

1. SUBPERIODIC GROUP TABLES: FRIEZE-GROUP, ROD-GROUP AND LAYER-GROUP TYPES

Table 1.2.17.2 (cont.)

	1	2	3	4	5	6	7	8	9
	65	$\mu 6_3 22$	72	$P6_3(22)$	73	$(a) \cdot 6_3 : 2$	$p6_3 22$	$r6_3 22$	$6_3 P22$
	66	$\mu 6_4 22$	71	$P6_4(22)$	74	$(a) \cdot 6_4 : 2$	$p6_4 22$	$r6_4 22$	$6_4 P22$
	67	$\mu 6_5 22$	69	$P6_5(22)$	75	$(a) \cdot 6_5 : 2$	$p6_5 22$	$r6_5 22$	$6_5 P22$
	68	$\mu 6mm$	64	$P6(mm)$	43	$(a) \cdot 6 \cdot m$	$p6mm$	$r6mm$	$6mmP1$
	69	$\mu 6cc$	65	$P6(cc)$	44	$(a) \cdot 6 \cdot \bar{a}$	$p6aa$	$r6cc$	$6ggP1$
	70	$\mu 6_3 mc$	66	$P6_3(cm)$	45	$(a) \cdot 6_3 \cdot m$	$p6_3 ma$	$r6_3 mc$	$6_3 mgP1$
	71	$\mu \bar{6}m2$	54	$P\bar{6}(m2)$	51	$(a) \cdot m \cdot 3 : m$	$p\bar{6}m2$	$r\bar{6}m2$	$3mPm2$
	72	$\mu \bar{6}c2$	55	$P\bar{6}(c2)$	52	$(a) \cdot \bar{a} \cdot 3 : m$	$p\bar{6}a2$	$r\bar{6}c2$	$3gPm2$
	73	$\mu 6/mmm$	73	$P6/m(2/m2/m)$	56	$(a) \cdot m \cdot 6 : m$	$p6/mmm$	$r6/m2/m2/m$	$6mmPm$
	74	$\mu 6/mcc$	74	$P6/m(2/c2/c)$	57	$(a) \cdot \bar{a} \cdot 6 : m$	$p6/maa$	$r6/m2/c2/c$	$6ggPm$
	75	$\mu 6_3/mmc$	75	$P6_3/m(2/c2/m)$	58	$(a) \cdot m \cdot 6_3 : m$	$p6_3/mma$	$r6_3/m2/m2/c$	$6_3 mgPm$

Column 8: symbols listed by Opechowski (1986).

Column 9: symbols listed by Niggli (Chapuis, 1966).

Sets of symbols which are of a non-Hermann–Mauguin (international) type are the set of symbols in column 6 and the Niggli-type set of symbols in column 9. The set of symbols in column 8 does not use the lower-case script letter μ , as does *IT A* (2005), to denote a one-dimensional lattice. The order of the characters indicating symmetry elements in the set of symbols in column 7 does not follow the sequence of symmetry directions used for three-dimensional space groups. The set of symbols in column 4 have the characters indicating symmetry elements along non-lattice directions enclosed in parentheses, and do not use a lower-case script letter to denote the one-dimensional lattice. Lastly, the set of symbols in column 4, without the parentheses and with the one-dimensional lattice denoted by a lower-case script μ , are identical with the symbols in Part 3, or in some cases are the second setting of rod groups whose symbols are given in Part 3. These second-setting symbols are included in the symmetry diagrams of the rod groups.

1.2.17.3. Layer groups

A list of sets of symbols for the layer groups is given in Table 1.2.17.3. The information provided in the columns of this table is as follows:

Columns 1 and 2: sequential numbering and symbols used in Part 4.

Columns 3 and 4: sequential numbering and symbols listed by Wood (1964*a,b*) and Litvin & Wike (1991).

Columns 5 and 6: sequential numbering and symbols listed by Bohm & Dornberger-Schiff (1966, 1967).

Columns 7 and 8: sequential numbering and symbols listed by Shubnikov & Koptsik (1974) and Vainshtein (1981).

Column 9: symbols listed by Holser (1958).

Column 10: sequential numbering listed by Weber (1929).

Column 11: symbols listed by Hermann (1929*a,b*).

Column 12: symbols listed by Alexander & Herrmann (1929*a,b*).

Column 13: symbols listed by Niggli (Wood, 1964*a,b*).

Column 14: symbols listed by Shubnikov & Koptsik (1974).

Columns 15 and 16: symbols listed by Aroyo & Wondratschek (1987).

Column 17: symbols listed by Belov *et al.* (1957*a,b*).

Columns 18 and 19: symbols and sequential numbering listed by Belov & Tarkhova (1956*a,b,c,d*).

Columns 20 and 21: symbols listed by Cochran as listed, respectively, by Cochran (1952) and Belov & Tarkhova (1956*a,b,c,d*).

Column 22: symbols listed by Opechowski (1986).

Column 23: symbols listed by Grunbaum & Shephard (1987).

Column 24: symbols listed by Woods (1935*a,b,c*, 1936).

Column 25: symbols listed by Coxeter (1986).

There is also a notation for layer groups, introduced by Janovec (1981), in which all elements in the group symbol which change the direction of the normal to the plane containing the translations are underlined, *e.g.* $p4/\underline{m}$. However, we know of no listing of all layer-group types in this notation.

Sets of symbols which are of a non-Hermann–Mauguin (international) type are the sets of symbols of the Schoenflies type (columns 11 and 12) and symbols of the ‘black and white’ symmetry type (columns 16, 17, 18, 20, 21, 22, 24 and 25). Additional non-Hermann–Mauguin (international) type sets of symbols are those in columns 14 and 23.

