | (42) $m x,y,\bar{y}$ | (43) $g(\frac{1}{2},\frac{1}{4},\frac{1}{4})$ $x,y+\frac{1}{4},y$ | (44) $\bar{4}^+ x,\frac{1}{4},\frac{1}{4};$ $\frac{1}{4},\frac{1}{4},\frac{1}{4}$ |
| (45) $\bar{4}^+ -\frac{1}{4},y,\frac{1}{4};$ $-\frac{1}{4},\frac{1}{4},\frac{1}{4}$ | (46) $m \bar{x}+\frac{1}{2},y,x$ | (47) $\bar{4}^- 0,y,0;$ $0,0,0$ | (48) $g(\frac{1}{4},\frac{1}{2},\frac{1}{4})$ $x+\frac{1}{4},y,x$ |

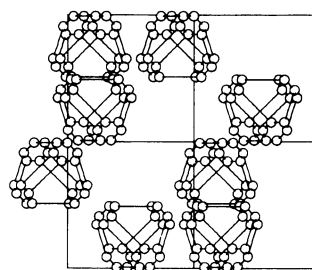
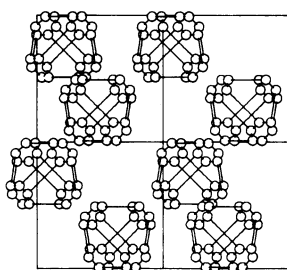
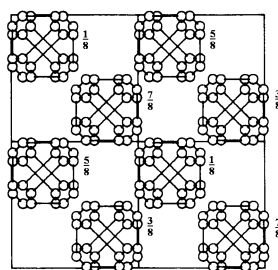
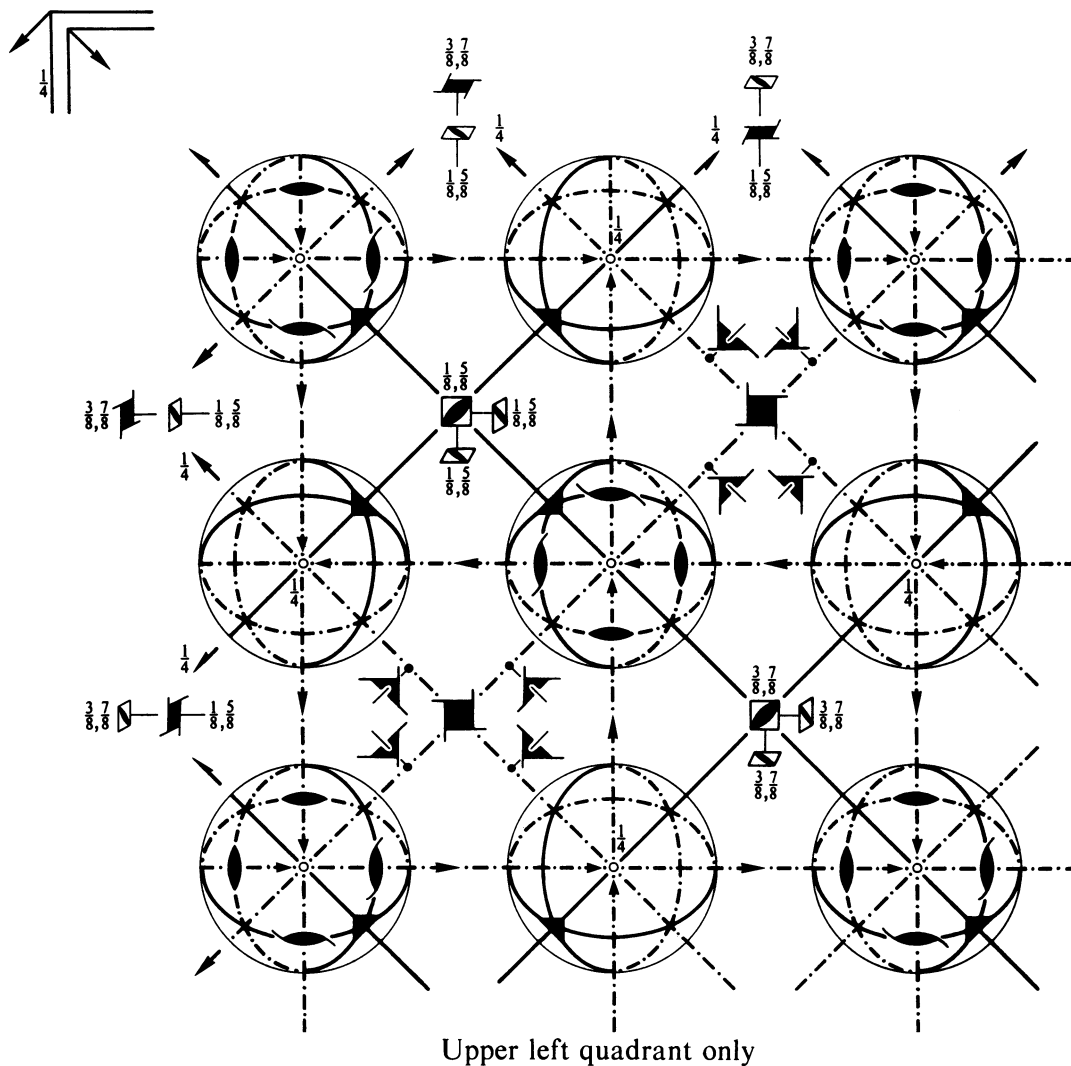
$Fd\bar{3}m$ O_h^7 $m\bar{3}m$

