

3.3. SPACE-GROUP SYMBOLS AND THEIR USE

Table 3.3.3.1
Standard space-group symbols

No.	Schoenflies symbol	Shubnikov symbol	Symbols of <i>International Tables</i>				Comments†
			1935 Edition		Present Edition		
			Short	Full	Short	Full	
1	C_1^1	$(a/b/c) \cdot 1$	$P1$	$P1$	$P1$	$P1$	
2	C_1^i	$(a/b/c) \cdot \bar{2}$	$P\bar{1}$	$P\bar{1}$	$P\bar{1}$	$P\bar{1}$	$(a/b/c) \cdot \bar{1}$ (Sh–K)
3	C_2^1	$(b:(c/a)):2$	$P2$	$P2$	$P2$	$P121$	
4	C_2^2	$(c:(a/b)):2$				$P112$	
		$(b:(c/a)):2_1$	$P2_1$	$P2_1$	$P2_1$	$P12_11$	
		$(c:(a/b)):2_1$				$P112_1$	
5	C_2^3	$\left(\frac{a+b}{2} / b:(c/a)\right):2$	$C2$	$C2$	$C2$	$C121$	$B2, B112$ (IT, 1952)
		$\left(\frac{b+c}{2} / c:(b/a)\right):2$				$A112$	$\left(\frac{a+c}{2} / c:(a/b)\right):2$ (Sh–K)
6	C_2^1	$(b:(c/a)) \cdot m$	Pm	Pm	Pm	$P1m1$	
		$(c:(a/b)) \cdot m$				$P11m$	
7	C_2^2	$(b:(c/a)) \cdot \tilde{c}$	Pc	Pc	Pc	$P1c1$	$Pb, P11b$ (IT, 1952)
		$(c:(b/a)) \cdot \tilde{a}$				$P11a$	$(c:(a/b)) \cdot \tilde{b}$ (Sh–K)
8	C_2^3	$\left(\frac{a+b}{2} / b:(c/a)\right) \cdot m$	Cm	Cm	Cm	$C1m1$	$Bm, B11m$ (IT, 1952)
		$\left(\frac{b+c}{2} / c:(b/a)\right) \cdot m$				$A11m$	$\left(\frac{a+c}{2} / c:(a/b)\right) \cdot m$ (Sh–K)
9	C_2^4	$\left(\frac{a+b}{2} / b:(c/a)\right) \cdot \tilde{c}$	Cc	Cc	Cc	$C1c1$	$Bb, B11b$ (IT, 1952)
		$\left(\frac{b+c}{2} / c:(b/a)\right) \cdot \tilde{a}$				$A11a$	$\left(\frac{a+c}{2} / c:(a/b)\right) \cdot \tilde{b}$ (Sh–K)
10	C_{2h}^1	$(b:(c/a)) \cdot m:2$	$P2/m$	$P2/m$	$P2/m$	$P1\ 2/m1$	
		$(c:(a/b)) \cdot m:2$				$P11\ 2/m$	
11	C_{2h}^2	$(b:(c/a)) \cdot m:2_1$	$P2_1/m$	$P2_1/m$	$P2_1/m$	$P1\ 2_1/m\ 1$	
		$(c:(a/b)) \cdot m:2_1$				$P11\ 2_1/m$	
12	C_{2h}^3	$\left(\frac{a+b}{2} / b:(c/a)\right) \cdot m:2$	$C2/m$	$C2/m$	$C2/m$	$C1\ 2/m\ 1$	$B2/m, B11\ 2/m$ (IT, 1952)
		$\left(\frac{b+c}{2} / c:(b/a)\right) \cdot m:2$				$A11\ 2/m$	$\left(\frac{a+c}{2} / c:(a/b)\right) \cdot m:2$ (Sh–K)
13	C_{2h}^4	$(b:(c/a)) \cdot \tilde{c}:2$	$P2/c$	$P2/c$	$P2/c$	$P1\ 2/c\ 1$	$P2/b, P11\ 2/b$ (IT, 1952)
		$(c:(a/b)) \cdot \tilde{a}:2$				$P11\ 2/a$	$(c:(a/b)) \cdot \tilde{b}:2$ (Sh–K)
14	C_{2h}^5	$(b:(c/a)) \cdot \tilde{c}:2_1$	$P2_1/c$	$P2_1/c$	$P2_1/c$	$P1\ 2_1/c\ 1$	$P2_1/b, P112_1/b$ (IT, 1952)
		$(c:(a/b)) \cdot \tilde{a}:2_1$				$P11\ 2_1/a$	$(c:(a/b)) \cdot b:2_1$ (Sh–K)
15	C_{2h}^6	$\left(\frac{a+b}{2} / b:(c/a)\right) \cdot \tilde{c}:2$	$C2/c$	$C2/c$	$C2/c$	$C1\ 2/c\ 1$	$B2/b, B11\ 2/b$ (IT, 1952)
		$\left(\frac{b+c}{2} / c:(b/a)\right) \cdot \tilde{a}:2$				$A11\ 2a$	$\left(\frac{a+c}{2} / c:(a/b)\right) \cdot \tilde{b}:2$ (Sh–K)
16	D_2^1	$(c:(a:b)):2:2$	$P222$	$P222$	$P222$	$P222$	
17	D_2^2	$(c:(a:b)):2_1:2$	$P222_1$	$P222_1$	$P222_1$	$P222_1$	
18	D_2^3	$(c:(a:b)):2 \odot 2_1$	$P2_12_12$	$P2_12_12$	$P2_12_12$	$P2_12_12$	
19	D_2^4	$(c:(a:b)):2_1 \odot 2_1$	$P2_12_12_1$	$P2_12_12_1$	$P2_12_12_1$	$P2_12_12_1$	
20	D_2^5	$\left(\frac{a+b}{2} : c:(a:b)\right):2_1:2$	$C222_1$	$C222_1$	$C222_1$	$C222_1$	
21	D_2^6	$\left(\frac{a+b}{2} : c:(a:b)\right):2:2$	$C222$	$C222$	$C222$	$C222$	
22	D_2^7	$\left(\frac{a+c}{2} / \frac{b+c}{2} / \frac{a+b}{2} : c:(a:b)\right):2:2$	$F222$	$F222$	$F222$	$F222$	
23	D_2^8	$\left(\frac{a+b+c}{2} / c:(a:b)\right):2:2$	$I222$	$I222$	$I222$	$I222$	
24	D_2^9	$\left(\frac{a+b+c}{2} / c:(a:b)\right):2:2_1$	$I2_12_12_1$	$I2_12_12_1$	$I2_12_12_1$	$I2_12_12_1$	
25	C_{2v}^1	$(c:(a:b)):m \cdot 2$	Pmm	$Pmm2$	$Pmm2$	$Pmm2$	
26	C_{2v}^2	$(c:(a:b)) \cdot \tilde{c} \cdot 2_1$	Pmc	$Pmc2_1$	$Pmc2_1$	$Pmc2_1$	
27	C_{2v}^3	$(c:(a:b)) \cdot \tilde{c} \cdot 2$	Pcc	$Pcc2$	$Pcc2$	$Pcc2$	

3. ADVANCED TOPICS ON SPACE-GROUP SYMMETRY

Table 3.3.3.1 (continued)