Sets of symbols which do not begin with a letter indicating the lattice centring type are the sets of symbols of the Niggli type (columns 13 and 15). The order of the characters indicating symmetry elements in the sets of symbols in columns 4 and 9 does not follow the sequence of symmetry directions used for three-dimensional space groups. The set of symbols in column 6 uses parentheses to denote a symmetry direction which is not a lattice direction. In addition, the set of symbols in column 6 uses upper-case letters to denote the two-dimensional lattice of the layer group, where as in *IT A* (2005) upper-case letters denote three-dimensional lattices.

The symbols in column 8 are either identical with or, in some monoclinic and orthorhombic cases, are the second-setting or alternative-cell-choice symbols of the layer groups whose symbols are given in Part 4. These second-setting and alternative-cell-choice symbols are included in the symmetry diagrams of the layer groups.

The isomorphism between layer groups and two-dimensional magnetic space groups can be seen in Table 1.2.17.3. The set of symbols which we use for layer groups is given in column 2. The sets of symbols in columns 16, 17 and 22 are sets of symbols for the two-dimensional magnetic space groups. The basic relationship between these two sets of groups is the interexchanging of the magnetic symmetry element $1'$ and the layer symmetry element m_z . A detailed discussion of the relationship between these two sets of groups has been given by Opechowski (1986).

References

- Alexander, E. (1929). *Systematik der eindimensionalen Raumgruppen*. *Z. Kristallogr.* **70**, 367–382.
 Alexander, E. (1934). *Bemerkung zur Systematik der eindimensionalen Raumgruppen*. *Z. Kristallogr.* **89**, 606–607.

1.2. GUIDE TO THE USE OF THE SUBPERIODIC GROUP TABLES

Table 1.2.17.3. Layer-group symbols

(a) Columns 1–9.