Cubic

No. 227

 $F4_1/d\bar{3}2/m$ Patterson symmetry $Fm\bar{3}m$

ORIGIN CHOICE 2

**Origin** at centre ($\bar{3}m$), at $\frac{1}{8}, \frac{1}{8}, \frac{1}{8}$ from $\bar{4}3m$ **Asymmetric unit** $-\frac{1}{8} \leq x \leq \frac{3}{8}; -\frac{1}{8} \leq y \leq 0; -\frac{1}{4} \leq z \leq 0; y \leq \min(\frac{1}{4}-x, x); -y-\frac{1}{4} \leq z \leq y$ Vertices $-\frac{1}{8}, -\frac{1}{8}, -\frac{1}{8}; \frac{3}{8}, -\frac{1}{8}, -\frac{1}{8}; \frac{1}{4}, 0, 0; 0, 0, 0; \frac{1}{4}, 0, -\frac{1}{4}; 0, 0, -\frac{1}{4}$ **Symmetry operations**

(given on page 703)

Generators selected (1); $t(1,0,0)$; $t(0,1,0)$; $t(0,0,1)$; $t(0, \frac{1}{2}, \frac{1}{2})$; $t(\frac{1}{2}, 0, \frac{1}{2})$; (2); (3); (5); (13); (25)

Positions

Multiplicity, Wyckoff letter, Site symmetry	(0,0,0)+	(0, $\frac{1}{2}$, $\frac{1}{2}$)+	($\frac{1}{2}$, 0, $\frac{1}{2}$)+	($\frac{1}{2}$, $\frac{1}{2}$, 0)+	Reflection conditions
					h, k, l permutable
					General:

192	i	1	(1) x, y, z	(2) $\bar{x} + \frac{3}{4}, \bar{y} + \frac{3}{4}, z + \frac{1}{2}$	(3) $\bar{x} + \frac{1}{4}, y + \frac{1}{2}, \bar{z} + \frac{3}{4}$	(4) $x + \frac{1}{2}, \bar{y} + \frac{3}{4}, \bar{z} + \frac{3}{4}$	hkl : $h + k = 2n$ and $h + l, k + l = 2n$
			(5) z, x, y	(6) $z + \frac{1}{2}, \bar{x} + \frac{3}{4}, \bar{y} + \frac{1}{4}$	(7) $\bar{z} + \frac{3}{4}, \bar{x} + \frac{1}{4}, y + \frac{1}{2}$	(8) $\bar{z} + \frac{1}{4}, x + \frac{1}{2}, \bar{y} + \frac{3}{4}$	Ok : $k + l = 4n$ and $k, l = 2n$
			(9) y, z, x	(10) $\bar{y} + \frac{1}{4}, z + \frac{1}{2}, \bar{x} + \frac{3}{4}$	(11) $y + \frac{1}{2}, \bar{z} + \frac{3}{4}, \bar{x} + \frac{1}{4}$	(12) $\bar{y} + \frac{3}{4}, \bar{z} + \frac{1}{4}, x + \frac{1}{2}$	hhl : $h + l = 2n$
			(13) $y + \frac{3}{4}, x + \frac{1}{4}, \bar{z} + \frac{1}{2}$	(14) $\bar{y}, \bar{x}, \bar{z}$	(15) $y + \frac{1}{4}, \bar{x} + \frac{1}{2}, z + \frac{3}{4}$	(16) $\bar{y} + \frac{1}{2}, x + \frac{3}{4}, z + \frac{1}{4}$	$h00$: $h = 4n$
			(17) $x + \frac{3}{4}, z + \frac{1}{4}, \bar{y} + \frac{1}{2}$	(18) $\bar{x} + \frac{1}{2}, z + \frac{3}{4}, y + \frac{1}{4}$	(19) $\bar{x}, \bar{z}, \bar{y}$	(20) $x + \frac{1}{4}, \bar{z} + \frac{1}{2}, y + \frac{3}{4}$	
			(21) $z + \frac{3}{4}, y + \frac{1}{4}, \bar{x} + \frac{1}{2}$	(22) $z + \frac{1}{4}, \bar{y} + \frac{1}{2}, x + \frac{3}{4}$	(23) $\bar{z} + \frac{1}{2}, y + \frac{3}{4}, x + \frac{1}{4}$	(24) $\bar{z}, \bar{y}, \bar{x}$	
			(25) $\bar{x}, \bar{y}, \bar{z}$	(26) $x + \frac{1}{4}, y + \frac{3}{4}, \bar{z} + \frac{1}{2}$	(27) $x + \frac{3}{4}, \bar{y} + \frac{1}{2}, z + \frac{1}{4}$	(28) $\bar{x} + \frac{1}{2}, y + \frac{1}{4}, z + \frac{3}{4}$	
			(29) $\bar{z}, \bar{x}, \bar{y}$	(30) $\bar{z} + \frac{1}{2}, x + \frac{1}{4}, y + \frac{3}{4}$	(31) $z + \frac{1}{4}, x + \frac{3}{4}, \bar{y} + \frac{1}{2}$	(32) $z + \frac{3}{4}, \bar{x} + \frac{1}{2}, y + \frac{1}{4}$	
			(33) $\bar{y}, \bar{z}, \bar{x}$	(34) $y + \frac{3}{4}, \bar{z} + \frac{1}{2}, x + \frac{1}{4}$	(35) $\bar{y} + \frac{1}{2}, z + \frac{1}{4}, x + \frac{3}{4}$	(36) $y + \frac{1}{4}, z + \frac{3}{4}, \bar{x} + \frac{1}{2}$	
			(37) $\bar{y} + \frac{1}{4}, \bar{x} + \frac{3}{4}, z + \frac{1}{2}$	(38) y, x, z	(39) $\bar{y} + \frac{3}{4}, x + \frac{1}{2}, \bar{z} + \frac{1}{4}$	(40) $y + \frac{1}{2}, \bar{x} + \frac{1}{4}, \bar{z} + \frac{3}{4}$	
			(41) $\bar{x} + \frac{1}{4}, \bar{z} + \frac{3}{4}, y + \frac{1}{2}$	(42) $x + \frac{1}{2}, \bar{z} + \frac{1}{4}, \bar{y} + \frac{3}{4}$	(43) x, z, y	(44) $\bar{x} + \frac{3}{4}, z + \frac{1}{2}, \bar{y} + \frac{1}{4}$	
			(45) $\bar{z} + \frac{1}{4}, \bar{y} + \frac{3}{4}, x + \frac{1}{2}$	(46) $\bar{z} + \frac{3}{4}, y + \frac{1}{2}, \bar{x} + \frac{1}{4}$	(47) $z + \frac{1}{2}, \bar{y} + \frac{1}{4}, \bar{x} + \frac{3}{4}$	(48) z, y, x	