No.	Schoenflies symbol	Shubnikov symbol	Symbols of <i>International Tables</i>				Comments†
			1935 Edition		Present Edition		
			Short	Full	Short	Full	
28	C_{2v}^4	$(c:(a:b)):\tilde{a} \cdot 2$	<i>Pma</i>	<i>Pma2</i>	<i>Pma2</i>	<i>Pma2</i>	$(c:(a:b)):\tilde{a}\tilde{c} \cdot 2$ (Sh-K)
29	C_{2v}^5	$(c:(a:b)):\tilde{a} \cdot 2_1$	<i>Pca</i>	<i>Pca2_1</i>	<i>Pca2_1</i>	<i>Pca2_1</i>	
30	C_{2v}^6	$(c:(a:b)):\tilde{c} \odot 2$	<i>Pnc</i>	<i>Pnc2</i>	<i>Pnc2</i>	<i>Pnc2</i>	
31	C_{2v}^7	$(c:(a:b)):\tilde{a}\tilde{c} \cdot 2_1$	<i>Pmn</i>	<i>Pmn2_1</i>	<i>Pmn2_1</i>	<i>Pmn2_1</i>	
32	C_{2v}^8	$(c:(a:b)):\tilde{a} \odot 2$	<i>Pba</i>	<i>Pba2</i>	<i>Pba2</i>	<i>Pba2</i>	
33	C_{2v}^9	$(c:(a:b)):\tilde{a} \odot 2_1$	<i>Pna</i>	<i>Pna2_1</i>	<i>Pna2_1</i>	<i>Pna2_1</i>	
34	C_{2v}^{10}	$(c:(a:b)):\tilde{a}\tilde{c} \odot 2$	<i>Pnn</i>	<i>Pnn2</i>	<i>Pnn2</i>	<i>Pnn2</i>	
35	C_{2v}^{11}	$\left(\frac{a+b}{2}:c:(a:b)\right):m \cdot 2$	<i>Cmm</i>	<i>Cmm2</i>	<i>Cmm2</i>	<i>Cmm2</i>	
36	C_{2v}^{12}	$\left(\frac{a+b}{2}:c:(a:b)\right):\tilde{c} \cdot 2_1$	<i>Cmc</i>	<i>Cmc2_1</i>	<i>Cmc2_1</i>	<i>Cmc2_1</i>	
37	C_{2v}^{13}	$\left(\frac{a+b}{2}:c:(a:b)\right):\tilde{c} \cdot 2$	<i>Ccc</i>	<i>Ccc2</i>	<i>Ccc2</i>	<i>Ccc2</i>	
38	C_{2v}^{14}	$\left(\frac{b+c}{2}/c:(a:b)\right):m \cdot 2$	<i>Amm</i>	<i>Amm2</i>	<i>Amm2</i>	<i>Amm2</i>	$\left(\frac{b+c}{2}/c:(a:b)\right):\tilde{c} \cdot 2$ (Sh-K) Use former symbol <i>Abm2</i> for generation
39	C_{2v}^{15}	$\left(\frac{b+c}{2}/c:(a:b)\right):m \cdot 2_1$	<i>Abm</i>	<i>Abm2</i>	<i>Aem2</i>	<i>Aem2</i>	
40	C_{2v}^{16}	$\left(\frac{b+c}{2}/c:(a:b)\right):\tilde{a} \cdot 2$	<i>Ama</i>	<i>Ama2</i>	<i>Ama2</i>	<i>Ama2</i>	
41	C_{2v}^{17}	$\left(\frac{b+c}{2}/c:(a:b)\right):\tilde{a} \cdot 2_1$	<i>Aba</i>	<i>Aba2</i>	<i>Aea2</i>	<i>Aea2</i>	$\left(\frac{b+c}{2}/c:(a:b)\right):\tilde{a}\tilde{c} \cdot 2$ (Sh-K) Use former symbol <i>Aba2</i> for generation
42	C_{2v}^{18}	$\left(\frac{a+c}{2}/\frac{b+c}{2}/\frac{a+b}{2}:c:(a:b)\right):m \cdot 2$	<i>Fmm</i>	<i>Fmm2</i>	<i>Fmm2</i>	<i>Fmm2</i>	
43	C_{2v}^{19}	$\left(\frac{a+c}{2}/\frac{b+c}{2}/\frac{a+b}{2}:\tilde{c}:(a:b)\right):m \cdot 2$	<i>Fdd</i>	<i>Fdd2</i>	<i>Fdd2</i>	<i>Fdd2</i>	
44	C_{2v}^{20}	$\left(\frac{a+b+c}{2}/c:(a:b)\right):m \cdot 2$	<i>Imm</i>	<i>Imm2</i>	<i>Imm2</i>	<i>Imm2</i>	
45	C_{2v}^{21}	$\left(\frac{a+b+c}{2}/c:(a:b)\right):\tilde{c} \cdot 2$	<i>Iba</i>	<i>Iba2</i>	<i>Iba2</i>	<i>Iba2</i>	
46	C_{2v}^{22}	$\left(\frac{a+b+c}{2}/c:(a:b)\right):\tilde{a} \cdot 2$	<i>Ima</i>	<i>Ima2</i>	<i>Ima2</i>	<i>Ima2</i>	
47	D_{2h}^1	$(c:(a:b)) \cdot m:2 \cdot m$	<i>Pmmm</i>	<i>P2/m 2/m 2/m</i>	<i>Pmmm</i>	<i>P2/m 2/m 2/m</i>	
48	D_{2h}^2	$(c:(a:b)) \cdot \tilde{a}\tilde{b}:2 \odot \tilde{a}\tilde{c}$	<i>Pnnn</i>	<i>P2/n 2/n 2/n</i>	<i>Pnnn</i>	<i>P2/n 2/n 2/n</i>	
49	D_{2h}^3	$(c:(a:b)) \cdot m:2 \cdot \tilde{c}$	<i>Pccm</i>	<i>P2/c 2/c 2/m</i>	<i>Pccm</i>	<i>P2/c 2/c 2/m</i>	
50	D_{2h}^4	$(c:(a:b)) \cdot \tilde{a}\tilde{b}:2 \odot \tilde{a}$	<i>Pban</i>	<i>P2/b 2/a 2/n</i>	<i>Pban</i>	<i>P2/b 2/a 2/n</i>	
51	D_{2h}^5	$(c:(a:b)) \cdot \tilde{a}:2 \cdot m$	<i>Pmma</i>	<i>P2_1/m 2/m 2/a</i>	<i>Pmma</i>	<i>P2_1/m 2/m 2/a</i>	
52	D_{2h}^6	$(c:(a:b)) \cdot \tilde{a}:2 \odot \tilde{a}\tilde{c}$	<i>Pnna</i>	<i>P2/n 2_1/n 2/a</i>	<i>Pnna</i>	<i>P2/n 2_1/n 2/a</i>	
53	D_{2h}^7	$(c:(a:b)) \cdot \tilde{a}:2_1 \cdot \tilde{a}\tilde{c}$	<i>Pmna</i>	<i>P2/m 2/n 2_1/a</i>	<i>Pmna</i>	<i>P2/m 2/n 2_1/a</i>	
54	D_{2h}^8	$(c:(a:b)) \cdot \tilde{a}:2 \cdot \tilde{c}$	<i>Pcca</i>	<i>P2_1/c 2/c 2/a</i>	<i>Pcca</i>	<i>P2_1/c 2/c 2/a</i>	
55	D_{2h}^9	$(c:(a:b)) \cdot m:2 \odot \tilde{a}$	<i>Pbam</i>	<i>P2_1/b 2_1/a 2/m</i>	<i>Pbam</i>	<i>P2_1/b 2_1/a 2/m</i>	
56	D_{2h}^{10}	$(c:(a:b)) \cdot \tilde{a}\tilde{b}:2 \cdot \tilde{c}$	<i>Pccn</i>	<i>P2_1/c 2_1/c 2/n</i>	<i>Pccn</i>	<i>P2_1/c 2_1/c 2/n</i>	
57	D_{2h}^{11}	$(c:(a:b)) \cdot m:2_1 \odot \tilde{c}$	<i>Pbcm</i>	<i>P2/b 2_1/c 2_1/m</i>	<i>Pbcm</i>	<i>P2/b 2_1/c 2_1/m</i>	
58	D_{2h}^{12}	$(c:(a:b)) \cdot m:2 \odot \tilde{a}\tilde{c}$	<i>Pnmm</i>	<i>P2_1/n 2_1/n 2/m</i>	<i>Pnmm</i>	<i>P2_1/n 2_1/n 2/m</i>	
59	D_{2h}^{13}	$(c:(a:b)) \cdot \tilde{a}\tilde{b}:2 \cdot m$	<i>Pmnn</i>	<i>P2_1/m 2_1/m 2/n</i>	<i>Pmnn</i>	<i>P2_1/m 2_1/m 2/n</i>	
60	D_{2h}^{14}	$(c:(a:b)) \cdot \tilde{a}\tilde{b}:2_1 \odot \tilde{c}$	<i>Pbcn</i>	<i>P2_1/b 2/c 2_1/n</i>	<i>Pbcn</i>	<i>P2_1/b 2/c 2_1/n</i>	
61	D_{2h}^{15}	$(c:(a:b)) \cdot \tilde{a}:2_1 \odot \tilde{c}$	<i>Pbca</i>	<i>P2_1/b 2_1/c 2_1/a</i>	<i>Pbca</i>	<i>P2_1/b 2_1/c 2_1/a</i>	
62	D_{2h}^{16}	$(c:(a:b)) \cdot \tilde{a}:2_1 \odot m$	<i>Pnma</i>	<i>P2_1/n 2_1/m 2_1/a</i>	<i>Pnma</i>	<i>P2_1/n 2_1/m 2_1/a</i>	
63	D_{2h}^{17}	$\left(\frac{a+b}{2}:c:(a:b)\right):m:2_1 \cdot \tilde{c}$	<i>Cmcm</i>	<i>C2/m 2/c 2_1/m</i>	<i>Cmcm</i>	<i>C2/m 2/c 2_1/m</i>	
64	D_{2h}^{18}	$\left(\frac{a+b}{2}:c:(a:b)\right):\tilde{a}:2_1 \cdot \tilde{c}$	<i>Cmca</i>	<i>C2/m 2/c 2_1/a</i>	<i>Cmce</i>	<i>C2/m 2/c 2_1/e</i>	