	1	2	3	4	5	6	7	8	9	
Triclinic/oblique	1	$p1$	1	$P1$	1	$P11(1)$	1	$p1$	$p1$	
	2	$p\bar{1}$	2	$P\bar{1}$	2	$P\bar{1}\bar{1}(\bar{1})$	3	$p\bar{1}$	$p\bar{1}$	
Monoclinic/oblique	3	$p112$	3	$P211$	9	$P11(2)$	5	$p112$	$p21$	
	4	$p11m$	4	$Pm11$	4	$P11(m)$	2	$p11m$	$pm1$	
	5	$p11a$	5	$Pb11$	5	$P11(b)$	4	$p11b$	$pa1$	
	6	$p112/m$	6	$P2/m11$	13	$P11(2/m)$	6	$p112/m$	$p2/m1$	
	7	$p112/a$	7	$P2/b11$	17	$P11(2/b)$	7	$p112/b$	$p2/a1$	
	Monoclinic/rectangular	8	$p211$	8	$P112$	8	$P12(1)$	14	$p121$	$p12$
		9	$p2_111$	9	$P112_1$	10	$P12_1(1)$	15	$p12_11$	$p12_1$
10		$c211$	10	$C112$	11	$C12(1)$	16	$c121$	$c12$	
11		$pm11$	11	$P11m$	3	$P1m(1)$	8	$p1m1$	$p1m$	
12		$pb11$	12	$P11a$	5	$P1a(1)$	10	$p1a1$	$p1b$	
13		$cm11$	13	$C11m$	7	$C1m(1)$	12	$c1m1$	$c1m$	
14		$p2/m11$	14	$P112/m$	12	$P12/m(1)$	17	$p12/m1$	$p12/m$	
15		$p2_1/m11$	15	$P112_1/m$	14	$P12_1/m(1)$	18	$p12_1/m1$	$p12_1/m$	
16		$p2/b11$	17	$P112/a$	16	$P12/a(1)$	20	$p12/a1$	$p12/b$	
17		$p2_1/b11$	18	$P112_1/a$	18	$P12_1/a(1)$	21	$p12_1/a1$	$p12_1/b$	
18		$c2/m11$	16	$C112/m$	15	$C12/m(1)$	19	$c12/m1$	$c12/m$	
Orthorhombic/rectangular		19	$p222$	19	$P222$	33	$P22(2)$	37	$p222$	$p222$
		20	$p2_122$	20	$P222_1$	34	$P2_12(2)$	38	$p2_122$	$p222_1$
		21	$p2_12_12$	21	$P22_12_1$	35	$P2_12_1(2)$	39	$p2_12_12$	$p22_12_1$
		22	$c222$	22	$C222$	36	$C22(2)$	40	$c222$	$c222$
	23	$pmm2$	23	$P2mm$	19	$Pmm(2)$	22	$pmm2$	$p2mm$	
	24	$pma2$	28	$P2ma$	24	$Pma(2)$	24	$pbm2$	$p2ma$	
	25	$pba2$	33	$P2ba$	29	$Pba(2)$	26	$pba2$	$p2ba$	
	26	$cmm2$	34	$C2mm$	30	$Cmm(2)$	28	$cmm2$	$c2mm$	
	27	$pm2m$	24	$Pmm2$	20	$P2m(m)$	9	$p2mm$	$pm2m$	
	28	$pm2_1b$	26	$Pbm2_1$	21	$P2_1m(a)$	30	$p2_1ma$	$pa2_1m$	
	29	$pb2_1m$	25	$Pm2_1a$	22	$P2_1a(m)$	11	$p2_1am$	$pm2_1a$	
	30	$pb2b$	27	$Pbb2$	23	$P2a(a)$	31	$p2aa$	$pa2a$	
	31	$pm2a$	29	$Pam2$	25	$P2m(b)$	32	$p2mb$	$pb2m$	
	32	$pm2_1n$	32	$Pnm2_1$	28	$P2_1m(n)$	35	$p2_1mn$	$pn2_1m$	
	33	$pb2_1a$	30	$Pab2_1$	26	$P2_1a(b)$	33	$p2_1ab$	$pb2_1a$	
	34	$pb2n$	31	$Pnb2$	27	$P2a(n)$	34	$p2an$	$pn2a$	
	35	$cm2m$	35	$Cmm2$	31	$C2m(m)$	13	$c2mm$	$cm2m$	
	36	$cm2e$	36	$Cam2$	32	$Cm2(a)$	36	$c2mb$	$cb2m$	
	37	$pmnm$	37	$P2/m2/m2/m$	37	$P2/m2/m(2/m)$	23	$pmnm$	$p2/m2/m2/m$	
	38	$pmaa$	38	$P2/a2/m2/a$	38	$P2/m2/a(2/a)$	41	$pmaa$	$p2/a2/m2/a$	
	39	$pban$	39	$P2/n2/b2/a$	39	$P2/b2/a(2/n)$	42	$pban$	$p2/n2/b2/a$	
	40	$pmam$	40	$P2/m2_1/m2/a$	41	$P2/b2_1/m(2/m)$	25	$pbmm$	$p2/m2_1/m2/a$	
	41	$pnma$	41	$P2/a2_1/m2/m$	40	$P2_1/m2/m(2/a)$	43	$pnma$	$p2/a2_1/m2/m$	
	42	$pman$	42	$P2/n2/m2_1/a$	42	$P2_1/b2/m(2/n)$	44	$pbmn$	$p2/n2/m2_1/a$	
	43	$pbaa$	43	$P2/a2/b2_1/a$	43	$P2/b2_1/a(2/a)$	45	$pbaa$	$p2/a2/b2_1/a$	
	44	$pbam$	44	$P2/m2_1/b2_1/a$	44	$P2_1/b2_1/a(2/m)$	27	$pbam$	$p2/m2_1/b2_1/a$	
	45	$pbma$	45	$P2/a2_1/b2_1/m$	45	$P2_1/m2_1/a(2/b)$	46	$pbma$	$p2/a2_1/b2_1/m$	
	46	$pmnn$	46	$P2/n2_1/m2_1/m$	46	$P2_1/m2_1/m(2/n)$	47	$pmnn$	$p2/n2_1/m2_1/m$	
	47	$cmmm$	47	$C2/m2/m2/m$	47	$C2/m2/m(2/m)$	29	$cmmm$	$c2/m2/m2/m$	
	48	$cmme$	48	$C2/a2/m2/m$	48	$C2/m2/m(2/a)$	48	$cmma$	$c2/a2/m2/m$	
	Tetragonal/square	49	$p4$	49	$P4$	54	$P(4)11$	50	$p4$	$p4$
		50	$p\bar{4}$	50	$P\bar{4}$	49	$P(\bar{4})11$	49	$p\bar{4}$	$p\bar{4}$
51		$p4/m$	51	$P4/m$	55	$P(4/m)11$	51	$p4/m$	$p4/m$	
52		$p4/n$	52	$P4/n$	56	$P(4/n)11$	57	$p4/n$	$p4/n$	
53		$p422$	53	$P422$	59	$P(4)22$	55	$p422$	$p422$	
54		$p42_12$	54	$P42_12$	60	$P(4)2_12$	56	$p42_12$	$p42_12$	
55		$p4mm$	55	$P4mm$	57	$P(4)mm$	52	$p4mm$	$p4mm$	
56		$p4bm$	56	$P4bm$	58	$P(4)bm$	59	$p4bm$	$p4bm$	
57		$p42m$	57	$P42m$	50	$P(\bar{4})2m$	54	$p42m$	$p42m$	
58		$p4_1m$	58	$P4_1m$	51	$P(\bar{4})2_1m$	60	$p4_1m$	$p4_1m$	
59		$p4m2$	59	$P4m2$	52	$P(\bar{4})m2$	61	$p4m2$	$p4m2$	
60		$p4b2$	60	$P4b2$	53	$P(\bar{4})b2$	64	$p4b2$	$p4b2$	
61		$p4/mmm$	61	$P4/m2/m2/m$	61	$P(4/m)2/m2/m$	53	$p4/mmm$	$p4/m2/m2/m$	
62		$p4/nbm$	62	$P4/n2/b2/m$	62	$P(4/n)2/b2/m$	62	$p4/nbm$	$p4/n2/b2/m$	

1. SUBPERIODIC GROUP TABLES: FRIEZE-GROUP, ROD-GROUP AND LAYER-GROUP TYPES

Table 1.2.17.3 (cont.)