Special: as above, plus

no extra conditions

96	h	..2	$0, y, \bar{y}$	$\frac{3}{4}, \bar{y} + \frac{1}{4}, \bar{y} + \frac{1}{2}$	$\frac{1}{4}, y + \frac{1}{2}, y + \frac{3}{4}$	$\frac{1}{2}, \bar{y} + \frac{3}{4}, y + \frac{1}{4}$
			$\bar{y}, 0, y$	$\bar{y} + \frac{1}{2}, \frac{3}{4}, \bar{y} + \frac{1}{4}$	$y + \frac{3}{4}, \frac{1}{4}, y + \frac{1}{2}$	$y + \frac{1}{4}, \frac{1}{2}, \bar{y} + \frac{3}{4}$
			$y, \bar{y}, 0$	$\bar{y} + \frac{1}{4}, \bar{y} + \frac{1}{2}, \frac{3}{4}$	$y + \frac{1}{2}, y + \frac{3}{4}, \frac{1}{4}$	$\bar{y} + \frac{3}{4}, y + \frac{1}{4}, \frac{1}{2}$
			$0, \bar{y}, y$	$\frac{1}{4}, y + \frac{3}{4}, y + \frac{1}{2}$	$\frac{3}{4}, \bar{y} + \frac{1}{2}, \bar{y} + \frac{1}{4}$	$\frac{1}{2}, y + \frac{1}{4}, \bar{y} + \frac{3}{4}$
			$y, 0, \bar{y}$	$y + \frac{1}{2}, \frac{1}{4}, y + \frac{3}{4}$	$\bar{y} + \frac{1}{4}, \frac{3}{4}, \bar{y} + \frac{1}{2}$	$\bar{y} + \frac{3}{4}, \frac{1}{2}, y + \frac{1}{4}$
			$\bar{y}, \bar{y}, 0$	$y + \frac{3}{4}, y + \frac{1}{2}, \frac{1}{4}$	$\bar{y} + \frac{1}{2}, \bar{y} + \frac{1}{4}, \frac{3}{4}$	$y + \frac{1}{4}, \bar{y} + \frac{3}{4}, \frac{1}{2}$

96	g	..m	x, x, z	$\bar{x} + \frac{3}{4}, \bar{x} + \frac{1}{4}, z + \frac{1}{2}$	$\bar{x} + \frac{1}{4}, x + \frac{1}{2}, \bar{z} + \frac{3}{4}$	$x + \frac{1}{2}, \bar{x} + \frac{3}{4}, \bar{z} + \frac{1}{4}$	no extra conditions
			z, x, x	$z + \frac{1}{2}, \bar{x} + \frac{3}{4}, \bar{x} + \frac{1}{4}$	$\bar{z} + \frac{3}{4}, \bar{x} + \frac{1}{4}, x + \frac{1}{2}$	$\bar{z} + \frac{1}{4}, x + \frac{1}{2}, \bar{x} + \frac{3}{4}$	
			x, z, x	$\bar{x} + \frac{1}{4}, z + \frac{1}{2}, \bar{x} + \frac{3}{4}$	$x + \frac{1}{2}, \bar{z} + \frac{3}{4}, \bar{x} + \frac{1}{4}$	$\bar{x} + \frac{3}{4}, \bar{z} + \frac{1}{4}, x + \frac{1}{2}$	
			$x + \frac{3}{4}, x + \frac{1}{4}, \bar{z} + \frac{1}{2}$	$\bar{x}, \bar{x}, \bar{z}$	$x + \frac{1}{4}, \bar{x} + \frac{1}{2}, z + \frac{3}{4}$	$\bar{x} + \frac{1}{2}, x + \frac{3}{4}, z + \frac{1}{4}$	
			$x + \frac{3}{4}, z + \frac{1}{4}, \bar{x} + \frac{1}{2}$	$\bar{x} + \frac{1}{2}, z + \frac{3}{4}, x + \frac{1}{4}$	$\bar{x}, \bar{z}, \bar{x}$	$x + \frac{1}{4}, \bar{z} + \frac{1}{2}, x + \frac{3}{4}$	
			$z + \frac{3}{4}, x + \frac{1}{4}, \bar{x} + \frac{1}{2}$	$z + \frac{1}{4}, \bar{x} + \frac{1}{2}, x + \frac{3}{4}$	$\bar{z} + \frac{1}{2}, x + \frac{3}{4}, x + \frac{1}{4}$	$\bar{z}, \bar{x}, \bar{x}$	

48	f	2.mm	$x, \frac{1}{8}, \frac{1}{8}$	$\bar{x} + \frac{3}{4}, \frac{1}{8}, \frac{5}{8}$	$\frac{1}{8}, x, \frac{1}{8}$	$\frac{5}{8}, \bar{x} + \frac{3}{4}, \frac{1}{8}$	$\frac{1}{8}, \frac{1}{8}, x$	$\frac{1}{8}, \frac{5}{8}, \bar{x} + \frac{3}{4}$	hkl : $h = 2n + 1$ or $h + k + l = 4n$
			$\frac{7}{8}, x + \frac{1}{4}, \frac{3}{8}$	$\frac{7}{8}, \bar{x}, \frac{7}{8}$	$x + \frac{3}{4}, \frac{3}{8}, \frac{3}{8}$	$\bar{x} + \frac{1}{2}, \frac{7}{8}, \frac{3}{8}$	$\frac{7}{8}, \frac{3}{8}, \bar{x} + \frac{1}{2}$	$\frac{3}{8}, \frac{3}{8}, x + \frac{3}{4}$	