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Table 3.3.3.1 (continued)

No.	Schoenflies symbol	Shubnikov symbol	Symbols of <i>International Tables</i>				Comments†
			1935 Edition		Present Edition		
			Short	Full	Short	Full	
65	D_{2h}^{19}	$\left(\frac{a+b}{2}:c:(a:b)\right) \cdot m:2 \cdot m$	<i>Cmmm</i>	<i>C2/m 2/m 2/m</i>	<i>Cmmm</i>	<i>C2/m 2/m 2/m</i>	Use former symbol <i>Cmma</i> for generation Use former symbol <i>Ccca</i> for generation
66	D_{2h}^{20}	$\left(\frac{a+b}{2}:c:(a:b)\right) \cdot m:2 \cdot \tilde{c}$	<i>Cccm</i>	<i>C2/c 2/c 2/m</i>	<i>Cccm</i>	<i>C2/c 2/c 2/m</i>	
67	D_{2h}^{21}	$\left(\frac{a+b}{2}:c:(a:b)\right) \cdot \tilde{a}:2 \cdot m$	<i>Cmma</i>	<i>C2/m 2/m 2/a</i>	<i>Cmme</i>	<i>C2/m 2/m 2/e</i>	
68	D_{2h}^{22}	$\left(\frac{a+b}{2}:c:(a:b)\right) \cdot \tilde{a}:2 \cdot \tilde{c}$	<i>Ccca</i>	<i>C2/c 2/c 2/a</i>	<i>Ccce</i>	<i>C2/c 2/c 2/e</i>	
69	D_{2h}^{23}	$\left(\frac{a+c}{2} \Big/ \frac{b+c}{2} \Big/ \frac{a+b}{2}:c:(a:b)\right) \cdot m:2 \cdot m$	<i>Fmmm</i>	<i>F2/m 2/m 2/m</i>	<i>Fmmm</i>	<i>F2/m 2/m 2/m</i>	
70	D_{2h}^{24}	$\left(\frac{a+c}{2} \Big/ \frac{b+c}{2} \Big/ \frac{a+b}{2}:c:(a:b)\right) \cdot \frac{1}{2}\tilde{a}\tilde{b}:2 \odot \frac{1}{2}\tilde{a}\tilde{c}$	<i>Fddd</i>	<i>F2/d 2/d 2/d</i>	<i>Fddd</i>	<i>F2/d 2/d 2/d</i>	
71	D_{2h}^{25}	$\left(\frac{a+b+c}{2} \Big/ c:(a:b)\right) \cdot m:2 \cdot m$	<i>Immm</i>	<i>I2/m 2/m 2/m</i>	<i>Immm</i>	<i>I2/m 2/m 2/m</i>	
72	D_{2h}^{26}	$\left(\frac{a+b+c}{2} \Big/ c:(a:b)\right) \cdot m:2 \cdot \tilde{c}$	<i>Ibam</i>	<i>I2/b 2/a 2/m</i>	<i>Ibam</i>	<i>I2/b 2/a 2/m</i>	
73	D_{2h}^{27}	$\left(\frac{a+b+c}{2} \Big/ c:(a:b)\right) \cdot \tilde{a}:2 \cdot \tilde{c}$	<i>Ibca</i>	<i>I2₁/b 2₁/c 2₁/a</i>	<i>Ibca</i>	<i>I2₁/b 2₁/c 2₁/a</i>	
74	D_{2h}^{28}	$\left(\frac{a+b+c}{2} \Big/ c:(a:b)\right) \cdot \tilde{a}:2 \cdot m$	<i>Imma</i>	<i>I2₁/m 2₁/m 2₁/a</i>	<i>Imma</i>	<i>I2₁/m 2₁/m 2₁/a</i>	
75	C_4^1	$(c:(a:a)):4$	<i>P4</i>	<i>P4</i>	<i>P4</i>	<i>P4</i>	
76	C_4^2	$(c:(a:a)):4_1$	<i>P4₁</i>	<i>P4₁</i>	<i>P4₁</i>	<i>P4₁</i>	
77	C_4^3	$(c:(a:a)):4_2$	<i>P4₂</i>	<i>P4₂</i>	<i>P4₂</i>	<i>P4₂</i>	
78	C_4^4	$(c:(a:a)):4_3$	<i>P4₃</i>	<i>P4₃</i>	<i>P4₃</i>	<i>P4₃</i>	
79	C_4^5	$\left(\frac{a+b+c}{2} \Big/ c:(a:a)\right):4$	<i>I4</i>	<i>I4</i>	<i>I4</i>	<i>I4</i>	
80	C_4^6	$\left(\frac{a-b-c}{2} \Big/ c:(a:a)\right):4_1$	<i>I4₁</i>	<i>I4₁</i>	<i>I4₁</i>	<i>I4₁</i>	
81	S_4^1	$(c:(a:a)):4$	<i>P4</i>	<i>P4</i>	<i>P4</i>	<i>P4</i>	
82	S_4^2	$\left(\frac{a+b+c}{2} \Big/ c:(a:a)\right):4$	<i>I4</i>	<i>I4</i>	<i>I4</i>	<i>I4</i>	
83	C_{4h}^1	$(c:(a:a)) \cdot m:4$	<i>P4/m</i>	<i>P4/m</i>	<i>P4/m</i>	<i>P4/m</i>	
84	C_{4h}^2	$(c:(a:a)) \cdot m:4_2$	<i>P4₂/m</i>	<i>P4₂/m</i>	<i>P4₂/m</i>	<i>P4₂/m</i>	
85	C_{4h}^3	$(c:(a:a)) \cdot \tilde{a}\tilde{b}:4$	<i>P4/n</i>	<i>P4/n</i>	<i>P4/n</i>	<i>P4/n</i>	
86	C_{4h}^4	$(c:(a:a)) \cdot \tilde{a}\tilde{b}:4_2$	<i>P4₂/n</i>	<i>P4₂/n</i>	<i>P4₂/n</i>	<i>P4₂/n</i>	
87	C_{4h}^5	$\left(\frac{a+b+c}{2} \Big/ c:(a:a)\right) \cdot m:4$	<i>I4/m</i>	<i>I4/m</i>	<i>I4/m</i>	<i>I4/m</i>	
88	C_{4h}^6	$\left(\frac{a+b+c}{2} \Big/ c:(a:a)\right) \cdot \tilde{a}:4_1$	<i>I4₁/a</i>	<i>I4₁/a</i>	<i>I4₁/a</i>	<i>I4₁/a</i>	
89	D_4^1	$(c:(a:a)):4:2$	<i>P42</i>	<i>P422</i>	<i>P422</i>	<i>P422</i>	
90	D_4^2	$(c:(a:a)):4 \odot 2_1$	<i>P42₁</i>	<i>P42₁2</i>	<i>P42₁2</i>	<i>P42₁2</i>	
91	D_4^3	$(c:(a:a)):4_1:2$	<i>P4₁2</i>	<i>P4₁22</i>	<i>P4₁22</i>	<i>P4₁22</i>	
92	D_4^4	$(c:(a:a)):4_1 \odot 2_1$	<i>P4₁2₁</i>	<i>P4₁2₁2</i>	<i>P4₁2₁2</i>	<i>P4₁2₁2</i>	
93	D_4^5	$(c:(a:a)):4_2:2$	<i>P4₂2</i>	<i>P4₂22</i>	<i>P4₂22</i>	<i>P4₂22</i>	
94	D_4^6	$(c:(a:a)):4_2 \odot 2_1$	<i>P4₂2₁</i>	<i>P4₂2₁2</i>	<i>P4₂2₁2</i>	<i>P4₂2₁2</i>	
95	D_4^7	$(c:(a:a)):4_3:2$	<i>P4₃2</i>	<i>P4₃22</i>	<i>P4₃22</i>	<i>P4₃22</i>	
96	D_4^8	$(c:(a:a)):4_3 \odot 2_1$	<i>P4₃2₁</i>	<i>P4₃2₁2</i>	<i>P4₃2₁2</i>	<i>P4₃2₁2</i>	
97	D_4^9	$\left(\frac{a+b+c}{2} \Big/ c:(a:a)\right):4:2$	<i>I42</i>	<i>I422</i>	<i>I422</i>	<i>I422</i>	
98	D_4^{10}	$\left(\frac{a+b+c}{2} \Big/ c:(a:a)\right):4_1:2$	<i>I4₁2</i>	<i>I4₁22</i>	<i>I4₁22</i>	<i>I4₁22</i>	
99	C_{4v}^1	$(c:(a:a)):4 \cdot m$	<i>P4mm</i>	<i>P4mm</i>	<i>P4mm</i>	<i>P4mm</i>	
100	C_{4v}^2	$(c:(a:a)):4 \odot \tilde{a}$	<i>P4bm</i>	<i>P4bm</i>	<i>P4bm</i>	<i>P4bm</i>	
101	C_{4v}^3	$(c:(a:a)):4_2 \cdot \tilde{c}$	<i>P4cm</i>	<i>P4₂cm</i>	<i>P4₂cm</i>	<i>P4₂cm</i>	
102	C_{4v}^4	$(c:(a:a)):4_2 \odot \tilde{a}\tilde{c}$	<i>P4nm</i>	<i>P4₂nm</i>	<i>P4₂nm</i>	<i>P4₂nm</i>	

