

$P6/mcc$

D_{6h}^2

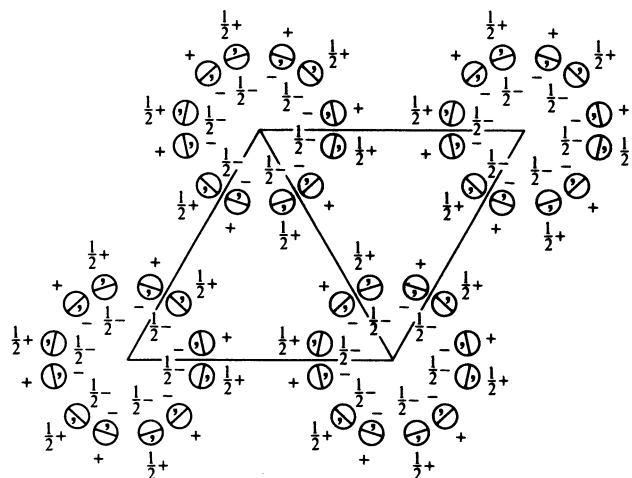
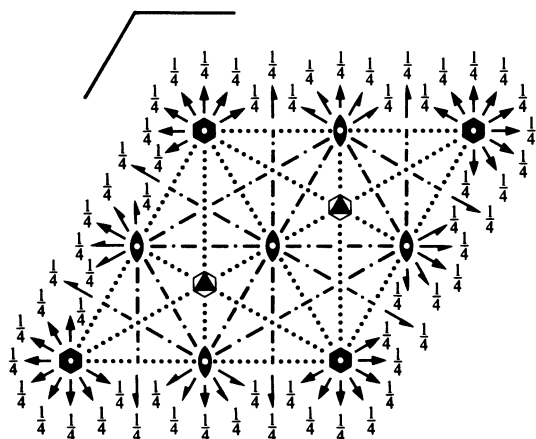
$6/mmm$

Hexagonal

No. 192

$P 6/m 2/c 2/c$

Patterson symmetry $P6/mmm$



Origin at centre ($6/m$) at $6/mcc$

Asymmetric unit $0 \leq x \leq \frac{2}{3}; 0 \leq y \leq \frac{1}{3}; 0 \leq z \leq \frac{1}{4}; x \leq (1+y)/2; y \leq \min(1-x, x)$
Vertices $0, 0, 0$ $\frac{1}{2}, 0, 0$ $\frac{2}{3}, \frac{1}{3}, 0$ $\frac{1}{2}, \frac{1}{2}, 0$
 $0, 0, \frac{1}{4}$ $\frac{1}{2}, 0, \frac{1}{4}$ $\frac{2}{3}, \frac{1}{3}, \frac{1}{4}$ $\frac{1}{2}, \frac{1}{2}, \frac{1}{4}$

Symmetry operations

- | | | |
|----------------------------------|-----------------------------------|-----------------------------------|
| (1) 1 | (2) $3^+ 0, 0, z$ | (3) $3^- 0, 0, z$ |
| (4) 2 $0, 0, z$ | (5) $6^- 0, 0, z$ | (6) $6^+ 0, 0, z$ |
| (7) 2 $x, x, \frac{1}{4}$ | (8) 2 $x, 0, \frac{1}{4}$ | (9) 2 $0, y, \frac{1}{4}$ |
| (10) 2 $x, \bar{x}, \frac{1}{4}$ | (11) 2 $x, 2x, \frac{1}{4}$ | (12) 2 $2x, x, \frac{1}{4}$ |
| (13) $\bar{1} 0, 0, 0$ | (14) $\bar{3}^+ 0, 0, z; 0, 0, 0$ | (15) $\bar{3}^- 0, 0, z; 0, 0, 0$ |
| (16) $m x, y, 0$ | (17) $\bar{6}^- 0, 0, z; 0, 0, 0$ | (18) $\bar{6}^+ 0, 0, z; 0, 0, 0$ |
| (19) $c x, \bar{x}, z$ | (20) $c x, 2x, z$ | (21) $c 2x, x, z$ |
| (22) $c x, x, z$ | (23) $c x, 0, z$ | (24) $c 0, y, z$ |