32	e	.3m	x, x, x	$\bar{x} + \frac{3}{4}, \bar{x} + \frac{1}{4}, x + \frac{1}{2}$				no extra conditions
			$\bar{x} + \frac{1}{4}, x + \frac{1}{2}, \bar{x} + \frac{3}{4}$	$x + \frac{1}{2}, \bar{x} + \frac{3}{4}, \bar{x} + \frac{1}{4}$				
			$x + \frac{3}{4}, x + \frac{1}{4}, \bar{x} + \frac{1}{2}$	$\bar{x}, \bar{x}, \bar{x}$				
			$x + \frac{1}{4}, \bar{x} + \frac{1}{2}, x + \frac{3}{4}$	$\bar{x} + \frac{1}{2}, x + \frac{3}{4}, x + \frac{1}{4}$				

16	d	. $\bar{3}m$	$\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$	$\frac{1}{4}, \frac{3}{4}, 0$	$\frac{3}{4}, 0, \frac{1}{4}$	$0, \frac{1}{4}, \frac{3}{4}$	} hkl : $h = 2n + 1$ or $h, k, l = 4n + 2$ or $h, k, l = 4n$
16	c	. $\bar{3}m$	$0, 0, 0$	$\frac{3}{4}, \frac{1}{4}, \frac{1}{2}$	$\frac{1}{4}, \frac{1}{2}, \frac{3}{4}$	$\frac{1}{2}, \frac{3}{4}, \frac{1}{4}$	

8	b	$\bar{4}3m$	$\frac{3}{8}, \frac{3}{8}, \frac{3}{8}$	$\frac{1}{8}, \frac{5}{8}, \frac{1}{8}$	} hkl : $h = 2n + 1$ or $h + k + l = 4n$
8	a	$\bar{4}3m$	$\frac{1}{8}, \frac{1}{8}, \frac{1}{8}$	$\frac{7}{8}, \frac{3}{8}, \frac{3}{8}$	

Symmetry of special projectionsAlong [001] $p4mm$

$$\mathbf{a}' = \frac{1}{4}(\mathbf{a} - \mathbf{b}) \quad \mathbf{b}' = \frac{1}{4}(\mathbf{a} + \mathbf{b})$$

Origin at $\frac{1}{8}, \frac{3}{8}, z$ Along [111] $p6mm$

$$\mathbf{a}' = \frac{1}{6}(2\mathbf{a} - \mathbf{b} - \mathbf{c}) \quad \mathbf{b}' = \frac{1}{6}(-\mathbf{a} + 2\mathbf{b} - \mathbf{c})$$

Origin at x, x, x Along [110] $c2mm$

$$\mathbf{a}' = \frac{1}{2}(-\mathbf{a} + \mathbf{b}) \quad \mathbf{b}' = \mathbf{c}$$

Origin at $x, x, 0$

ORIGIN CHOICE 2

Maximal non-isomorphic subgroups

I	[2] $F \bar{4} 3 m$ (216)	(1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 37; 38; 39; 40; 41; 42; 43; 44; 45; 46; 47; 48)+
	[2] $F 4_1 3 2$ (210)	(1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19; 20; 21; 22; 23; 24)+
	[2] $F d \bar{3} 1$ ($F d \bar{3}$, 203)	(1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 25; 26; 27; 28; 29; 30; 31; 32; 33; 34; 35; 36)+
	{ [3] $F 4_1/d 1 2/m$ ($I 4_1/amd$, 141)	(1; 2; 3; 4; 13; 14; 15; 16; 25; 26; 27; 28; 37; 38; 39; 40)+
	{ [3] $F 4_1/d 1 2/m$ ($I 4_1/amd$, 141)	(1; 2; 3; 4; 17; 18; 19; 20; 25; 26; 27; 28; 41; 42; 43; 44)+
	{ [3] $F 4_1/d 1 2/m$ ($I 4_1/amd$, 141)	(1; 2; 3; 4; 21; 22; 23; 24; 25; 26; 27; 28; 45; 46; 47; 48)+
	{ [4] $F 1 \bar{3} 2/m$ ($R \bar{3} m$, 166)	(1; 5; 9; 14; 19; 24; 25; 29; 33; 38; 43; 48)+
	{ [4] $F 1 \bar{3} 2/m$ ($R \bar{3} m$, 166)	(1; 6; 12; 13; 18; 24; 25; 30; 36; 37; 42; 48)+
	{ [4] $F 1 \bar{3} 2/m$ ($R \bar{3} m$, 166)	(1; 7; 10; 13; 19; 22; 25; 31; 34; 37; 43; 46)+
	{ [4] $F 1 \bar{3} 2/m$ ($R \bar{3} m$, 166)	(1; 8; 11; 14; 18; 22; 25; 32; 35; 38; 42; 46)+

IIa none

IIb none

Maximal isomorphic subgroups of lowest index

IIc [27] $F d \bar{3} m$ ($\mathbf{a}' = 3\mathbf{a}, \mathbf{b}' = 3\mathbf{b}, \mathbf{c}' = 3\mathbf{c}$) (227)

Minimal non-isomorphic supergroups

I none

II [2] $P n \bar{3} m$ ($\mathbf{a}' = \frac{1}{2}\mathbf{a}, \mathbf{b}' = \frac{1}{2}\mathbf{b}, \mathbf{c}' = \frac{1}{2}\mathbf{c}$) (224)