	1	2	3	4	5	6	7	8	9
Trigonal/hexagonal	63	$p4/mbm$	63	$P4/m2_1/b2/m$	63	$P(4/m)2_1/b2/m$	58	$p4/mbm$	$p4/m2_1/b2/m$
	64	$p4/nmm$	64	$P4/n2_1/m2/m$	64	$P(4/n)2_1/m2/m$	63	$p4/nmm$	$p4/n2_1/m2/m$
	65	$p3$	65	$P3$	65	$P(3)11$	65	$p3$	$p3$
	66	$p\bar{3}$	66	$P\bar{3}$	66	$P(\bar{3})11$	67	$p\bar{3}$	$p\bar{3}$
	67	$p312$	67	$P312$	70	$P(3)12$	72	$p312$	$p312$
	68	$p321$	68	$P321$	69	$P(3)21$	73	$p321$	$p321$
	69	$p3m1$	69	$P3m1$	67	$P(3)m1$	68	$p3m1$	$p3m1$
	70	$p31m$	70	$P31m$	68	$P(3)1m$	70	$p31m$	$p31m$
Hexagonal/hexagonal	71	$p\bar{3}1m$	71	$P\bar{3}12/m$	72	$P(\bar{3})1m$	74	$p\bar{3}1m$	$p\bar{3}12/m$
	72	$p\bar{3}m1$	72	$P\bar{3}2/m1$	71	$P(\bar{3})m1$	75	$p\bar{3}m1$	$p\bar{3}2/m1$
	73	$p6$	73	$P6$	76	$P(6)11$	76	$p6$	$p6$
	74	$p\bar{6}$	74	$P\bar{6}$	73	$P(\bar{6})11$	66	$p\bar{6}$	$p\bar{6}$
	75	$p6/m$	75	$P6/m$	77	$P(6/m)11$	77	$p6/m$	$p6/m$
	76	$p622$	76	$P622$	79	$P(6)22$	80	$p622$	$p622$
	77	$p6mm$	77	$P6mm$	78	$P(6)mm$	78	$p6mm$	$p6mm$
	78	$p\bar{6}m2$	78	$P\bar{6}m2$	74	$P(\bar{6})m2$	69	$p\bar{6}m2$	$p\bar{6}m2$
	79	$p\bar{6}2m$	79	$P\bar{6}2m$	75	$P(\bar{6})2m$	71	$p\bar{6}2m$	$p\bar{6}2m$
	80	$p6/mmm$	80	$P6/m2/m2/m$	80	$P(6/m)2/m2/m$	79	$p6/mmm$	$p6/m2/m2/m$

(b) Columns 10–17.

