

# MSG No. 217.78 $I\bar{4}3m$ [ Type I, cubic ]

Table 1: Wyckoff site: 2a, site symmetry:  $\bar{4}3m$

No.	position	mapping
1	$[0, 0, 0]$	$[1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24]$
2	$[\frac{1}{2}, \frac{1}{2}, \frac{1}{2}]$	$[25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48]$

Table 2: Wyckoff site: 6b, site symmetry:  $\bar{4}2.m$

No.	position	mapping
1	$[0, \frac{1}{2}, \frac{1}{2}]$	$[1, 2, 3, 4, 13, 14, 21, 22]$
2	$[\frac{1}{2}, 0, \frac{1}{2}]$	$[5, 8, 10, 12, 17, 18, 19, 20]$
3	$[\frac{1}{2}, \frac{1}{2}, 0]$	$[6, 7, 9, 11, 15, 16, 23, 24]$
4	$[\frac{1}{2}, 0, 0]$	$[25, 26, 27, 28, 37, 38, 45, 46]$
5	$[0, \frac{1}{2}, 0]$	$[29, 32, 34, 36, 41, 42, 43, 44]$
6	$[0, 0, \frac{1}{2}]$	$[30, 31, 33, 35, 39, 40, 47, 48]$

Table 3: Wyckoff site: 8c, site symmetry:  $\bar{3}m$

No.	position	mapping
1	$[x, x, x]$	$[1, 5, 6, 20, 22, 24]$
2	$[x, -x, -x]$	$[2, 10, 11, 16, 17, 21]$
3	$[-x, x, -x]$	$[3, 7, 12, 13, 18, 23]$
4	$[-x, -x, x]$	$[4, 8, 9, 14, 15, 19]$
5	$[x + \frac{1}{2}, x + \frac{1}{2}, x + \frac{1}{2}]$	$[25, 29, 30, 44, 46, 48]$
6	$[x + \frac{1}{2}, \frac{1}{2} - x, \frac{1}{2} - x]$	$[26, 34, 35, 40, 41, 45]$
7	$[\frac{1}{2} - x, x + \frac{1}{2}, \frac{1}{2} - x]$	$[27, 31, 36, 37, 42, 47]$
8	$[\frac{1}{2} - x, \frac{1}{2} - x, x + \frac{1}{2}]$	$[28, 32, 33, 38, 39, 43]$

Table 4: Wyckoff site: 12d, site symmetry:  $\bar{4}. .$

No.	position	mapping
1	$[\frac{1}{4}, \frac{1}{2}, 0]$	$[1, 2, 37, 38]$
2	$[\frac{3}{4}, \frac{1}{2}, 0]$	$[3, 4, 45, 46]$
3	$[0, \frac{1}{4}, \frac{1}{2}]$	$[5, 12, 41, 43]$
4	$[\frac{1}{2}, 0, \frac{1}{4}]$	$[6, 9, 40, 47]$
5	$[\frac{1}{2}, 0, \frac{3}{4}]$	$[7, 11, 39, 48]$
6	$[0, \frac{3}{4}, \frac{1}{2}]$	$[8, 10, 42, 44]$
7	$[\frac{3}{4}, 0, \frac{1}{2}]$	$[13, 14, 25, 26]$
8	$[0, \frac{1}{2}, \frac{1}{4}]$	$[15, 24, 31, 35]$
9	$[0, \frac{1}{2}, \frac{3}{4}]$	$[16, 23, 30, 33]$

*continued ...*

Table 4

No.	position	mapping
10	$[\frac{1}{2}, \frac{3}{4}, 0]$	$[17, 19, 29, 36]$
11	$[\frac{1}{2}, \frac{1}{4}, 0]$	$[18, 20, 32, 34]$
12	$[\frac{1}{4}, 0, \frac{1}{2}]$	$[21, 22, 27, 28]$

Table 5: Wyckoff site: **12e**, site symmetry: **2.mm**

No.	position	mapping
1	$[x, 0, 0]$	$[1, 2, 21, 22]$
2	$[-x, 0, 0]$	$[3, 4, 13, 14]$
3	$[0, x, 0]$	$[5, 12, 18, 20]$
4	$[0, 0, x]$	$[6, 9, 15, 24]$
5	$[0, 0, -x]$	$[7, 11, 16, 23]$
6	$[0, -x, 0]$	$[8, 10, 17, 19]$
7	$[x + \frac{1}{2}, \frac{1}{2}, \frac{1}{2}]$	$[25, 26, 45, 46]$
8	$[\frac{1}{2} - x, \frac{1}{2}, \frac{1}{2}]$	$[27, 28, 37, 38]$
9	$[\frac{1}{2}, x + \frac{1}{2}, \frac{1}{2}]$	$[29, 36, 42, 44]$
10	$[\frac{1}{2}, \frac{1}{2}, x + \frac{1}{2}]$	$[30, 33, 39, 48]$
11	$[\frac{1}{2}, \frac{1}{2}, \frac{1}{2} - x]$	$[31, 35, 40, 47]$
12	$[\frac{1}{2}, \frac{1}{2} - x, \frac{1}{2}]$	$[32, 34, 41, 43]$