Symmetry operations

For (0,0,0)+ set

- | | | | |
|---|--|--|--|
| (1) 1 | (2) $2(0,0,\frac{1}{2}) \frac{3}{8},\frac{3}{8},z$ | (3) $2(0,\frac{1}{2},0) \frac{1}{8},y,\frac{3}{8}$ | (4) $2(\frac{1}{2},0,0) x,\frac{3}{8},\frac{3}{8}$ |
| (5) $3^+ x,x,x$ | (6) $3^+ \bar{x}+\frac{1}{2},x+\frac{1}{4},\bar{x}$ | (7) $3^+ x+\frac{3}{4},\bar{x}-\frac{1}{2},\bar{x}$ | (8) $3^+ \bar{x}+\frac{1}{4},\bar{x}+\frac{3}{4},x$ |
| (9) $3^- x,x,x$ | (10) $3^- (-\frac{1}{3},\frac{1}{3},\frac{1}{3}) x+\frac{5}{12},\bar{x}+\frac{1}{6},\bar{x}$ | (11) $3^- (\frac{1}{3},\frac{1}{3},-\frac{1}{3}) \bar{x}+\frac{7}{12},\bar{x}+\frac{5}{12},x$ | (12) $3^- (\frac{1}{3},-\frac{1}{3},\frac{1}{3}) \bar{x}-\frac{1}{6},x+\frac{7}{12},\bar{x}$ |
| (13) $2(\frac{1}{2},\frac{1}{2},0) x,x-\frac{1}{4},\frac{1}{4}$ | (14) $2 x,\bar{x},0$ | (15) $4^-(0,0,\frac{3}{4}) \frac{3}{8},\frac{1}{8},z$ | (16) $4^+(0,0,\frac{1}{4}) -\frac{1}{8},\frac{5}{8},z$ |
| (17) $4^-(\frac{3}{4},0,0) x,\frac{3}{8},\frac{3}{8}$ | (18) $2(0,\frac{1}{2},\frac{1}{2}) \frac{1}{4},y+\frac{1}{4},y$ | (19) $2 0,y,\bar{y}$ | (20) $4^+(\frac{1}{4},0,0) x,-\frac{1}{8},\frac{5}{8}$ |
| (21) $4^+(0,\frac{1}{4},0) \frac{5}{8},y,-\frac{1}{8}$ | (22) $2(\frac{1}{2},0,\frac{1}{2}) x-\frac{1}{4},\frac{1}{4},x$ | (23) $4^-(0,\frac{3}{4},0) \frac{1}{8},y,\frac{3}{8}$ | (24) $2 \bar{x},0,x$ |
| (25) $\bar{1} 0,0,0$ | (26) $d(\frac{1}{4},\frac{3}{4},0) x,y,\frac{1}{4}$ | (27) $d(\frac{3}{4},0,\frac{1}{4}) x,\frac{1}{4},z$ | (28) $d(0,\frac{1}{4},\frac{3}{4}) \frac{1}{4},y,z$ |
| (29) $\bar{3}^+ x,x,x; 0,0,0$ | (30) $\bar{3}^+ \bar{x}-1,x+\frac{3}{4},\bar{x}; -\frac{1}{4},0,\frac{3}{4}$ | (31) $\bar{3}^+ x-\frac{1}{4},\bar{x}+1,\bar{x}; 0,\frac{3}{4},-\frac{1}{4}$ | (32) $\bar{3}^+ \bar{x}+\frac{3}{4},\bar{x}-\frac{1}{4},x; \frac{3}{4},-\frac{1}{4},0$ |
| (33) $\bar{3}^- x,x,x; 0,0,0$ | (34) $\bar{3}^- x+\frac{5}{4},\bar{x}-1,\bar{x}; \frac{1}{2},-\frac{1}{4},\frac{3}{4}$ | (35) $\bar{3}^- \bar{x}+\frac{1}{4},\bar{x}+\frac{5}{4},x; -\frac{1}{4},\frac{3}{4},\frac{1}{2}$ | (36) $\bar{3}^- \bar{x}+1,x+\frac{1}{4},\bar{x}; \frac{3}{4},\frac{1}{2},-\frac{1}{4}$ |
| (37) $g(-\frac{1}{4},\frac{1}{4},\frac{1}{2}) x+\frac{1}{2},\bar{x},z$ | (38) $m x,x,z$ | (39) $\bar{4}^- \frac{1}{8},\frac{5}{8},z; \frac{1}{8},\frac{5}{8},\frac{1}{8}$ | (40) $\bar{4}^+ \frac{3}{8},-\frac{1}{8},z; \frac{3}{8},-\frac{1}{8},\frac{3}{8}$ |
| (41) $\bar{4}^- x,\frac{1}{8},\frac{5}{8}; \frac{1}{8},\frac{1}{8},\frac{5}{8}$ | (42) $g(\frac{1}{2},-\frac{1}{4},\frac{1}{4}) x,y+\frac{1}{2},\bar{y}$ | (43) $m x,y,y$ | (44) $\bar{4}^+ x,\frac{3}{8},-\frac{1}{8}; \frac{3}{8},\frac{3}{8},-\frac{1}{8}$ |
| (45) $\bar{4}^+ -\frac{1}{8},y,\frac{3}{8}; -\frac{1}{8},\frac{3}{8},\frac{3}{8}$ | (46) $g(\frac{1}{4},\frac{1}{2},-\frac{1}{4}) \bar{x}+\frac{1}{2},y,x$ | (47) $\bar{4}^- \frac{5}{8},y,\frac{1}{8}; \frac{5}{8},\frac{1}{8},\frac{1}{8}$ | (48) $m x,y,x$ |