	1	10	11	12	13	14	15	16	17
Triclinic/oblique	1	1	$C_1\bar{p}$	C_1^1	1P1	$(a/b) \cdot 1$	1p1	p1	p1
Monoclinic/oblique	2	2	$S_2\bar{p}$	C_1^i	1P $\bar{1}$	$(a/b) \cdot \bar{1}$	1p $\bar{1}$	p2'	p2'
	3	8	$C_2\bar{p}$	C_2^1	1P2	$(a/b) : 2$	1p112	p2	p2
	4	3	$C_{1h}\bar{p}\mu$	C_{1h}^1	mP1	$(a/b) \cdot m$	mp1	p*1	
	5	4	$C_{1h}\bar{p}\alpha$	C_{1h}^2	aP1	$(a/b) \cdot \bar{b}$	bp1	p'_b1	p'_b1
Monoclinic/rectangular	6	12	$C_{2h}\bar{p}\mu$	C_{2h}^1	mP2	$(a/b) \cdot m : 2$	mp112	p*2	
	7	13	$C_{2h}\bar{p}\alpha$	C_{2h}^2	aP2	$(a/b) \cdot \bar{b} : 2$	bp112	p'_b2	p'_b2
	8	9	$D_1\bar{p}1$	C_2^2	1P12	$(a : b) \cdot 2$	1p12	p1m'1	pm'
	9	10	$D_1\bar{p}2$	C_2^3	1P12 $_1$	$(a : b) \cdot 2_1$	1p12 $_1$	p1g'1	pg'
	10	11	$D_1\bar{c}1$	C_2^4	1C12	$(\frac{a+b}{2} / a : b) \cdot 2$	1c12	c1m'1	cm'
	11	5	$C_{1v}\bar{p}\mu$	C_{1h}^3	1P1m	$(a : b) : m$	1p1m	p11m	pm
	12	6	$C_{1v}\bar{p}\beta$	C_{1h}^4	1P1g	$(a : b) : \bar{a}$	1p1a	p11g	pg
	13	7	$C_{1v}\bar{c}\mu$	C_{1h}^5	1C1m	$(\frac{a+b}{2} / a : b) : m$	1c1m	c11m	cm
	14	14	$D_{1d}\bar{p}\mu1$	C_{2h}^3	1P12/m	$(a : b) \cdot 2 : m$	1p12/m	p2'm'm	pm'm
	15	15	$D_{1d}\bar{p}\mu2$	C_{2h}^5	1P12 $_1/m$	$(a : b) \cdot 2_1 : m$	1p12 $_1/m$	p2'g'm	pg'm
Orthorhombic/rectangular	16	18	$D_{1d}\bar{p}\beta2$	C_{2h}^6	1P12/g	$(a : b) \cdot 2 \cdot \bar{a}$	1p12 $_1/a$	p2'g'g	pg'g
	17	17	$D_{1d}\bar{p}\beta1$	C_{2h}^4	1P12 $_1/g$	$(a : b) \cdot 2_1 : \bar{a}$	1p12/a	p2'm'g	pm'g
	18	16	$D_{1d}\bar{c}\mu1$	C_{2h}^7	1C12/m	$(\frac{a+b}{2} / a : b) \cdot 2 : m$	1c12/m	c2'm'm	cm'm
	19	33	$D_2\bar{p}11$	V^1	1P222	$(a : b) : 2 : 2$	1p222	p2m'm'	pm'm'
	20	34	$D_2\bar{p}12$	V^3	1P222 $_1$	$(a : b) : 2 : 2_1$	1p22 $_12$	p2g'm'	pm'g'
	21	35	$D_2\bar{p}22$	V^2	1P22 $_12_1$	$(a : b) \cdot 2_1 : 2_1$	1p2 $_12_12$	p2g'g'	pg'g'
	22	36	$D_2\bar{c}11$	V^4	1C222	$(\frac{a+b}{2} / a : b) : 2 : 2$	1c222	c2m'm'	cm'm'
	23	19	$C_{2v}\bar{p}\mu\mu$	C_{2v}^1	1P2mm	$(a : b) : 2 \cdot m$	1pmm2	p2mm	pnmm
	24	20	$C_{2v}\bar{p}\mu\alpha$	C_{2v}^2	1P2mg	$(a : b) : 2 \cdot \bar{b}$	1pma2	p2mg	pmg
	25	21	$C_{2v}\bar{p}\beta\alpha$	C_{2v}^{10}	1P2gg	$(a : b) : \bar{a} : \bar{b}$	1pba2	p2gg	pgg
	26	22	$C_{2v}\bar{c}\mu\mu$	C_{2v}^3	1C2mm	$(\frac{a+b}{2} / a : b) : m \cdot 2$	1cnmm2	c2mm	cnmm
	27	23	$D_{1h}\bar{p}\mu\mu$	C_{2v}^4	mP12m	$(a : b) \cdot m \cdot 2$	mpm2	p*1m1	
	28	25	$D_{1h}\bar{p}\beta\mu$	C_{2v}^5	aP12 $_1m$	$(a : b) : m \cdot 2_1$	bpm2 $_1$	p'_b1m1	p'_b1m
	29	24	$D_{1h}\bar{p}\mu\beta$	C_{2v}^7	mP12 $_1g$	$(a : b) \cdot m \cdot 2_1$	mpb2 $_1$	p*1g1	
	30	26	$D_{1h}\bar{p}\beta\beta$	C_{2v}^6	aP12g	$(a : b) : \bar{a} \cdot 2$	bpb2	$p'_b1m'1$	p'_b1g
	31	27	$D_{1h}\bar{p}\alpha\mu$	C_{11}^{11}	bP12m	$(a : b) : \bar{b} \cdot 2$	apm2	p'_a1m1	p'_a1m
	32	30	$D_{1h}\bar{p}\nu\mu$	C_{11}^{13}	nP12 $_1m$	$(a : b) : ab \cdot 2_1$	npm2 $_1$	c'1m1	p'_c1m
	33	28	$D_{1h}\bar{p}\alpha\beta$	C_{11}^{14}	bP12 $_1g$	$(a : b) : \bar{b} : \bar{a}$	apb2 $_1$	p'_a1g1	p'_a1g
34	29	$D_{1h}\bar{p}\nu\beta$	C_{11}^{12}	nP12g	$(a : b) : ab \cdot 2$	npb2	c'1m'1	p'_c1m'	
35	31	$D_{1h}\bar{c}\mu\mu$	C_{2v}^8	mC12m	$(\frac{a+b}{2} / a : b) \cdot m \cdot 2$	mcm2	c*1m1		
36	32	$D_{1h}\bar{c}\alpha\mu$	C_{2v}^9	aC12m	$(\frac{a+b}{2} / a : b) \cdot \bar{b} \cdot 2$	acm2	$p'_{a'b'}1m1$	c'1m	
37	37	$D_{2h}\bar{p}\mu\mu\mu$	V_h^1	mP2mm	$(a : b) \cdot m : 2 \cdot m$	mp2/m2/m2	p*2mm		
38	38	$D_{2h}\bar{p}\alpha\mu\alpha$	V_h^5	aP2mg	$(a : b) : \bar{a} : 2 \cdot \bar{a}$	ip2/m2/a2	p'_a2mg	$p'_a mg$	
39	39	$D_{2h}\bar{p}\nu\beta\alpha$	V_h^3	nP2gg	$(a : b) : ab : 2 \cdot a$	np2/b2/a2	c'2m'm'	$p'_c m' m'$	
40	40	$D_{2h}\bar{p}\mu\mu\alpha$	V_h^3	mP2mg	$(a : b) \cdot m : 2 \cdot \bar{b}$	np2 $_1/m2/a2$	p*2mg		
41	41	$D_{2h}\bar{p}\alpha\mu\mu$	V_h^9	aP2mm	$(a : b) : \bar{a} : 2 \cdot m$	ap2 $_1/m2/m2$	p'_a2mm	$p'_a mm$	
42	42	$D_{2h}\bar{p}\nu\mu\alpha$	V_h^{11}	nP2mg	$(a : b) : ab : 2 \cdot b$	np2/m2 $_1/a2$	c'2mm'	$p'_c m' m'$	

1.2. GUIDE TO THE USE OF THE SUBPERIODIC GROUP TABLES

Table 1.2.17.3 (cont.)