3. ADVANCED TOPICS ON SPACE-GROUP SYMMETRY

Table 3.3.3.1 (continued)

No.	Schoenflies symbol	Shubnikov symbol	Symbols of <i>International Tables</i>				Comments†
			1935 Edition		Present Edition		
			Short	Full	Short	Full	
103	C_{4v}^5	$(c:(a:a)):4 \cdot \bar{c}$	$P4cc$	$P4cc$	$P4cc$	$P4cc$	
104	C_{4v}^6	$(c:(a:a)):4 \odot \bar{a}\bar{c}$	$P4nc$	$P4nc$	$P4nc$	$P4nc$	
105	C_{4v}^7	$(c:(a:a)):4_2 \cdot m$	$P4mc$	$P4_2mc$	$P4_2mc$	$P4_2mc$	
106	C_{4v}^8	$(c:(a:a)):4_2 \odot \bar{a}$	$P4bc$	$P4_2bc$	$P4_2bc$	$P4_2bc$	
107	C_{4v}^9	$\left(\frac{a+b+c}{2} / c:(a:a)\right):4 \cdot m$	$I4mm$	$I4mm$	$I4mm$	$I4mm$	
108	C_{4v}^{10}	$\left(\frac{a+b+c}{2} / c:(a:a)\right):4 \cdot \bar{c}$	$I4cm$	$I4cm$	$I4cm$	$I4cm$	
109	C_{4v}^{11}	$\left(\frac{a+b+c}{2} / c:(a:a)\right):4_1 \odot m$	$I4md$	$I4_1md$	$I4_1md$	$I4_1md$	
110	C_{4v}^{12}	$\left(\frac{a+b+c}{2} / c:(a:a)\right):4_1 \odot \bar{c}$	$I4cd$	$I4_1cd$	$I4_1cd$	$I4_1cd$	$\left(\frac{a+b+c}{2} / c:(a:a)\right):4_1 \cdot \bar{a}$ (Sh-K)
111	D_{2d}^1	$(c:(a:a)):4:2$	$P\bar{4}2m$	$P\bar{4}2m$	$P\bar{4}2m$	$P\bar{4}2m$	
112	D_{2d}^2	$(c:(a:a)):4 \odot 2$	$P\bar{4}2c$	$P\bar{4}2c$	$P\bar{4}2c$	$P\bar{4}2c$	
113	D_{2d}^3	$(c:(a:a)):4 \cdot \bar{a}\bar{b}$	$P\bar{4}2_1m$	$P\bar{4}2_1m$	$P\bar{4}2_1m$	$P\bar{4}2_1m$	
114	D_{2d}^4	$(c:(a:a)):4 \cdot \bar{a}\bar{b}\bar{c}$	$P\bar{4}2_1c$	$P\bar{4}2_1c$	$P\bar{4}2_1c$	$P\bar{4}2_1c$	
115	D_{2d}^5	$(c:(a:a)):4 \cdot m$	$C\bar{4}2m$	$C\bar{4}2m$	$P\bar{4}m2$	$P\bar{4}m2$	
116	D_{2d}^6	$(c:(a:a)):4 \cdot \bar{c}$	$C\bar{4}2c$	$C\bar{4}2c$	$P\bar{4}c2$	$P\bar{4}c2$	
117	D_{2d}^7	$(c:(a:a)):4 \odot \bar{a}$	$C\bar{4}2b$	$C\bar{4}2b$	$P\bar{4}b2$	$P\bar{4}b2$	
118	D_{2d}^8	$(c:(a:a)):4 \cdot \bar{a}\bar{c}$	$C\bar{4}2n$	$C\bar{4}2n$	$P\bar{4}n2$	$P\bar{4}n2$	
119	D_{2d}^9	$\left(\frac{a+b+c}{2} / c:(a:a)\right):4 \cdot m$	$F\bar{4}2m$	$F\bar{4}2m$	$\bar{I}4m2$	$\bar{I}4m2$	
120	D_{2d}^{10}	$\left(\frac{a+b+c}{2} / c:(a:a)\right):4 \cdot \bar{c}$	$F\bar{4}2c$	$F\bar{4}2c$	$\bar{I}4c2$	$\bar{I}4c2$	
121	D_{2d}^{11}	$\left(\frac{a+b+c}{2} / c:(a:a)\right):4:2$	$\bar{I}42m$	$\bar{I}42m$	$\bar{I}42m$	$\bar{I}42m$	
122	D_{2d}^{12}	$\left(\frac{a+b+c}{2} / c:(a:a)\right):4 \odot \frac{1}{2} \bar{a}\bar{b}\bar{c}$	$\bar{I}42d$	$\bar{I}42d$	$\bar{I}42d$	$\bar{I}42d$	
123	D_{4h}^1	$(c:(a:a)) \cdot m:4 \cdot m$	$P4/mmm$	$P4/m 2/m 2/m$	$P4/mmm$	$P4/m 2/m 2/m$	
124	D_{4h}^2	$(c:(a:a)) \cdot m:4 \cdot \bar{c}$	$P4/mcc$	$P4/m 2/c 2/c$	$P4/mcc$	$P4/m 2/c 2/c$	
