

Point Groups, Space Groups, and Special Diffraction Conditions

What does the term “Special Conditions” mean? It means a given hkl reflection must be absent if the conditions are not all met. Other reflections may be observed. Examples:

- S.G. 1: None. Means all reflections (all hkl) may be observed.
- S.G. 11: The special conditions are “ $0k0: k=2n$.”
 - For all cases where h and l are “0”, k must be an even number for the reflection to be seen. Thus, “010” would have no intensity but “020” may have a non-zero structure factor.
 - All other possible hkl’s may be observed.
- S.G. 227: The special conditions are “ $hkl: k+l=2n, h+l=2n, h+k=2n; hh0: h=2n, 00l: l=4n; h00: h=4n; 0k0: k=4n; 0kk: k=2n; h0h: h=2n; hk0: h+k=4n; 0kl: k+l=4n; h0l: h+l=4n$.”
 - The first one is the usual face-centered rules – hkl all odd or all even.
 - $hh0: h=2n; 0kk: k=2n; h0h: h=2n$ mean that if one of the indices is zero and the other two are equal, the two indices must be even, yielding a sum divisible by 4. Since this condition cannot be met without meeting the first condition, it seems redundant.
 - $00l: l=4n; h00: h=4n; 0k0: k=4n$ mean that if there are two zeroes in the hkl, the non-zero index must be divisible by 4. Thus, a “200” reflection would not be observed while a “400” may be seen.
 - $hk0: h+k=4n; 0kl: k+l=4n; h0l: h+l=4n$ means that if one of the indices is zero, the other two indices must yield a sum divisible by 4. Thus, a “420” reflection would not be observed while a “220” may be seen.
 - A full appreciation of the effect of the added conditions beyond face-centered can be seen on the table below:

| hkl | Possibly observed in face-centered? | Possibly observed in S.G. 227? |
|-------------|-------------------------------------|--------------------------------|
| 100 | No | No |
| 110 | No | No |
| 111 | Yes | Yes |
| 200 | Yes | No |
| 210 | No | No |
| 211 | No | No |
| 220 | Yes | Yes |
| 330 and 221 | No | No |
| 310 | No | No |
| 311 | Yes | Yes |
| 222 | Yes | Yes |
| 320 | No | No |
| 321 | No | No |
| 400 | Yes | Yes |
| 411, 330 | No | No |
| 331 | Yes | Yes |
| 420 | Yes | No |
| 421 | No | No |

| Triclinic | | | | | |
|-------------|-----------|-------------|------------|------------|--------------------|
| Point Group | | Space Group | | | |
| Long | Short | # | Long | Short | Special Conditions |
| 1 | 1 | 1 | P1 | P1 | None |
| $\bar{1}$ | $\bar{1}$ | 2 | $P\bar{1}$ | $P\bar{1}$ | None |

| Monoclinic | | | | | |
|-----------------|---------------|-------------|---------------------------------|------------------------------|------------------------|
| Point Group | | Space Group | | | |
| Long | Short | # | Long | Short | Special Conditions |
| 121 | 2 | 3 | P121 | P2 | None |
| | | 4 | P12 ₁ 1 | P2 ₁ | 0k0: k=2n |
| | | 5 | C121 | C2 | hkl: h+k=2n |
| 1m1 | m | 6 | P1m1 | Pm | None |
| | | 7 | P1c1 | Pc | h0l: l=2n |
| | | 8 | C1m1 | Cm | hkl: h+k=2n |
| | | 9 | C1c1 | Cc | 0k0: k=2n; h0l: l=2n |
| 1 $\frac{2}{m}$ | $\frac{2}{m}$ | 10 | P1 $\frac{2}{m}$ 1 | P $\frac{2}{m}$ | None |
| | | 11 | P1 $\frac{2}{m}$ ₁ 1 | P $\frac{2}{m}$ ₁ | 0k0: k=2n |
| | | 12 | C1 $\frac{2}{m}$ 1 | C $\frac{2}{m}$ | hkl: h+k=2n |
| | | 13 | P1 $\frac{2}{c}$ 1 | P $\frac{2}{c}$ | h0l: l=2n |
| | | 14 | P1 $\frac{2}{c}$ ₁ 1 | P $\frac{2}{c}$ ₁ | h0l: l=2n; 0k0: k=2n |
| | | 15 | C1 $\frac{2}{c}$ 1 | C $\frac{2}{c}$ | hkl: h+k=2n; h0l: l=2n |

| Orthorhombic | | | | | |
|--------------|-------------------|-------------|---|---|---------------------------------|
| Point Group | | Space Group | | | |
| Long | Short | # | Long | Short | Special Conditions |
| 222 | 22 | 16 | P222 | P222 | None |
| | | 17 | P222 ₁ | P222 ₁ | 00l: l=2n |
| | | 18 | P2 ₁ 2 ₁ 2 | P2 ₁ 2 ₁ 2 | h00: h=2n; 0k0: k=2n |
| | | 19 | P2 ₁ 2 ₁ 2 ₁ | P2 ₁ 2 ₁ 2 ₁ | 00l: l=2n; h00: h=2n; 0k0: k=2n |
| | | 20 | C222 ₁ | C222 ₁ | hkl: h+k=2n; 00l: l=2n |
| | | 21 | C222 | C222 | hkl: h+k=2n |
| | | 22 | F222 | F222 | hkl: k+l=2n, h+l=2n, h+k=2n |
| | | 23 | I222 | I222 | hkl: h+k+l=2n |
| | | 24 | I2 ₁ 2 ₁ 2 ₁ | I2 ₁ 2 ₁ 2 ₁ | hkl: h+k+l=2n |
| | | mm2 | mm | 25 | Pmm2 |
| 26 | Pmc2 ₁ | | | Pmc | 00l: l=2n; h0l: l=2n |
| 27 | Pcc2 | | | Pcc | 0kl: l=2n; h0l: l=2n |
| 28 | Pma2 | | | Pma | h0l: h=2n |
| 29 | Pca2 ₁ | | | Pca | 00l: l=2n; 0kl: l=2n; h0l: h=2n |
| 30 | Pnc2 | | | Pnc | 0kl: k+l=2n; h0l: l=2n |
| 31 | Pmn2 ₁ | | | Pmn | 00l: l=2n; h0l: h+l=2n |