	1	10	11	12	13	14	15	16	17
Tetragonal/square	43	43	$D_{2h}\bar{p}\alpha\beta\alpha$	V_h^{10}	$aP2gg$	$(a : b) \cdot \bar{a} : 2 : \bar{b}$	$ap2/b2_1/a2$	p'_a2gg	p'_bgg
	44	44	$D_{2h}\bar{p}\mu\beta\alpha$	V_h^2	$mP2gg$	$(a : b) \cdot m : \bar{a} : \bar{b}$	$np2_1/b2_1/a2$	p^*2gg	
	45	45	$D_{2h}\bar{p}\alpha\beta\mu$	V_h^7	$aP2gm$	$(a : b) \cdot \bar{b} : 2 : \bar{a}$	$ap2_1/b2_1/m2$	p'_a2gm	p'_bmg
	46	46	$D_{2h}\bar{p}\nu\mu\mu$	V_h^8	$nP2mm$	$(a : b) \cdot ab : 2 \cdot m$	$np2_1/m2_1/m2$	c^*2mm	p'_cmm
	47	47	$D_{2h}\bar{c}\mu\mu\mu$	V_h^4	$mC2mm$	$(\frac{a+b}{2} / a : b) \cdot m : 2 \cdot m$	$mc2/m2/m2$	c^*2mm	
	48	48	$D_{2h}\bar{c}\alpha\mu\mu$	V_h^{12}	$aC2mm$	$(\frac{a+b}{2} / a : b) \cdot \bar{a} : 2 \cdot m$	$ac2/m2/m2$	$p'_{a'b'}2mm$	$c'mm$
	49	58	$C_4\bar{p}$	C_4^1	$1P4$	$(a : a) : 4$	$1p4$	$p4$	$p4$
	50	57	$S_4\bar{p}$	S_4^1	$1P\bar{4}$	$(a : a) : \bar{4}$	$1p\bar{4}$	$p4'$	$p4'$
	51	61	$C_{4h}\bar{p}\mu$	C_{4h}^1	$mP4$	$(a : a) : 4 : m$	$mp4$	p^*4	
	52	62	$C_{4h}\bar{p}\nu$	C_{4h}^2	$nP4$	$(a : a) : 4 : ab$	$np4$	$c'4$	$p'4$
	53	67	$D_4\bar{p}11$	D_4^1	$1P422$	$(a : a) : 4 : 2$	$1p422$	$p4m'm'$	$p4m'm'$
	54	68	$D_4\bar{p}21$	D_4^2	$1P42_12$	$(a : a) : 4 : 2_1$	$1p42_12$	$p4g'm'$	$p4g'm'$
	55	59	$C_{4v}\bar{p}\mu\mu$	C_{4v}^1	$1P4mm$	$(a : a) : 4 : m$	$1p4mm$	$p4mm$	$p4mm$
	56	60	$C_{4v}\bar{p}\beta\mu$	C_{4v}^2	$1P4gm$	$(a : a) : 4 \odot b$	$1p4bm$	$p4gm$	$p4gm$
	57	63	$D_{2d}\bar{p}\mu 1$	V_d^1	$1P\bar{4}2m$	$(a : a) : \bar{4} : 2$	$1p\bar{4}2m$	$p4'm'm$	$p4'm'm$
	58	64	$D_{2d}\bar{p}\mu 2$	V_d^2	$1P\bar{4}2_1m$	$(a : a) : \bar{4} \odot 2_1$	$1p\bar{4}_12m$	$p4'g'm$	$p4'g'm$
	59	65	$D_{2d}\bar{c}\mu 1$	V_d^3	$1P4m2$	$(a : a) : \bar{4} \cdot m$	$1p4m2$	$p4'mm'$	$p4'mm'$
	60	66	$D_{2d}\bar{c}\beta 1$	V_d^4	$1P4g2$	$(a : a) : \bar{4} \odot \bar{b}$	$1p4b2$	$p4'gm'$	$p4'gm'$
Trigonal/hexagonal	61	69	$D_{4h}\bar{p}\mu\mu\mu$	D_{4h}^1	$mP4mm$	$(a : a) \cdot m : 4 \cdot m$	$mp42/m2/m$	p^*4mm	
	62	70	$D_{4h}\bar{p}\nu\beta\mu$	D_{4h}^2	$nP4gm$	$(a : a) : ab : 4 \odot b$	$np42/b2/m$	$c'4m'm$	$p'4gm$
	63	71	$D_{4h}\bar{p}\mu\beta\mu$	D_{4h}^3	$mP4gm$	$(a : a) \cdot m : 4 \odot b$	$mp42_1/b2/m$	p^*4gm	
	64	72	$D_{4h}\bar{p}\nu\mu\mu$	D_{4h}^4	$nP4mm$	$(a : a) \cdot ab : 4 \cdot m$	$np42_1/m2/m$	$c'4mm$	$p'4mm$
	65	49	$C_3\bar{c}$	C_3^1	$1P3$	$(a/a) : 3$	$1p3$	$p3$	$p3$
	66	50	$S_6\bar{p}$	C_{3i}^1	$1P\bar{3}$	$(a/a) : \bar{3}$	$1p\bar{3}$	$p6'$	$p6'$
	67	54	$D_3\bar{c}1$	D_3^1	$1P312$	$(a/a) : 2 : 3$	$1p312$	$p3m'1$	$p3m'1$
	68	53	$D_3\bar{h}1$	D_3^2	$1P321$	$(a/a) \cdot 2 : 3$	$1p321$	$p31m'$	$p31m'$
	69	51	$C_{3v}\bar{c}\mu$	C_{3v}^2	$1P3m1$	$(a/a) : m : 3$	$1p3m1$	$p3m1$	$p3m1$
	70	52	$C_{3v}\bar{h}\mu$	C_{3v}^1	$1P31m$	$(a/a) \cdot m : 3$	$1p31m$	$p31m$	$p31m$
	71	55	$D_{3d}\bar{c}\mu 1$	D_{3d}^2	$1P\bar{3}1m$	$(a/a) \cdot m : \bar{6}$	$1p\bar{3}12/m$	$p6'm'm$	$p6'm'm$
	72	56	$D_{3d}\bar{h}\mu 1$	D_{3d}^1	$1P\bar{3}m1$	$(a/a) \cdot m : \bar{6}$	$1p\bar{3}2/m1$	$p6'mm'$	$p6'mm'$
Hexagonal/hexagonal	73	76	$C_6\bar{c}$	C_6^1	$1P6$	$(a/a) : 6$	$1p6$	$p6$	$p6$
	74	73	$C_{3h}\bar{c}\mu$	C_{3h}^1	$mP3$	$(a/a) : 3 : m$	$mp3$	p^*3	
	75	78	$C_{6h}\bar{c}\mu$	C_{6h}^1	$mP6$	$(a/a) \cdot m : 6$	$mp6$	p^*6	
	76	79	$D_6\bar{c}11$	D_6^1	$1P622$	$(a/a) \cdot 2 : 6$	$1p622$	$p6m'm'$	$p6m'm'$
	77	77	$C_{6v}\bar{c}\mu\mu$	C_{6v}^1	$1P6mm$	$(a/a) : m : 6$	$1p6mm$	$p6mm$	$p6mm$
	78	74	$D_{3h}\bar{c}\mu\mu$	D_{3h}^1	$mP3m2$	$(a/a) : m : 3 : m$	$mp3m2$	p^*3m1	
	79	75	$D_{3h}\bar{h}\mu\mu$	D_{3h}^2	$mP32m$	$(a/a) \cdot m : 3 \cdot m$	$mp32m$	p^*31m	
	80	80	$D_{6h}\bar{c}\mu\mu\mu$	D_{6h}^1	$mP6mm$	$(a/a) \cdot m : 6 \cdot m$	$mp6mm$	p^*6mm	