125	D_{4h}^3	$(c:(a:a)) \cdot \bar{a}\bar{b}:4 \odot \bar{a}$	$P4/nbm$	$P4/n 2/b 2/m$	$P4/nbm$	$P4/n 2/b 2/m$	$(c:(a:a)) \cdot \bar{a}\bar{b}:4 \odot \bar{b}$ (Sh-K)
126	D_{4h}^4	$(c:(a:a)) \cdot \bar{a}\bar{b}:4 \odot \bar{a}\bar{c}$	$P4/nnc$	$P4/n 2/n 2/c$	$P4/nnc$	$P4/n 2/n 2/c$	
127	D_{4h}^5	$(c:(a:a)) \cdot m:4 \odot \bar{a}$	$P4/mbm$	$P4/m 2_1/b 2/m$	$P4/mbm$	$P4/m 2_1/b 2/m$	$(c:(a:a)) \cdot m:4 \odot \bar{b}$ (Sh-K)
128	D_{4h}^6	$(c:(a:a)) \cdot m:4 \odot \bar{a}\bar{c}$	$P4/mnc$	$P4/m 2_1/n 2/c$	$P4/mnc$	$P4/m 2_1/n 2/c$	
129	D_{4h}^7	$(c:(a:a)) \cdot \bar{a}\bar{b}:4 \cdot m$	$P4/nmm$	$P4/n 2_1/m 2/m$	$P4/nmm$	$P4/n 2_1/m 2/m$	
130	D_{4h}^8	$(c:(a:a)) \cdot \bar{a}\bar{b}:4 \cdot \bar{c}$	$P4/ncc$	$P4/n 2/c 2/c$	$P4/ncc$	$P4/n 2/c 2/c$	
131	D_{4h}^9	$(c:(a:a)) \cdot m:4_2 \cdot m$	$P4/mnc$	$P4_2/m 2/m 2/c$	$P4_2/mnc$	$P4_2/m 2/m 2/c$	
132	D_{4h}^{10}	$(c:(a:a)) \cdot m:4_2 \cdot \bar{c}$	$P4/mcm$	$P4_2/m 2/c 2/m$	$P4_2/mcm$	$P4_2/m 2/c 2/m$	
133	D_{4h}^{11}	$(c:(a:a)) \cdot \bar{a}\bar{b}:4_2 \odot \bar{a}$	$P4/nbc$	$P4_2/n 2/b 2/c$	$P4_2/nbc$	$P4_2/n 2/b 2/c$	$(c:(a:a)) \cdot \bar{a}\bar{b}:4_2 \odot \bar{b}$ (Sh-K)
134	D_{4h}^{12}	$(c:(a:a)) \cdot \bar{a}\bar{b}:4_2 \odot \bar{a}\bar{c}$	$P4/nnm$	$P4_2/n 2/n 2/m$	$P4_2/nnm$	$P4_2/n 2/n 2/m$	
135	D_{4h}^{13}	$(c:(a:a)) \cdot n:4_2 \odot \bar{a}$	$P4/mbc$	$P4_2/m 2_1/b 2/c$	$P4_2/mbc$	$P4_2/m 2_1/b 2/c$	$(c:(a:a)) \cdot m:4_2 \odot \bar{b}$ (Sh-K)
136	D_{4h}^{14}	$(c:(a:a)) \cdot m:4_2 \odot \bar{a}\bar{c}$	$P4/mnm$	$P4_2/m 2_1/n 2/m$	$P4_2/mnm$	$P4_2/m 2_1/n 2/m$	
137	D_{4h}^{15}	$(c:(a:a)) \cdot \bar{a}\bar{b}:4_2 \cdot m$	$P4/nmc$	$P4_2/n 2_1/m 2/c$	$P4_2/nmc$	$P4_2/n 2_1/m 2/c$	
138	D_{4h}^{16}	$(c:(a:a)) \cdot \bar{a}\bar{b}:4_2 \cdot \bar{c}$	$P4/ncm$	$P4_2/n 2_1/c 2/m$	$P4_2/ncm$	$P4_2/n 2_1/c 2/m$	
139	D_{4h}^{17}	$\left(\frac{a+b+c}{2} / c:(a:a)\right) \cdot m:4 \cdot m$	$I4/mmm$	$I4/m 2/m 2/m$	$I4/mmm$	$I4/m 2/m 2/m$	
140	D_{4h}^{18}	$\left(\frac{a+b+c}{2} / c:(a:a)\right) \cdot m:4 \cdot \bar{c}$	$I4/mcm$	$I4/m 2/c 2/m$	$I4/mcm$	$I4/m 2/c 2/m$	
141	D_{4h}^{19}	$\left(\frac{a+b+c}{2} / c:(a:a)\right) \cdot \bar{a}:4_1 \odot m$	$I4/amd$	$I4_1/a 2/m 2/d$	$I4_1/amd$	$I4_1/a 2/m 2/d$	
142	D_{4h}^{20}	$\left(\frac{a+b+c}{2} / c:(a:a)\right) \cdot \bar{a}:4_1 \odot \bar{c}$	$I4/acd$	$I4_1/a 2/c 2/d$	$I4_1/acd$	$I4_1/a 2/c 2/d$	
143	C_3^1	$(c:(a/a)):3$	$C3$	$C3$	$P3$	$P3$	
144	C_3^2	$(c:(a/a)):3_1$	$C3_1$	$C3_1$	$P3_1$	$P3_1$	
145	C_3^3	$(c:(a/a)):3_2$	$C3_2$	$C3_2$	$P3_2$	$P3_2$	