Table 6: Wyckoff site: **24f**, site symmetry: **2..**

No.	position	mapping
1	$[x, \frac{1}{2}, 0]$	$[1, 2]$
2	$[-x, \frac{1}{2}, 0]$	$[3, 4]$
3	$[0, x, \frac{1}{2}]$	$[5, 12]$
4	$[\frac{1}{2}, 0, x]$	$[6, 9]$
5	$[\frac{1}{2}, 0, -x]$	$[7, 11]$
6	$[0, -x, \frac{1}{2}]$	$[8, 10]$
7	$[-x, 0, \frac{1}{2}]$	$[13, 14]$
8	$[0, \frac{1}{2}, x]$	$[15, 24]$
9	$[0, \frac{1}{2}, -x]$	$[16, 23]$
10	$[\frac{1}{2}, -x, 0]$	$[17, 19]$
11	$[\frac{1}{2}, x, 0]$	$[18, 20]$
12	$[x, 0, \frac{1}{2}]$	$[21, 22]$
13	$[x + \frac{1}{2}, 0, \frac{1}{2}]$	$[25, 26]$
14	$[\frac{1}{2} - x, 0, \frac{1}{2}]$	$[27, 28]$
15	$[\frac{1}{2}, x + \frac{1}{2}, 0]$	$[29, 36]$
16	$[0, \frac{1}{2}, x + \frac{1}{2}]$	$[30, 33]$
17	$[0, \frac{1}{2}, \frac{1}{2} - x]$	$[31, 35]$
18	$[\frac{1}{2}, \frac{1}{2} - x, 0]$	$[32, 34]$
19	$[\frac{1}{2} - x, \frac{1}{2}, 0]$	$[37, 38]$

*continued ...*

Table 6

No.	position	mapping
20	$[\frac{1}{2}, 0, x + \frac{1}{2}]$	[39, 48]
21	$[\frac{1}{2}, 0, \frac{1}{2} - x]$	[40, 47]
22	$[0, \frac{1}{2} - x, \frac{1}{2}]$	[41, 43]
23	$[0, x + \frac{1}{2}, \frac{1}{2}]$	[42, 44]
24	$[x + \frac{1}{2}, \frac{1}{2}, 0]$	[45, 46]

Table 7: Wyckoff site: **24g**, site symmetry:  $\bar{3}m$ 

No.	position	mapping
1	$[x, x, z]$	[1, 20]
2	$[x, -x, -z]$	[2, 17]
3	$[-x, x, -z]$	[3, 18]
4	$[-x, -x, z]$	[4, 19]
5	$[z, x, x]$	[5, 24]
6	$[x, z, x]$	[6, 22]
7	$[-x, z, -x]$	[7, 13]
8	$[-z, -x, x]$	[8, 15]
9	$[-x, -z, x]$	[9, 14]
10	$[z, -x, -x]$	[10, 16]
11	$[x, -z, -x]$	[11, 21]
12	$[-z, x, -x]$	[12, 23]
13	$[x + \frac{1}{2}, x + \frac{1}{2}, z + \frac{1}{2}]$	[25, 44]
14	$[x + \frac{1}{2}, \frac{1}{2} - x, \frac{1}{2} - z]$	[26, 41]
15	$[\frac{1}{2} - x, x + \frac{1}{2}, \frac{1}{2} - z]$	[27, 42]
16	$[\frac{1}{2} - x, \frac{1}{2} - x, z + \frac{1}{2}]$	[28, 43]
17	$[z + \frac{1}{2}, x + \frac{1}{2}, x + \frac{1}{2}]$	[29, 48]
18	$[x + \frac{1}{2}, z + \frac{1}{2}, x + \frac{1}{2}]$	[30, 46]
19	$[\frac{1}{2} - x, z + \frac{1}{2}, \frac{1}{2} - x]$	[31, 37]
20	$[\frac{1}{2} - z, \frac{1}{2} - x, x + \frac{1}{2}]$	[32, 39]
21	$[\frac{1}{2} - x, \frac{1}{2} - z, x + \frac{1}{2}]$	[33, 38]
22	$[z + \frac{1}{2}, \frac{1}{2} - x, \frac{1}{2} - x]$	[34, 40]
23	$[x + \frac{1}{2}, \frac{1}{2} - z, \frac{1}{2} - x]$	[35, 45]
24	$[\frac{1}{2} - z, x + \frac{1}{2}, \frac{1}{2} - x]$	[36, 47]