(c) Columns 18–25.

	1	18	19	20	21	22	23	24	25
Triclinic/oblique	1	$p1$	47			$p1$			
Monoclinic/oblique	2	$p2'$	1	$p2'$	$p2^-$	$p2'$	$p2[2]_1$	$2'11$	$p2/p1$
	3	$p2$	48			$p2$			
	4	$p1'$	64			$p11'$			
Monoclinic/rectangular	5	p'_b1	2	pt'	pt^-	$p_{2b}1$	$p1[2]$	$b11$	$p1/p1$
	6	$p21'$	65			$p21'$			
	7	p'_b2	3	$p2t'$	$p2t^-$	$p_{2b}2$	$p2[2]_2$	$2/b11$	$p2/p2$
	8	pm'	4	pm'	pm^-	pm'	$pm[2]_4$	$12'1$	$pm/p1$
	9	pg'	5	pg'	pg^-	pg'	$pg[2]_1$	$112'_1$	$pg/p1$
	10	cm'	6	cm'	cm^-	cm'	$cm[2]_1$	$c112'$	$cm/p1$
	11	pm	49			pm			
	12	pg	50			pg			
	13	cm	51			cm			
	14	pnm'	14	pnm'	pmm^-	$pm'm$	$pnm[2]_2$	$2'2'2$	pnm/pm
15	pmg'	17	pmg'	pmg^-	pmg'	$pmg[2]_4$	$2'2'_12$	pmg/pm	
16	pgg'	18	pgg'	pgg^-	pgg'	$pgg[2]_1$	$2'2'_12_1$	pgg/pg	
17	$pm'g$	16	$pm'g$	pm^-g	$pm'g$	$pmg[2]_2$	$2'2'_12'$	pmg/pg	
Orthorhombic/rectangular	18	cmm'	21	cmm'	cmm^-	cmm'	$cmm[2]_2$	$c2'22'$	cmm/cm
	19	$pm'm'$	15	$pm'm'$	pm^-m^-	$pm'm'$	$pnm[2]_5$	$22'2'$	$pnm/p2$
	20	$pm'g'$	20	$pm'g'$	pm^-g^-	$pm'g'$	$pmg[2]_5$	$22'2'_1$	$pmg/p2$
	21	$pg'g'$	19	$pg'g'$	pg^-g^-	$pg'g'$	$pgg[2]_2$	$22'_12'_1$	$pgg/p2$
	22	$cm'm'$	22	$cm'm'$	cm^-m^-	$cm'm'$	$cmm[2]_4$	$c22'2'$	$cmm/p2$

1. SUBPERIODIC GROUP TABLES: FRIEZE-GROUP, ROD-GROUP AND LAYER-GROUP TYPES

Table 1.2.17.3 (cont.)