3.3. SPACE-GROUP SYMBOLS AND THEIR USE

Table 3.3.3.1 (continued)

No.	Schoenflies symbol	Shubnikov symbol	Symbols of <i>International Tables</i>				Comments†
			1935 Edition		Present Edition		
			Short	Full	Short	Full	
146	C_3^4	$\left(\frac{2a+b+c}{3} \middle/ \frac{a+2b+2c}{3} \middle/ c:(a/a)\right)$: 3 (a/a/a)/3	R3	R3	R3	R3	Hexagonal setting (Sh-K) Rhombohedral setting (Sh-K)
147	C_{3i}^1	(c:(a/a)):6̄	$C\bar{3}$	$C\bar{3}$	$P\bar{3}$	$P\bar{3}$	Hexagonal setting (Sh-K) Rhombohedral setting (Sh-K)
148	C_{3i}^2	$\left(\frac{2a+b+c}{3} \middle/ \frac{a+2b+2c}{3} \middle/ c:(a/a)\right)$: 6̄ (a/a/a)/6̄	$R\bar{3}$	$R\bar{3}$	$R\bar{3}$	$R\bar{3}$	
149	D_3^1	(c:(a/a)):2:3	$H32$	$H321$	$P312$	$P312$	Hexagonal setting (Sh-K) Rhombohedral setting (Sh-K)
150	D_3^2	(c:(a/a)):2:3	$C32$	$C321$	$P321$	$P321$	
151	D_3^3	(c:(a/a)):2:3 ₁	$H3_12$	$H3_121$	$P3_112$	$P3_112$	
152	D_3^4	(c:(a/a)):2:3 ₁	$C3_12$	$C3_121$	$P3_121$	$P3_121$	
153	D_3^5	(c:(a/a)):2:3 ₂	$H3_22$	$H3_221$	$P3_212$	$P3_212$	
154	D_3^6	(c:(a/a)):2:3 ₂	$C3_22$	$C3_221$	$P3_221$	$P3_221$	
155	D_3^7	$\left(\frac{2a+b+c}{3} \middle/ \frac{a+2b+2c}{3} \middle/ c:(a/a)\right)$: 2:3 (a/a/a)/3:2	$R32$	$R32$	$R32$	$R32$	
156	C_{3v}^1	(c:(a/a)):m:3	$C3m$	$C3m1$	$P3m1$	$P3m1$	(c:(a/a)) · m · 3 (Sh-K) with special comment
157	C_{3v}^2	(a:c:a):m:3	$H3m$	$H3m1$	$P31m$	$P31m$	
158	C_{3v}^3	(c:(a/a)):c̄:3	$C3c$	$C3c1$	$P3c1$	$P3c1$	(c:(a/a)) · c̄ · 3 (Sh-K) with special comment
159	C_{3v}^4	(a:c:a):c̄:3	$H3c$	$H3c1$	$P31c$	$P31c$	
160	C_{3v}^5	$\left(\frac{2a+b+c}{3} \middle/ \frac{a+2b+2c}{3} \middle/ c:(a/a)\right)$ · m · 3 (a/a/a)/3 · m	$R3m$	$R3m$	$R3m$	$R3m$	Hexagonal setting (Sh-K) Rhombohedral setting (Sh-K)
161	C_{3v}^6	$\left(\frac{2a+b+c}{3} \middle/ \frac{a+2b+2c}{3} \middle/ c:(a/a)\right)$ · c̄ · 3 (a/a/a)/3 · abc̄	$R3c$	$R3c$	$R3c$	$R3c$	Hexagonal setting (Sh-K) Rhombohedral setting (Sh-K)
162	D_{3d}^1	(a:c:a) · m · 6̄	$H\bar{3}m$	$H\bar{3} 2/m 1$	$P\bar{3}1m$	$P\bar{3}1 2/m$	(c:(a/a)) · m · 6̄ (Sh-K) with special comment
163	D_{3d}^2	(a:c:a) · c̄ · 6̄	$H\bar{3}c$	$H\bar{3} 2/c 1$	$P\bar{3}1c$	$P\bar{3}1 2/c$	(c:(a/a)) · c̄ · 6̄ (Sh-K) with special comment
164	D_{3d}^3	(c:(a/a)):m · 6̄	$C\bar{3}m$	$C\bar{3} 2/m 1$	$P\bar{3}m1$	$P\bar{3} 2/m 1$	Hexagonal setting (Sh-K) Rhombohedral setting (Sh-K)
165	D_{3d}^4	(c:(a/a)):c̄ · 6̄	$C\bar{3}c$	$C\bar{3} 2/c 1$	$P\bar{3}c1$	$P\bar{3} 2/c 1$	
166	D_{3d}^5	$\left(\frac{2a+b+c}{3} \middle/ \frac{a+2b+2c}{3} \middle/ c:(a/a)\right)$: m · 6̄ (a/a/a)/6̄ · m	$R\bar{3}m$	$R\bar{3} 2/m$	$R\bar{3}m$	$R\bar{3} 2/m$	Hexagonal setting (Sh-K) Rhombohedral setting (Sh-K)
167	D_{3d}^6	$\left(\frac{2a+b+c}{3} \middle/ \frac{a+2b+2c}{3} \middle/ c:(a/a)\right)$: c̄ · 6̄ (a/a/a)/6̄ · abc̄	$R\bar{3}c$	$R\bar{3} 2/c$	$R\bar{3}c$	$R\bar{3} 2/c$	
168	C_6^1	(c:(a/a)):6	$C6$	$C6$	$P6$	$P6$	
169	C_6^2	(c:(a/a)):6 ₁	$C6_1$	$C6_1$	$P6_1$	$P6_1$	
170	C_6^3	(c:(a/a)):6 ₅	$C6_5$	$C6_5$	$P6_5$	$P6_5$	
171	C_6^4	(c:(a/a)):6 ₂	$C6_2$	$C6_2$	$P6_2$	$P6_2$	
172	C_6^5	(c:(a/a)):6 ₄	$C6_4$	$C6_4$	$P6_4$	$P6_4$	
173	C_6^6	(c:(a/a)):6 ₃	$C6_3$	$C6_3$	$P6_3$	$P6_3$	
174	C_{3h}^1	(c:(a/a)):3:m	$C\bar{6}$	$C\bar{6}$	$P\bar{6}$	$P\bar{6}$	
175	C_{6h}^1	(c:(a/a)) · m:6	$C6/m$	$C6/m$	$P6/m$	$P6/m$	
176	C_{6h}^2	(c:(a/a)) · m:6 ₃	$C6_3/m$	$C6_3/m$	$P6_3/m$	$P6_3/m$	

3. ADVANCED TOPICS ON SPACE-GROUP SYMMETRY

Table 3.3.3.1 (continued)