Maximal non-isomorphic subgroups

- I** [2] $P\bar{6}2c$ (190) 1; 2; 3; 7; 8; 9; 16; 17; 18; 22; 23; 24
 [2] $P\bar{6}c2$ (188) 1; 2; 3; 10; 11; 12; 16; 17; 18; 19; 20; 21
 [2] $P6cc$ (184) 1; 2; 3; 4; 5; 6; 19; 20; 21; 22; 23; 24
 [2] $P622$ (177) 1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12
 [2] $P6/m11$ ($P6/m$, 175) 1; 2; 3; 4; 5; 6; 13; 14; 15; 16; 17; 18
 [2] $P\bar{3}c1$ (165) 1; 2; 3; 7; 8; 9; 13; 14; 15; 19; 20; 21
 [2] $P\bar{3}1c$ (163) 1; 2; 3; 10; 11; 12; 13; 14; 15; 22; 23; 24
 { [3] $Pmcc$ ($Cccm$, 66) 1; 4; 7; 10; 13; 16; 19; 22
 [3] $Pmcc$ ($Cccm$, 66) 1; 4; 8; 11; 13; 16; 20; 23
 [3] $Pmcc$ ($Cccm$, 66) 1; 4; 9; 12; 13; 16; 21; 24

IIa none

IIb none

Maximal isomorphic subgroups of lowest index

IIc [3] $P6/mcc$ ($c' = 3c$) (192); [3] $H6/mcc$ ($a' = 3a, b' = 3b$) ($P6/mcc$, 192)

Minimal non-isomorphic supergroups

I none

II [2] $P6/mmm$ ($c' = \frac{1}{2}c$) (191)

Generators selected (1); $t(1,0,0)$; $t(0,1,0)$; $t(0,0,1)$; (2); (4); (7); (13)

Positions

Multiplicity,
Wyckoff letter,
Site symmetry

Coordinates

Reflection conditions

24	<i>m</i>	1	(1) x, y, z	(2) $\bar{y}, x - y, z$	(3) $\bar{x} + y, \bar{x}, z$	<i>hh2hl</i> : $l = 2n$ <i>hhl0l</i> : $l = 2n$ <i>000l</i> : $l = 2n$
			(4) \bar{x}, \bar{y}, z	(5) $y, \bar{x} + y, z$	(6) $x - y, x, z$	
			(7) $y, x, \bar{z} + \frac{1}{2}$	(8) $x - y, \bar{y}, \bar{z} + \frac{1}{2}$	(9) $\bar{x}, \bar{x} + y, \bar{z} + \frac{1}{2}$	
			(10) $\bar{y}, \bar{x}, \bar{z} + \frac{1}{2}$	(11) $\bar{x} + y, y, \bar{z} + \frac{1}{2}$	(12) $x, x - y, \bar{z} + \frac{1}{2}$	
			(13) $\bar{x}, \bar{y}, \bar{z}$	(14) $y, \bar{x} + y, \bar{z}$	(15) $x - y, x, \bar{z}$	
			(16) x, y, \bar{z}	(17) $\bar{y}, x - y, \bar{z}$	(18) $\bar{x} + y, \bar{x}, \bar{z}$	
			(19) $\bar{y}, \bar{x}, z + \frac{1}{2}$	(20) $\bar{x} + y, y, z + \frac{1}{2}$	(21) $x, x - y, z + \frac{1}{2}$	
			(22) $y, x, z + \frac{1}{2}$	(23) $x - y, \bar{y}, z + \frac{1}{2}$	(24) $\bar{x}, \bar{x} + y, z + \frac{1}{2}$	

General:

Special: as above, plus

12	<i>l</i>	<i>m</i> ..	$x, y, 0$ $y, x, \frac{1}{2}$	$\bar{y}, x - y, 0$ $x - y, \bar{y}, \frac{1}{2}$	$\bar{x} + y, \bar{x}, 0$ $\bar{x}, \bar{x} + y, \frac{1}{2}$	$\bar{x}, \bar{y}, 0$ $\bar{y}, \bar{x}, \frac{1}{2}$	$y, \bar{x} + y, 0$ $\bar{x} + y, y, \frac{1}{2}$	$x - y, x, 0$ $x, x - y, \frac{1}{2}$	no extra conditions
12	<i>k</i>	..2	$x, 2x, \frac{1}{4}$ $\bar{x}, 2\bar{x}, \frac{3}{4}$	$2\bar{x}, \bar{x}, \frac{1}{4}$ $2x, x, \frac{3}{4}$	$x, \bar{x}, \frac{1}{4}$ $\bar{x}, x, \frac{3}{4}$	$\bar{x}, 2\bar{x}, \frac{1}{4}$ $x, 2x, \frac{3}{4}$	$2x, x, \frac{1}{4}$ $2\bar{x}, \bar{x}, \frac{3}{4}$	$\bar{x}, x, \frac{1}{4}$ $x, \bar{x}, \frac{3}{4}$	<i>hkil</i> : $l = 2n$
12	<i>j</i>	.2.	$x, 0, \frac{1}{4}$ $\bar{x}, 0, \frac{3}{4}$	$0, x, \frac{1}{4}$ $0, \bar{x}, \frac{3}{4}$	$\bar{x}, \bar{x}, \frac{1}{4}$ $x, x, \frac{3}{4}$	$\bar{x}, 0, \frac{1}{4}$ $x, 0, \frac{3}{4}$	$0, \bar{x}, \frac{1}{4}$ $0, x, \frac{3}{4}$	$x, x, \frac{1}{4}$ $\bar{x}, \bar{x}, \frac{3}{4}$	<i>hkil</i> : $l = 2n$
12	<i>i</i>	2..	$\frac{1}{2}, 0, z$ $\frac{1}{2}, 0, \bar{z}$	$0, \frac{1}{2}, z$ $0, \frac{1}{2}, \bar{z}$	$\frac{1}{2}, \frac{1}{2}, z$ $\frac{1}{2}, \frac{1}{2}, \bar{z}$	$0, \frac{1}{2}, \bar{z} + \frac{1}{2}$ $0, \frac{1}{2}, z + \frac{1}{2}$	$\frac{1}{2}, 0, \bar{z} + \frac{1}{2}$ $\frac{1}{2}, 0, z + \frac{1}{2}$	$\frac{1}{2}, \frac{1}{2}, \bar{z} + \frac{1}{2}$ $\frac{1}{2}, \frac{1}{2}, z + \frac{1}{2}$	<i>hkil</i> : $l = 2n$
8	<i>h</i>	3..	$\frac{1}{3}, \frac{2}{3}, z$ $\frac{2}{3}, \frac{1}{3}, \bar{z}$	$\frac{2}{3}, \frac{1}{3}, z$ $\frac{1}{3}, \frac{2}{3}, \bar{z}$	$\frac{2}{3}, \frac{1}{3}, \bar{z} + \frac{1}{2}$ $\frac{1}{3}, \frac{2}{3}, z + \frac{1}{2}$	$\frac{1}{3}, \frac{2}{3}, \bar{z} + \frac{1}{2}$ $\frac{2}{3}, \frac{1}{3}, z + \frac{1}{2}$			<i>hkil</i> : $l = 2n$
6	<i>g</i>	2/ <i>m</i> ..	$\frac{1}{2}, 0, 0$	$0, \frac{1}{2}, 0$	$\frac{1}{2}, \frac{1}{2}, 0$	$0, \frac{1}{2}, \frac{1}{2}$	$\frac{1}{2}, 0, \frac{1}{2}$	$\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$	<i>hkil</i> : $l = 2n$
6	<i>f</i>	222	$\frac{1}{2}, 0, \frac{1}{4}$	$0, \frac{1}{2}, \frac{1}{4}$	$\frac{1}{2}, \frac{1}{2}, \frac{1}{4}$	$\frac{1}{2}, 0, \frac{3}{4}$	$0, \frac{1}{2}, \frac{3}{4}$	$\frac{1}{2}, \frac{1}{2}, \frac{3}{4}$	<i>hkil</i> : $l = 2n$
4	<i>e</i>	6..	$0, 0, z$	$0, 0, \bar{z} + \frac{1}{2}$	$0, 0, \bar{z}$	$0, 0, z + \frac{1}{2}$			<i>hkil</i> : $l = 2n$
4	<i>d</i>	$\bar{6}$..	$\frac{1}{3}, \frac{2}{3}, 0$	$\frac{2}{3}, \frac{1}{3}, 0$	$\frac{2}{3}, \frac{1}{3}, \frac{1}{2}$	$\frac{1}{3}, \frac{2}{3}, \frac{1}{2}$			<i>hkil</i> : $l = 2n$
4	<i>c</i>	3.2	$\frac{1}{3}, \frac{2}{3}, \frac{1}{4}$	$\frac{2}{3}, \frac{1}{3}, \frac{1}{4}$	$\frac{2}{3}, \frac{1}{3}, \frac{3}{4}$	$\frac{1}{3}, \frac{2}{3}, \frac{3}{4}$			<i>hkil</i> : $l = 2n$
2	<i>b</i>	6/ <i>m</i> ..	$0, 0, 0$	$0, 0, \frac{1}{2}$					<i>hkil</i> : $l = 2n$
2	<i>a</i>	622	$0, 0, \frac{1}{4}$	$0, 0, \frac{3}{4}$					<i>hkil</i> : $l = 2n$

Symmetry of special projections

Along [001] *p6mm*

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

Origin at 0, 0, z

Along [100] *p2mm*

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

Origin at x, 0, 0

Along [210] *p2mm*

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

Origin at $x, \frac{1}{2}x, 0$

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