	1	18	19	20	21	22	23	24	25
Tetragonal/square	23	$pmm2$	52			pmm			
	24	$pmg2$	53			pmg			
	25	$pgg2$	54			pgg			
	26	$cmm2$	55			cmm			
	27	$pm1'$	66			$pm1'$			
	28	$p'_b m$	7	$pm + t'$	$pm + t^-$	$p_{2b} m$	$pm[2]_3$	$b12$	$pm/pm(m)$
	29	$pg1'$	67			$pg1'$			
	30	$p'_b g$	8	$pg + t'$	$pg + t^-$	$p_{2b} m'$	$pm[2]_1$	$b12_1$	pm/pg
	31	$p'_b 1m$	9	$pm + m'$	$pm + m^-$	$p_{2a} m$	$pm[2]_5$	$b'1m$	$pm/pm(m')$
	32	$p'_c m$	11	$pm + g'$	$pm + g^-$	$c_p m$	$cm[2]_3$	$n12$	cm/pm
	33	$p'_b 1g$	10	$pg + g'$	$pg + g^-$	$p_{2a} g$	$pg[2]_2$	$b2_1 1$	pg/pg
	34	$p'_c g$	12	$pg + m'$	$pg + m^-$	$c_p m'$	$cm[2]_2$	$n12_1$	cm/pg
	35	$cm1'$	68			$cm1'$			
	36	$c'm$	13	$cm + m'$	$cm + m^-$	$p_c m$	$pm[2]_2$	$ca12$	pm/cm
	37	$pmm21'$	69			$pmm1'$			
	38	$p'_b gm$	25	$pg, m + m'$	$pg, m + m^-$	$p_{2a} mm'$	$pmm[2]_4$	$a2_1 2$	pmm/pgm
	39	$p'_c gg$	29	$pg + m', g + m'$	$pg + m^-, g + m^-$	$c_p m' m'$	$cmm[2]_1$	$n2_1 2_1$	cmm/pgg
	40	$pmg21'$	70			$pmg1'$			
	41	$p'_b mm$	23	$pm, m + m'$	$pm, m + m^-$	$p_{2a} mm$	$pmm[2]_1$	$a22$	pmm/pmm
	42	$p'_c mg$	28	$pm + g', g + m'$	$pm + g^-, g + m^-$	$c_p mm'$	$cmm[2]_3$	$n22_1$	cmm/pgm
	43	$p'_b gg$	26	$pg, g + g'$	$pg, g + g^-$	$p_{2b} m' g$	$pmg[2]_3$	$a2_1 2_1$	pmg/pgg
	44	$pgg21'$	71			$pgg1'$			
	45	$p'_b mg$	24	$pm, g + g'$	$pm, g + g^-$	$p_{2b} mg$	$pmg[2]_1$	$b2_1 2$	pmg/pgm
	46	$p'_c mm$	27	$pm + g', m + g'$	$pm + g^-, m + g^-$	$c_p mm$	$cmm[2]_5$	$n22$	cmm/pmm
	47	$cmm21'$	72			$cmm1'$			
	48	$c'mm$	30	$cm + m', m + m'$	$cm + m^-, m + m^-$	$p_c mm$	$pmm[2]_3$	$ca22$	pmm/cmm
	49	$p4$	56			$p4$			
	50	$p4'$	31	$p4'$	$p4^-$	$p4'$	$p4[2]_2$	$4'11$	$p4/p2$
	51	$p41'$	73			$p41'$			
	52	$p'_c 4$	32	$p4'$	$p4^-$	$p_p 4$	$p4[2]_1$	$4/n11$	$p4/p4$
	53	$p4m' m'$	35	$p4m' m'$	$p4m^- m^-$	$p4m'$	$pm4[2]_2$	$42'2'$	$p4m/p4$
	54	$p4g' m'$	38	$p4g' m'$	$p4g^- m^-$	$p4g'$	$p4g[2]_1$	$42'_1 2'$	$p4g/p4$
	55	$p4mm$	57			$p4m$			
	56	$p4gm$	58			$p4g$			
	57	$p4' m' m$	34	$p4' m' m$	$p4^- m^- m$	$p4' m'$	$p4m[2]_3$	$4'2'2$	$p4m/cmm$
	58	$p4' g' m$	37	$p4' g' m$	$p4^- g^- m$	$p4' g'$	$p4g[2]_2$	$4'2'_1 2$	$p4g/cmm$
	59	$p4' mm'$	33	$p4' mm'$	$p4^- mm^-$	$p4' m$	$p4m[2]_4$	$4'22'$	$p4m/pmm$
	60	$p4' gm'$	36	$p4' gm'$	$p4^- gm^-$	$p4' g$	$p4g[2]_3$	$4'2_1 2'$	$p4g/pgg$
	61	$p4mm1'$	74			$p4m1'$			
	62	$p'_c 4gm$	40	$p4g + m', m + m'$	$p4g + m^-, m + m^-$	$p_p 4m'$	$p4m[2]_1$	$4/n2_1 2$	$p4m/p4g$
	63	$p4gm1'$	75			$p4g1'$			
	64	$p'_c 4mm$	39	$p4m + g', m + m'$	$p4m + g^-, m + m^-$	$p_p 4m$	$p4m[2]_5$	$4/n22$	$p4m/p4m$
	65	$p3$	59			$p3$			
	66	$p6'$	43	$p6'$	$p6^-$	$p6'$	$p6[2]$	$6'$	$p6/p3$
	67	$p3m'$	41	$p3m' 1$	$p3m^- 1$	$p3m' 1$	$p3m1[2]$	$312'$	$p3m1/p3$
	68	$p31m'$	42	$p31m'$	$p31m^-$	$p31m'$	$p31m[2]$	$32'1$	$p31m/p3$
	69	$p3m$	60			$p3m1$			
	70	$p31m$	61			$p31m$			
71	$p6' m' m$	44	$p6' m' m$	$p6^- m^- m$	$p6' m'$	$p6m[2]_1$	$6'22'$	$p6m/p31m$	
72	$p6' mm'$	45	$p6' mm'$	$p6^- mm^-$	$p6' m$	$p6m[2]_2$	$6'2'2$	$p6m/p3m1$	
73	$p6$	62			$p6$				
74	$p3'$	76			$p31'$				
75	$p61'$	79			$p61'$				
76	$p6m' m'$	46	$p6m' m'$	$p6m^- m^-$	$p6m'$	$p6m[2]_3$	$62'2'$	$p6m/p6$	
77	$p6mm$	63			$p6m$				
78	$p3' m$	77			$p3m11'$				
79	$p3' 1m$	78			$p31m1'$				
80	$p6mm1'$	80			$p6m1'$				

1.2. GUIDE TO THE USE OF THE SUBPERIODIC GROUP TABLES

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