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

- | | | | |
|---|--|--|--|
| (1) $t(0,\frac{1}{2},\frac{1}{2})$ | (2) $2 \frac{3}{8},\frac{3}{8},z$ | (3) $2 \frac{1}{8},y,\frac{1}{8}$ | (4) $2(\frac{1}{2},0,0) x,\frac{1}{8},\frac{3}{8}$ |
| (5) $3^+(\frac{1}{3},\frac{1}{3},\frac{1}{3}) x-\frac{1}{3},x-\frac{1}{6},x$ | (6) $3^+(\frac{1}{3},-\frac{1}{3},\frac{1}{3}) \bar{x}+\frac{1}{6},x+\frac{5}{12},\bar{x}$ | (7) $3^+ x+\frac{3}{4},\bar{x},\bar{x}$ | (8) $3^+ \bar{x}+\frac{1}{4},\bar{x}+\frac{1}{4},x$ |
| (9) $3^-(\frac{1}{3},\frac{1}{3},\frac{1}{3}) x-\frac{1}{6},x+\frac{1}{6},x$ | (10) $3^- x+\frac{1}{4},\bar{x},\bar{x}$ | (11) $3^- \bar{x}+\frac{3}{4},\bar{x}+\frac{1}{4},x$ | (12) $3^- \bar{x},x+\frac{3}{4},\bar{x}$ |
| (13) $2(\frac{3}{4},\frac{3}{4},0) x,x,0$ | (14) $2(-\frac{1}{4},\frac{1}{4},0) x,\bar{x}+\frac{1}{4},\frac{1}{4}$ | (15) $4^-(0,0,\frac{1}{4}) \frac{1}{8},-\frac{1}{8},z$ | (16) $4^+(0,0,\frac{3}{4}) \frac{1}{8},\frac{3}{8},z$ |
| (17) $4^-(\frac{3}{4},0,0) x,\frac{3}{8},-\frac{3}{8}$ | (18) $2(0,\frac{1}{2},\frac{1}{2}) \frac{1}{4},y-\frac{1}{4},y$ | (19) $2 0,y+\frac{1}{2},\bar{y}$ | (20) $4^+(\frac{1}{4},0,0) x,-\frac{1}{8},\frac{1}{8}$ |
| (21) $4^+(0,\frac{3}{4},0) \frac{3}{8},y,-\frac{3}{8}$ | (22) $2(\frac{1}{4},0,\frac{1}{4}) x,0,x$ | (23) $4^-(0,\frac{1}{4},0) -\frac{1}{8},y,\frac{5}{8}$ | (24) $2(-\frac{1}{4},0,\frac{1}{4}) \bar{x}+\frac{1}{4},\frac{1}{4},x$ |
| (25) $\bar{1} 0,\frac{1}{4},\frac{1}{4}$ | (26) $d(\frac{1}{4},\frac{1}{4},0) x,y,0$ | (27) $d(\frac{3}{4},0,\frac{3}{4}) x,0,z$ | (28) $d(0,\frac{3}{4},\frac{1}{4}) \frac{1}{4},y,z$ |
| (29) $\bar{3}^+ x,x+\frac{1}{2},x; 0,\frac{1}{2},0$ | (30) $\bar{3}^+ \bar{x}-1,x+\frac{5}{4},\bar{x}; -\frac{1}{4},\frac{1}{4},\frac{3}{4}$ | (31) $\bar{3}^+ x-\frac{1}{4},\bar{x}+\frac{1}{2},\bar{x}; 0,\frac{1}{4},-\frac{1}{4}$ | (32) $\bar{3}^+ \bar{x}+\frac{3}{4},\bar{x}-\frac{3}{4},x; \frac{3}{4},-\frac{3}{4},0$ |
| (33) $\bar{3}^- x-\frac{1}{2},x-\frac{1}{2},x; 0,0,\frac{1}{2}$ | (34) $\bar{3}^- x+\frac{3}{4},\bar{x}-\frac{3}{2},\bar{x}; 0,-\frac{3}{4},\frac{3}{4}$ | (35) $\bar{3}^- \bar{x}-\frac{1}{4},\bar{x}+\frac{3}{4},x; -\frac{1}{4},\frac{3}{4},0$ | (36) $\bar{3}^- \bar{x}+\frac{1}{2},x-\frac{1}{4},\bar{x}; \frac{1}{4},0,-\frac{1}{4}$ |
| (37) $m x+\frac{1}{4},\bar{x},z$ | (38) $g(\frac{1}{4},\frac{1}{4},\frac{1}{2}) x-\frac{1}{4},x,z$ | (39) $\bar{4}^- \frac{3}{8},\frac{5}{8},z; \frac{3}{8},\frac{5}{8},\frac{3}{8}$ | (40) $\bar{4}^+ \frac{5}{8},\frac{3}{8},z; \frac{5}{8},\frac{3}{8},\frac{5}{8}$ |
| (41) $\bar{4}^- x,\frac{1}{8},\frac{1}{8}; \frac{1}{8},\frac{1}{8},\frac{1}{8}$ | (42) $g(\frac{1}{2},\frac{1}{4},-\frac{1}{4}) x,y+\frac{1}{2},\bar{y}$ | (43) $g(0,\frac{1}{2},\frac{1}{2}) x,y,y$ | (44) $\bar{4}^+ x,\frac{3}{8},\frac{3}{8}; \frac{3}{8},\frac{3}{8},\frac{3}{8}$ |
| (45) $\bar{4}^+ \frac{1}{8},y,\frac{1}{8}; \frac{1}{8},\frac{1}{8},\frac{1}{8}$ | (46) $m \bar{x}+\frac{3}{4},y,x$ | (47) $\bar{4}^- \frac{5}{8},y,-\frac{1}{8}; \frac{5}{8},\frac{3}{8},-\frac{1}{8}$ | (48) $g(\frac{1}{4},\frac{1}{2},\frac{1}{4}) x-\frac{1}{4},y,x$ |

