$F\,d\,\bar{3}\,c$ No. 228 $F\,4_1/d\,\bar{3}\,2/c$ O_h^8

ORIGIN CHOICE 2, Origin at centre $(\bar{3})$, at $\frac{3}{8},\frac{3}{8},\frac{3}{8}$ from 23

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)

General position

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

I Maximal *translationengleiche* subgroups

[2] $F\bar{4}3c$ (219)	(1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 37; 38; 39; 40; 41; 42; 43; 44; 45; 46; 47; 48)+		$1/8,1/8,1/8$
[2] $F4_132$ (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)+		$1/8,1/8,1/8$
[2] $Fd\bar{3}1$ (203, $Fd\bar{3}$)	(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] $F4_1/d12/c$ (142, $I4_1/acd$)	(1; 2; 3; 4; 13; 14; 15; 16; 25; 26; 27; 28; 37; 38; 39; 40)+	$1/2(\mathbf{a}-\mathbf{b}),1/2(\mathbf{a}+\mathbf{b}),\mathbf{c}$	
[3] $F4_1/d12/c$ (142, $I4_1/acd$)	(1; 4; 2; 3; 18; 19; 17; 20; 25; 28; 26; 27; 42; 43; 41; 44)+	$1/2(\mathbf{b}-\mathbf{c}),1/2(\mathbf{b}+\mathbf{c}),\mathbf{a}$	
[3] $F4_1/d12/c$ (142, $I4_1/acd$)	(1; 3; 4; 2; 22; 24; 23; 21; 25; 27; 28; 26; 46; 48; 47; 45)+	$1/2(-\mathbf{a}+\mathbf{c}),1/2(\mathbf{a}+\mathbf{c}),\mathbf{b}$	
[4] $F1\bar{3}2/c$ (167, $R\bar{3}c$)	(1; 5; 9; 14; 19; 24; 25; 29; 33; 38; 43; 48)+	$1/2(-\mathbf{a}+\mathbf{b}),1/2(-\mathbf{b}+\mathbf{c}),\mathbf{a}+\mathbf{b}+\mathbf{c}$	
[4] $F1\bar{3}2/c$ (167, $R\bar{3}c$)	(1; 6; 12; 13; 18; 24; 25; 30; 36; 37; 42; 48)+	$1/2(\mathbf{a}+\mathbf{b}),1/2(-\mathbf{b}-\mathbf{c}),-\mathbf{a}+\mathbf{b}-\mathbf{c}$	$1/4,0,1/4$
[4] $F1\bar{3}2/c$ (167, $R\bar{3}c$)	(1; 7; 10; 13; 19; 22; 25; 31; 34; 37; 43; 46)+	$1/2(-\mathbf{a}-\mathbf{b}),1/2(\mathbf{b}-\mathbf{c}),\mathbf{a}-\mathbf{b}-\mathbf{c}$	$0,1/4,1/4$
[4] $F1\bar{3}2/c$ (167, $R\bar{3}c$)	(1; 8; 11; 14; 18; 22; 25; 32; 35; 38; 42; 46)+	$1/2(\mathbf{a}-\mathbf{b}),1/2(\mathbf{b}+\mathbf{c}),-\mathbf{a}-\mathbf{b}+\mathbf{c}$	$1/4,1/4,0$

II Maximal *klassengleiche* subgroups

- **Loss of centring translations** none
- **Enlarged unit cell** none

(*Continued on the preceding page*)

- **Series of maximal isomorphic subgroups**

[p^3] $\mathbf{a}' = p\mathbf{a},\ \mathbf{b}' = p\mathbf{b},\ \mathbf{c}' = p\mathbf{c}$

$Fd\bar{3}c$ (228)	$\langle 2+(\frac{1}{2}+2u,\frac{p}{2}+2v,\frac{p}{2}-\frac{1}{2});\ 3+(\frac{p}{2}+2u,\frac{p}{2}-\frac{1}{2},\frac{1}{2}+2w);$ $5+(u-w,-u+v,-v+w);$ $13+(\frac{3p}{4}-\frac{3}{4}+u-v,\frac{p}{4}-\frac{1}{4}-u+v,\frac{3p}{4}-\frac{1}{4}+2w);$ $25+(\frac{3p}{4}-\frac{1}{4}+2u,\frac{3p}{4}-\frac{1}{4}+2v,\frac{3p}{4}-\frac{1}{4}+2w)\rangle$ $p>2;\ 0\le u<p;\ 0\le v<p;\ 0\le w<p$ p^3 conjugate subgroups for prime $p\equiv 3\ (\mathrm{mod}\ 4)$	$p\mathbf{a}, p\mathbf{b}, p\mathbf{c}$	$1/4+u, 1/4+v, 1/4+w$
$Fd\bar{3}c$ (228)	$\langle 2+(2u,\frac{p}{2}-\frac{1}{2}+2v,\frac{p}{2}-\frac{1}{2});\ 3+(\frac{p}{2}-\frac{1}{2}+2u,\frac{p}{2}-\frac{1}{2},2w);$ $5+(u-w,-u+v,-v+w);$ $13+(\frac{3p}{4}-\frac{3}{4}+u-v,\frac{p}{4}-\frac{1}{4}-u+v,\frac{3p}{4}-\frac{3}{4}+2w);$ $25+(\frac{3p}{4}-\frac{3}{4}+2u,\frac{3p}{4}-\frac{3}{4}+2v,\frac{3p}{4}-\frac{3}{4}+2w)\rangle$ $p>4;\ 0\le u<p;\ 0\le v<p;\ 0\le w<p$ p^3 conjugate subgroups for prime $p\equiv 1\ (\mathrm{mod}\ 4)$	$p\mathbf{a}, p\mathbf{b}, p\mathbf{c}$	u, v, w

I Minimal *translationengleiche* supergroups none

II Minimal non-isomorphic *klassengleiche* supergroups

- **Additional centring translations** none

- **Decreased unit cell**

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

(*Continued from the following page*) No. 228 ORIGIN CHOICE 2 $Fd\bar{3}c$

- **Series of maximal isomorphic subgroups**

[p^3] $\mathbf{a}' = p\mathbf{a},\ \mathbf{b}' = p\mathbf{b},\ \mathbf{c}' = p\mathbf{c}$

$Fd\bar{3}c$ (228)	$\langle 2+(\frac{p}{4}-\frac{1}{4}+2u,\frac{3p}{4}-\frac{3}{4}+2v,\frac{p}{2}-\frac{1}{2});$ $3+(\frac{3p}{4}-\frac{3}{4}+2u,\frac{p}{2}-\frac{1}{2},\frac{p}{4}-\frac{1}{4}+2w);$ $5+(u-w,-u+v,-v+w);$ $13+(\frac{3p}{4}-\frac{3}{4}+u-v,\frac{p}{4}-\frac{1}{4}-u+v,2w);\ 25+(2u,2v,2w)\rangle$ $p>2;\ 0\le u<p;\ 0\le v<p;\ 0\le w<p$ p^3 conjugate subgroups for the prime p	$p\mathbf{a}, p\mathbf{b}, p\mathbf{c}$	u, v, w

I Minimal *translationengleiche* supergroups none

II Minimal non-isomorphic *klassengleiche* supergroups

- **Additional centring translations** none

- **Decreased unit cell**

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