Table 8: Wyckoff site: **48h**, site symmetry:  $\bar{1}$ 

No.	position	mapping
1	$[x, y, z]$	[1]
2	$[x, -y, -z]$	[2]
3	$[-x, y, -z]$	[3]
4	$[-x, -y, z]$	[4]
5	$[z, x, y]$	[5]

*continued ...*

Table 8

No.	position	mapping
6	$[y, z, x]$	[6]
7	$[-y, z, -x]$	[7]
8	$[-z, -x, y]$	[8]
9	$[-y, -z, x]$	[9]
10	$[z, -x, -y]$	[10]
11	$[y, -z, -x]$	[11]
12	$[-z, x, -y]$	[12]
13	$[-x, z, -y]$	[13]
14	$[-x, -z, y]$	[14]
15	$[-z, -y, x]$	[15]
16	$[z, -y, -x]$	[16]
17	$[y, -x, -z]$	[17]
18	$[-y, x, -z]$	[18]
19	$[-y, -x, z]$	[19]
20	$[y, x, z]$	[20]
21	$[x, -z, -y]$	[21]
22	$[x, z, y]$	[22]
23	$[-z, y, -x]$	[23]
24	$[z, y, x]$	[24]
25	$[x + \frac{1}{2}, y + \frac{1}{2}, z + \frac{1}{2}]$	[25]
26	$[x + \frac{1}{2}, \frac{1}{2} - y, \frac{1}{2} - z]$	[26]
27	$[\frac{1}{2} - x, y + \frac{1}{2}, \frac{1}{2} - z]$	[27]
28	$[\frac{1}{2} - x, \frac{1}{2} - y, z + \frac{1}{2}]$	[28]
29	$[z + \frac{1}{2}, x + \frac{1}{2}, y + \frac{1}{2}]$	[29]
30	$[y + \frac{1}{2}, z + \frac{1}{2}, x + \frac{1}{2}]$	[30]
31	$[\frac{1}{2} - y, z + \frac{1}{2}, \frac{1}{2} - x]$	[31]
32	$[\frac{1}{2} - z, \frac{1}{2} - x, y + \frac{1}{2}]$	[32]
33	$[\frac{1}{2} - y, \frac{1}{2} - z, x + \frac{1}{2}]$	[33]
34	$[z + \frac{1}{2}, \frac{1}{2} - x, \frac{1}{2} - y]$	[34]
35	$[y + \frac{1}{2}, \frac{1}{2} - z, \frac{1}{2} - x]$	[35]
36	$[\frac{1}{2} - z, x + \frac{1}{2}, \frac{1}{2} - y]$	[36]
37	$[\frac{1}{2} - x, z + \frac{1}{2}, \frac{1}{2} - y]$	[37]
38	$[\frac{1}{2} - x, \frac{1}{2} - z, y + \frac{1}{2}]$	[38]
39	$[\frac{1}{2} - z, \frac{1}{2} - y, x + \frac{1}{2}]$	[39]
40	$[z + \frac{1}{2}, \frac{1}{2} - y, \frac{1}{2} - x]$	[40]
41	$[y + \frac{1}{2}, \frac{1}{2} - x, \frac{1}{2} - z]$	[41]
42	$[\frac{1}{2} - y, x + \frac{1}{2}, \frac{1}{2} - z]$	[42]
43	$[\frac{1}{2} - y, \frac{1}{2} - x, z + \frac{1}{2}]$	[43]
44	$[y + \frac{1}{2}, x + \frac{1}{2}, z + \frac{1}{2}]$	[44]
45	$[x + \frac{1}{2}, \frac{1}{2} - z, \frac{1}{2} - y]$	[45]
46	$[x + \frac{1}{2}, z + \frac{1}{2}, y + \frac{1}{2}]$	[46]
47	$[\frac{1}{2} - z, y + \frac{1}{2}, \frac{1}{2} - x]$	[47]
48	$[z + \frac{1}{2}, y + \frac{1}{2}, x + \frac{1}{2}]$	[48]