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

- | | | | |
|---|--|--|--|
| (1) $t(\frac{1}{2},0,\frac{1}{2})$ | (2) $2 \frac{1}{8},\frac{1}{8},z$ | (3) $2(0,\frac{1}{2},0) \frac{3}{8},y,\frac{1}{8}$ | (4) $2 x,\frac{3}{8},\frac{3}{8}$ |
| (5) $3^+(\frac{1}{3},\frac{1}{3},\frac{1}{3}) x+\frac{1}{6},x-\frac{1}{6},x$ | (6) $3^+ \bar{x},x+\frac{3}{4},\bar{x}$ | (7) $3^+ x+\frac{1}{4},\bar{x},\bar{x}$ | (8) $3^+(\frac{1}{3},\frac{1}{3},-\frac{1}{3}) \bar{x}+\frac{5}{12},\bar{x}+\frac{7}{12},x$ |
| (9) $3^-(\frac{1}{3},\frac{1}{3},\frac{1}{3}) x-\frac{1}{6},x-\frac{1}{3},x$ | (10) $3^- x+\frac{1}{4},\bar{x}+\frac{1}{2},\bar{x}$ | (11) $3^- \bar{x}+\frac{3}{4},\bar{x}+\frac{3}{4},x$ | (12) $3^- \bar{x},x+\frac{1}{4},\bar{x}$ |
| (13) $2(\frac{1}{4},\frac{1}{4},0) x,x,0$ | (14) $2(\frac{1}{4},-\frac{1}{4},0) x,\bar{x}+\frac{1}{4},\frac{1}{4}$ | (15) $4^-(0,0,\frac{1}{4}) \frac{5}{8},-\frac{1}{8},z$ | (16) $4^+(0,0,\frac{3}{4}) -\frac{3}{8},\frac{3}{8},z$ |
| (17) $4^-(\frac{1}{4},0,0) x,\frac{1}{8},-\frac{1}{8}$ | (18) $2(0,\frac{3}{4},\frac{3}{4}) 0,y,y$ | (19) $2(0,-\frac{1}{4},\frac{1}{4}) \frac{1}{4},y+\frac{1}{4},\bar{y}$ | (20) $4^+(\frac{3}{4},0,0) x,\frac{1}{8},\frac{3}{8}$ |
| (21) $4^+(0,\frac{1}{4},0) \frac{1}{8},y,-\frac{1}{8}$ | (22) $2(\frac{1}{2},0,\frac{1}{2}) x+\frac{1}{4},\frac{1}{4},x$ | (23) $4^-(0,\frac{3}{4},0) -\frac{3}{8},y,\frac{3}{8}$ | (24) $2 \bar{x}+\frac{1}{2},0,x$ |
| (25) $\bar{1} \frac{1}{4},0,\frac{1}{4}$ | (26) $d(\frac{3}{4},\frac{3}{4},0) x,y,0$ | (27) $d(\frac{1}{4},0,\frac{3}{4}) x,\frac{1}{4},z$ | (28) $d(0,\frac{1}{4},\frac{1}{4}) 0,y,z$ |
| (29) $\bar{3}^+ x-\frac{1}{2},x-\frac{1}{2},x; 0,0,\frac{1}{2}$ | (30) $\bar{3}^+ \bar{x}-\frac{1}{2},x+\frac{1}{4},\bar{x}; -\frac{1}{4},0,\frac{1}{4}$ | (31) $\bar{3}^+ x-\frac{3}{4},\bar{x}+\frac{3}{2},\bar{x}; 0,\frac{3}{4},-\frac{3}{4}$ | (32) $\bar{3}^+ \bar{x}+\frac{3}{4},\bar{x}+\frac{1}{4},x; \frac{3}{4},-\frac{1}{4},\frac{1}{2}$ |
| (33) $\bar{3}^- x+\frac{1}{2},x,x; \frac{1}{2},0,0$ | (34) $\bar{3}^- x+\frac{3}{4},\bar{x}-1,\bar{x}; 0,-\frac{1}{4},\frac{3}{4}$ | (35) $\bar{3}^- \bar{x}-\frac{1}{2},\bar{x}+\frac{1}{4},x; -\frac{1}{4},\frac{1}{4},0$ | (36) $\bar{3}^- \bar{x}+\frac{3}{2},x-\frac{3}{4},\bar{x}; \frac{3}{4},0,-\frac{3}{4}$ |
| (37) $m x+\frac{3}{4},\bar{x},z$ | (38) $g(\frac{1}{4},\frac{1}{4},\frac{1}{2}) x+\frac{1}{4},x,z$ | (39) $\bar{4}^- -\frac{1}{8},\frac{3}{8},z; -\frac{1}{8},\frac{3}{8},\frac{3}{8}$ | (40) $\bar{4}^+ \frac{1}{8},\frac{3}{8},z; \frac{1}{8},\frac{3}{8},\frac{1}{8}$ |
| (41) $\bar{4}^- x,\frac{3}{8},\frac{3}{8}; \frac{3}{8},\frac{3}{8},\frac{3}{8}$ | (42) $m x,y+\frac{1}{4},\bar{y}$ | (43) $g(\frac{1}{2},\frac{1}{4},\frac{1}{4}) x,y-\frac{1}{4},y$ | (44) $\bar{4}^+ x,\frac{5}{8},\frac{1}{8}; \frac{1}{8},\frac{5}{8},\frac{1}{8}$ |
| (45) $\bar{4}^+ \frac{3}{8},y,\frac{3}{8}; \frac{3}{8},\frac{3}{8},\frac{3}{8}$ | (46) $g(-\frac{1}{4},\frac{1}{2},\frac{1}{4}) \bar{x}+\frac{1}{2},y,x$ | (47) $\bar{4}^- \frac{1}{8},y,\frac{1}{8}; \frac{1}{8},\frac{1}{8},\frac{1}{8}$ | (48) $g(\frac{1}{2},0,\frac{1}{2}) x,y,x$ |