No.	Schoenflies symbol	Shubnikov symbol	Symbols of <i>International Tables</i>				Comments†
			1935 Edition		Present Edition		
			Short	Full	Short	Full	
177	D_6^1	$(c:(a/a)) \cdot 2:6$	$C62$	$C622$	$P622$	$P622$	
178	D_6^2	$(c:(a/a)) \cdot 2:6_1$	$C6_12$	$C6_122$	$P6_122$	$P6_122$	
179	D_6^3	$(c:(a/a)) \cdot 2:6_5$	$C6_52$	$C6_522$	$P6_522$	$P6_522$	
180	D_6^4	$(c:(a/a)) \cdot 2:6_2$	$C6_22$	$C6_222$	$P6_222$	$P6_222$	
181	D_6^5	$(c:(a/a)) \cdot 2:6_4$	$C6_42$	$C6_422$	$P6_422$	$P6_422$	
182	D_6^6	$(c:(a/a)) \cdot 2:6_3$	$C6_32$	$C6_322$	$P6_322$	$P6_322$	
183	C_{6v}^1	$(c:(a/a)):m \cdot 6$	$C6mm$	$C6mm$	$P6mm$	$P6mm$	
184	C_{6v}^2	$(c:(a/a)):\tilde{c} \cdot 6$	$C6cc$	$C6cc$	$P6cc$	$P6cc$	
185	C_{6v}^3	$(c:(a/a)):\tilde{c} \cdot 6_3$	$C6cm$	$C6_3cm$	$P6_3cm$	$P6_3cm$	
186	C_{6v}^4	$(c:(a/a)):m \cdot 6_3$	$C6mc$	$C6_3mc$	$P6_3mc$	$P6_3mc$	
187	D_{3h}^1	$(c:(a/a)):m \cdot 3:m$	$\bar{C}6m2$	$\bar{C}6m2$	$\bar{P}6m2$	$\bar{P}6m2$	
188	D_{3h}^2	$(c:(a/a)):\tilde{c} \cdot 3:m$	$\bar{C}6c2$	$\bar{C}6c2$	$\bar{P}6c2$	$\bar{P}6c2$	
189	D_{3h}^3	$(c:(a/a)) \cdot m:3 \cdot m$	$\bar{H}6m2$	$\bar{H}6m2$	$\bar{P}6_2m$	$\bar{P}6_2m$	
190	D_{3h}^4	$(c:(a/a)) \cdot m:3 \cdot \tilde{c}$	$\bar{H}6c2$	$\bar{H}6c2$	$\bar{P}6_2c$	$\bar{P}6_2c$	
191	D_{6h}^1	$(c:(a/a)) \cdot m:6 \cdot m$	$C6/mmm$	$C6/m \ 2/m \ 2/m$	$P6/mmm$	$P6/m \ 2/m \ 2/m$	
192	D_{6h}^2	$(c:(a/a)) \cdot m:6 \cdot \tilde{c}$	$C6/mcc$	$C6/m \ 2/c \ 2/c$	$P6/mcc$	$P6/m \ 2/c \ 2/c$	
193	D_{6h}^3	$(c:(a/a)) \cdot m:6_3 \cdot \tilde{c}$	$C6/mcm$	$C6_3/m \ 2/c \ 2/m$	$P6_3/mcm$	$P6_3/m \ 2/c \ 2/m$	
194	D_{6h}^4	$(c:(a/a)) \cdot m:6_3 \cdot m$	$C6/mmc$	$C6_3/m \ 2/m \ 2/c$	$P6_3/mmc$	$P6_3/m \ 2/m \ 2/c$	
195	T^1	$(a:(a/a)):2/3$	$P23$	$P23$	$P23$	$P23$	
196	T^2	$\left(\frac{a+c}{2} \middle/ \frac{b+c}{2} \middle/ \frac{a+b}{2} : a:(a:a)\right) : 2/3$	$F23$	$F23$	$F23$	$F23$	
197	T^3	$\left(\frac{a+b+c}{2} \middle/ a:(a:a)\right) : 2/3$	$I23$	$I23$	$I23$	$I23$	
198	T^4	$(a:(a/a)):2_1//3$	$P2_13$	$P2_13$	$P2_13$	$P2_13$	
199	T^5	$\left(\frac{a+b+c}{2} \middle/ a:(a:a)\right) : 2_1//3$	$I2_13$	$I2_13$	$I2_13$	$I2_13$	
200	T_h^1	$(a:(a:a)) \cdot m/\tilde{6}$	$Pm3$	$P2/m \bar{3}$	$Pm\bar{3}$	$P2/m \bar{3}$	$Pm3$ (IT, 1952)
201	T_h^2	$(a:(a:a)) \cdot \tilde{a}b/\tilde{6}$	$Pn3$	$P2/n \bar{3}$	$Pn\bar{3}$	$P2/n \bar{3}$	$Pn3$ (IT, 1952)
202	T_h^3	$\left(\frac{a+c}{2} \middle/ \frac{b+c}{2} \middle/ \frac{a+b}{2} : a:(a:a)\right) \cdot m/\tilde{6}$	$Fm3$	$F2/m \bar{3}$	$Fm\bar{3}$	$F2/m \bar{3}$	$Fm3$ (IT, 1952)
203	T_h^4	$\left(\frac{a+c}{2} \middle/ \frac{b+c}{2} \middle/ \frac{a+b}{2} : a:(a:a)\right) \cdot \frac{1}{2}ab/\tilde{6}$	$Fd3$	$F2/d \bar{3}$	$Fd\bar{3}$	$F2/d \bar{3}$	$Fd3$ (IT, 1952)
204	T_h^5	$\left(\frac{a+b+c}{2} \middle/ a:(a:a)\right) \cdot m/\tilde{6}$	$Im3$	$I2/m \bar{3}$	$Im\bar{3}$	$I2/m \bar{3}$	$Im3$ (IT, 1952)
205	T_h^6	$(a:(a:a)) \cdot \tilde{a}/\tilde{6}$	$Pa3$	$P2_1/a \bar{3}$	$Pa\bar{3}$	$P2_1/a \bar{3}$	$Pa3$ (IT, 1952)
206	T_h^7	$\left(\frac{a+b+c}{2} \middle/ a:(a:a)\right) \cdot \tilde{a}/\tilde{6}$	$Ia3$	$I2_1/a \bar{3}$	$Ia\bar{3}$	$I2_1/a \bar{3}$	$Ia3$ (IT, 1952)
207	O^1	$(a:(a:a)):4/3$	$P43$	$P432$	$P432$	$P432$	
208	O^2	$(a:(a:a)):4_2//3$	$P4_23$	$P4_232$	$P4_232$	$P4_232$	
209	O^3	$\left(\frac{a+c}{2} \middle/ \frac{b+c}{2} \middle/ \frac{a+b}{2} : a:(a:a)\right) : 4/3$	$F43$	$F432$	$F432$	$F432$	
210	O^4	$\left(\frac{a+c}{2} \middle/ \frac{b+c}{2} \middle/ \frac{a+b}{2} : a:(a:a)\right) : 4_1//3$	$F4_13$	$F4_132$	$F4_132$	$F4_132$	
211	O^5	$\left(\frac{a+b+c}{2} \middle/ a:(a:a)\right) : 4/3$	$I43$	$I432$	$I432$	$I432$	
212	O^6	$(a:(a:a)):4_3//3$	$P4_33$	$P4_332$	$P4_332$	$P4_332$	
213	O^7	$(a:(a:a)):4_1//3$	$P4_13$	$P4_132$	$P4_132$	$P4_132$	
214	O^8	$\left(\frac{a+b+c}{2} \middle/ a:(a:a)\right) : 4_1//3$	$I4_13$	$I4_132$	$I4_132$	$I4_132$	

Table 3.3.3.1 (continued)