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

- | | | | |
|---|--|---|--|
| (1) $t(\frac{1}{2},\frac{1}{2},0)$ | (2) $2(0,0,\frac{1}{2}) \frac{1}{8},\frac{3}{8},z$ | (3) $2 \frac{3}{8},y,\frac{3}{8}$ | (4) $2 x,\frac{1}{8},\frac{1}{8}$ |
| (5) $3^+(\frac{1}{3},\frac{1}{3},\frac{1}{3}) x+\frac{1}{6},x+\frac{1}{3},x$ | (6) $3^+ \bar{x},x+\frac{1}{4},\bar{x}$ | (7) $3^+(\frac{1}{3},\frac{1}{3},\frac{1}{3}) x+\frac{7}{12},\bar{x}-\frac{1}{6},\bar{x}$ | (8) $3^+ \bar{x}+\frac{3}{4},\bar{x}+\frac{3}{4},x$ |
| (9) $3^-(\frac{1}{3},\frac{1}{3},\frac{1}{3}) x+\frac{1}{3},x+\frac{1}{6},x$ | (10) $3^- x+\frac{3}{4},\bar{x},\bar{x}$ | (11) $3^- \bar{x}+\frac{1}{4},\bar{x}+\frac{1}{4},x$ | (12) $3^- \bar{x}-\frac{1}{2},x+\frac{3}{4},\bar{x}$ |
| (13) $2(\frac{1}{2},\frac{1}{2},0) x,x+\frac{1}{4},\frac{1}{4}$ | (14) $2 x,\bar{x}+\frac{1}{2},0$ | (15) $4^-(0,0,\frac{3}{4}) \frac{3}{8},-\frac{3}{8},z$ | (16) $4^+(0,0,\frac{1}{4}) -\frac{1}{8},\frac{1}{8},z$ |
| (17) $4^-(\frac{1}{4},0,0) x,\frac{5}{8},-\frac{1}{8}$ | (18) $2(0,\frac{1}{4},\frac{1}{4}) 0,y,y$ | (19) $2(0,\frac{1}{4},-\frac{1}{4}) \frac{1}{4},y+\frac{1}{4},\bar{y}$ | (20) $4^+(\frac{3}{4},0,0) x,-\frac{3}{8},\frac{3}{8}$ |
| (21) $4^+(0,\frac{3}{4},0) \frac{3}{8},y,\frac{1}{8}$ | (22) $2(\frac{3}{4},0,\frac{3}{4}) x,0,x$ | (23) $4^-(0,\frac{1}{4},0) -\frac{1}{8},y,\frac{1}{8}$ | (24) $2(\frac{1}{4},0,-\frac{1}{4}) \bar{x}+\frac{1}{4},\frac{1}{4},x$ |
| (25) $\bar{1} \frac{1}{4},\frac{1}{4},0$ | (26) $d(\frac{3}{4},\frac{1}{4},0) x,y,\frac{1}{4}$ | (27) $d(\frac{1}{4},0,\frac{1}{4}) x,0,z$ | (28) $d(0,\frac{3}{4},\frac{3}{4}) 0,y,z$ |
| (29) $\bar{3}^+ x+\frac{1}{2},x,x; \frac{1}{2},0,0$ | (30) $\bar{3}^+ \bar{x}-\frac{3}{2},x+\frac{3}{4},\bar{x}; -\frac{3}{4},0,\frac{3}{4}$ | (31) $\bar{3}^+ x+\frac{1}{4},\bar{x}+1,\bar{x}; \frac{1}{2},\frac{3}{4},-\frac{1}{4}$ | (32) $\bar{3}^+ \bar{x}+\frac{1}{4},\bar{x}-\frac{1}{4},x; \frac{1}{4},-\frac{1}{4},0$ |
| (33) $\bar{3}^- x,x+\frac{1}{2},x; 0,\frac{1}{2},0$ | (34) $\bar{3}^- x+\frac{1}{4},\bar{x}-\frac{1}{2},\bar{x}; 0,-\frac{1}{4},\frac{1}{4}$ | (35) $\bar{3}^- \bar{x}-\frac{3}{4},\bar{x}+\frac{3}{4},x; -\frac{3}{4},\frac{3}{4},0$ | (36) $\bar{3}^- \bar{x}+1,x-\frac{1}{4},\bar{x}; \frac{3}{4},0,-\frac{1}{4}$ |
| (37) $g(\frac{1}{4},-\frac{1}{4},\frac{1}{2}) x+\frac{1}{2},\bar{x},z$ | (38) $g(\frac{1}{2},\frac{1}{2},0) x,x,z$ | (39) $\bar{4}^- \frac{1}{8},\frac{1}{8},z; \frac{1}{8},\frac{1}{8},\frac{1}{8}$ | (40) $\bar{4}^+ \frac{3}{8},\frac{3}{8},z; \frac{3}{8},\frac{3}{8},\frac{3}{8}$ |
| (41) $\bar{4}^- x,-\frac{1}{8},\frac{3}{8}; \frac{3}{8},-\frac{1}{8},\frac{3}{8}$ | (42) $m x,y+\frac{3}{4},\bar{y}$ | (43) $g(\frac{1}{2},\frac{1}{4},\frac{1}{4}) x,y+\frac{1}{4},y$ | (44) $\bar{4}^+ x,\frac{1}{8},\frac{1}{8}; \frac{1}{8},\frac{1}{8},\frac{1}{8}$ |
| (45) $\bar{4}^+ \frac{1}{8},y,\frac{3}{8}; \frac{1}{8},\frac{1}{8},\frac{5}{8}$ | (46) $m \bar{x}+\frac{1}{4},y,x$ | (47) $\bar{4}^- \frac{3}{8},y,\frac{3}{8}; \frac{3}{8},\frac{3}{8},\frac{3}{8}$ | (48) $g(\frac{1}{4},\frac{1}{2},\frac{1}{4}) x+\frac{1}{4},y,x$ |