No.	Schoenflies symbol	Shubnikov symbol	Symbols of <i>International Tables</i>				Comments†
			1935 Edition		Present Edition		
			Short	Full	Short	Full	
215	T_d^1	$(a:(a:a)):\bar{4}/3$	$P\bar{4}3m$	$P\bar{4}3m$	$P\bar{4}3m$	$P\bar{4}3m$	
216	T_d^2	$\left(\frac{a+c}{2}/\frac{b+c}{2}/\frac{a+b}{2}:a:(a:a)\right)$: $\bar{4}/3$	$F\bar{4}3m$	$F\bar{4}3m$	$F\bar{4}3m$	$F\bar{4}3m$	
217	T_d^3	$\left(\frac{a+b+c}{2}/a:(a:a)\right)$: $\bar{4}/3$	$I\bar{4}3m$	$I\bar{4}3m$	$I\bar{4}3m$	$I\bar{4}3m$	
218	T_d^4	$(a:(a:a)):\bar{4}/3$	$P\bar{4}3n$	$P\bar{4}3n$	$P\bar{4}3n$	$P\bar{4}3n$	
219	T_d^5	$\left(\frac{a+c}{2}/\frac{b+c}{2}/\frac{a+b}{2}:a:(a:a)\right)$: $\bar{4}/3$	$F\bar{4}3c$	$F\bar{4}3c$	$F\bar{4}3c$	$F\bar{4}3c$	
220	T_d^6	$\left(\frac{a+b+c}{2}/a:(a:a)\right):\bar{4}/3$	$I\bar{4}3d$	$I\bar{4}3d$	$I\bar{4}3d$	$I\bar{4}3d$	
221	O_h^1	$(a:(a:a)):4/\bar{6}\cdot m$	$Pm\bar{3}m$	$P4/m\bar{3}2/m$	$Pm\bar{3}m$	$P4/m\bar{3}2/m$	$Pm\bar{3}m$ (IT, 1952)
222	O_h^2	$(a:(a:a)):4/\bar{6}\cdot\widetilde{abc}$	$Pn\bar{3}n$	$P4/n\bar{3}2/n$	$Pn\bar{3}n$	$P4/n\bar{3}2/n$	$Pn\bar{3}n$ (IT, 1952)
223	O_h^3	$(a:(a:a)):4_2/\bar{6}\cdot\widetilde{abc}$	$Pm\bar{3}n$	$P4_2/m\bar{3}2/n$	$Pm\bar{3}n$	$P4_2/m\bar{3}2/n$	$Pm\bar{3}n$ (IT, 1952)
224	O_h^4	$(a:(a:a)):4_2/\bar{6}\cdot m$	$Pn\bar{3}m$	$P4_2/n\bar{3}2/m$	$Pn\bar{3}m$	$P4_2/n\bar{3}2/m$	$Pn\bar{3}m$ (IT, 1952)
225	O_h^5	$\left(\frac{a+c}{2}/\frac{b+c}{2}/\frac{a+b}{2}:a:(a:a)\right)$: $4/\bar{6}\cdot m$	$Fm\bar{3}m$	$F4/m\bar{3}2/m$	$Fm\bar{3}m$	$F4/m\bar{3}2/m$	$Fm\bar{3}m$ (IT, 1952)
226	O_h^6	$\left(\frac{a+c}{2}/\frac{b+c}{2}/\frac{a+b}{2}:a:(a:a)\right)$: $4/\bar{6}\cdot\bar{c}$	$Fm\bar{3}c$	$F4/m\bar{3}2/c$	$Fm\bar{3}c$	$F4/m\bar{3}2/c$	$Fm\bar{3}c$ (IT, 1952)
227	O_h^7	$\left(\frac{a+c}{2}/\frac{b+c}{2}/\frac{a+b}{2}:a:(a:a)\right)$: $4_1/\bar{6}\cdot m$	$Fd\bar{3}m$	$F4_1/d\bar{3}2/m$	$Fd\bar{3}m$	$F4_1/d\bar{3}2/m$	$Fd\bar{3}m$ (IT, 1952)
228	O_h^8	$\left(\frac{a+c}{2}/\frac{b+c}{2}/\frac{a+b}{2}:a:(a:a)\right)$: $4_1/\bar{6}\cdot\bar{c}$	$Fd\bar{3}c$	$F4_1/d\bar{3}2/c$	$Fd\bar{3}c$	$F4_1/d\bar{3}2/c$	$Fd\bar{3}c$ (IT, 1952)
229	O_h^9	$\left(\frac{a+b+c}{2}/a:(a:a)\right):4/\bar{6}\cdot m$	$Im\bar{3}m$	$I4/m\bar{3}2/m$	$Im\bar{3}m$	$I4/m\bar{3}2/m$	$Im\bar{3}m$ (IT, 1952)
230	O_h^{10}	$\left(\frac{a+b+c}{2}/a:(a:a)\right):4_1/\bar{6}\cdot\frac{1}{2}\widetilde{abc}$	$Ia\bar{3}d$	$I4_1/a\bar{3}2/d$	$Ia\bar{3}d$	$I4_1/a\bar{3}2/d$	$Ia\bar{3}d$ (IT, 1952)

† Abbreviations used in the column *Comments*: IT, 1952: *International Tables for X-ray Crystallography*, Vol. I (1952); Sh-K; Shubnikov & Koptsik (1972). Note that this table contains only one notation for the *b*-unique setting and one notation for the *c*-unique setting in the monoclinic case, always referring to cell choice 1 of the space-group tables.

3.3.3.5. Systematic absences

Hermann (1928a) emphasized that the short symbols permit the derivation of systematic absences of X-ray reflections caused by the glide/screw parts of the symmetry operations. If $\mathbf{h} = (hkl)$ describes the X-ray reflection and (\mathbf{W}, \mathbf{w}) is the matrix representation of a symmetry operation, the matrix can be expanded as follows:

$$(\mathbf{W}, \mathbf{w}) = (\mathbf{W}, \mathbf{w}_g + \mathbf{w}_l) = (\mathbf{W}, \begin{pmatrix} w_{g,1} \\ w_{g,2} \\ w_{g,3} \end{pmatrix} + \mathbf{w}_l).$$

The absence of a reflection is governed by the relation (i) $\mathbf{h} \cdot \mathbf{W} = \mathbf{h}$ and the scalar product (ii) $\mathbf{h} \cdot \mathbf{w}_g = hw_{g,1} + kw_{g,2} + lw_{g,3}$. A reflection \mathbf{h} is absent if condition (i) holds and the scalar product (ii) is not an integer. The calculation must be made for all generators and indicators of the short symbol. Systematic absences, introduced by the further symmetry operations gener-

ated, are obtained by the combination of the extinction rules derived for the generators and indicators.

Example: Space group $D_4^{10} = I4_122$ (98)

The generators of the space group are the integral translations and the centring translation $x + \frac{1}{2}, y + \frac{1}{2}, z + \frac{1}{2}$, the rotation 2 in direction [100]: x, \bar{y}, \bar{z} and the rotation 2 in direction $[1\bar{1}0]$: $\bar{y}, \bar{x}, \bar{z} - \frac{1}{4}$. The combination of the two generators gives the operation corresponding to the indicator, namely $\bar{y}, x, z + \frac{1}{4}$, which represents a fourfold screw rotation in the direction [001].

The integral translations imply no restriction because the scalar product is always an integer. For the centring, condition (i) with $\mathbf{W} = \mathbf{I}$ holds for all reflections (integral condition), but the scalar product (ii) is an integer only for $h + k + l = 2n$. Thus, reflections hkl with $h + k + l \neq 2n$ are absent. The screw

rotation 4 has the screw part $\mathbf{w}_g = \begin{pmatrix} 0 \\ 0 \\ \frac{1}{4} \end{pmatrix}$. Only $00l$ reflections