| Orthorhombic | | | | | |
|--------------|---|---------------------------------------|-------------------|------|---|
| | | 32 | Pba2 | Pba | 0kl: k=2n; h0l: h=2n |
| | | 33 | Pna2 ₁ | Pna | 00l: l=2n; 0kl: k+l=2n; h0l: h=2n |
| | | 34 | Pnn2 | Pnn | 0kl: k+l=2n; h0l: h+k=2n |
| | | 35 | Cmm2 | Cmm | hkl: h+k=2n |
| | | 36 | Cmc2 ₁ | Cmc | hkl: h+k=2n; 00l: l=2n; h0l: l=2n |
| | | 37 | Ccc2 | Ccc | hkl: h+k=2n; 0kl: l=2n; h0l: l=2n |
| | | 38 | Amm2 | Amm | hkl: k+l=2n |
| | | 39 | Abm2 | Abm | hkl: k+l=2n; 0kl: k=2n |
| | | 40 | Ama2 | Ama | hkl: k+l=2n; h0l: h=2n |
| | | 41 | Aba2 | Aba | hkl: k+l=2n; 0kl: k=2n; h0l: h=2n |
| | | 42 | Fmm2 | Fmm | hkl: k+l=2n, h+l=2n, h+k=2n |
| | | 43 | Fdd2 | Fdd | hkl: k+l=2n, h+l=2n, h+k=2n; 0kl: k+l=4n; h0l: h+l=4n |
| | | 44 | Imm2 | Imm | hkl: h+k+l=2n |
| | | 45 | lba2 | lba | hkl: h+k+l=2n; 0kl: l=2n; h0l: l=2n |
| | | 46 | lma2 | lma | hkl: h+k+l=2n; h0l: h=2n |
| | | $\frac{2}{m} \frac{2}{m} \frac{2}{m}$ | mmm | 47 | $P \frac{2}{m} \frac{2}{m} \frac{2}{m}$ |
| 48 | $P \frac{2}{n} \frac{2}{n} \frac{2}{n}$ | | | Pnnn | hk0: h+k=2n; 0kl: k+l=2n; h0l: h+l=2n |
| 49 | $P \frac{2}{c} \frac{2}{c} \frac{2}{m}$ | | | Pccm | 0kl: l=2n; h0l: l=2n |
| 50 | $P \frac{2}{b} \frac{2}{a} \frac{2}{n}$ | | | Pban | hk0: h+k=2n; 0kl: k=2n; h0l: h=2n |
| 51 | $P \frac{2}{m} \frac{2}{m} \frac{2}{a}$ | | | Pmma | h00: h=2n; hk0: h=2n |
| 52 | $P \frac{2}{n} \frac{2}{n} \frac{2}{a}$ | | | Pnna | 0k0: k=2n; hk0: h=2n; 0kl: k+l=2n; h0l: h+l=2n |
| 53 | $P \frac{2}{m} \frac{2}{n} \frac{2}{a}$ | | | Pmna | 00l: l=2n; hk0: h=2n; h0l: h+l=2n |
| 54 | $P \frac{2}{c} \frac{2}{c} \frac{2}{a}$ | | | Pcca | h00: h=2n; hk0: h=2n; 0kl: l=2n; h0l: l=2n |
| 55 | $P \frac{2}{b} \frac{2}{a} \frac{2}{m}$ | | | Pbam | h00: h=2n; 0k0: k=2n; 0kl: k=2n; h0l: h=2n |
| 56 | $P \frac{2}{c} \frac{2}{c} \frac{2}{n}$ | | | Pccn | h00: h=2n; 0k0: k=2n; hk0: h+k=2n; 0kl: l=2n; h0l: l=2n |
| 57 | $P \frac{2}{b} \frac{2}{c} \frac{2}{m}$ | | | Pbcm | 00l: l=2n; 0k0: k=2n; 0kl: k=2n; h0l: l=2n |
| 58 | $P \frac{2}{n} \frac{2}{n} \frac{2}{m}$ | | | Pnnm | h00: h=2n; 0k0: k=2n; 0kl: k+l=2n; h0l: h+l=2n |
| 59 | $P \frac{2}{m} \frac{2}{m} \frac{2}{n}$ | | | Pmmn | h00: h=2n; 0k0: k=2n; hk0: h+k=2n |

| Orthorhombic | | | | | |
|--------------|--|----|-------------------------------|------|--|
| | | 60 | $P \frac{2_1 2 2_1}{b c n}$ | Pbcn | 00l: l=2n; h00: h=2n; kh0: h+k=2n; 0kl: k=2n; h0l: l=2n |
| | | 61 | $P \frac{2_1 2_1 2_1}{b c a}$ | Pbca | 00l: l=2n; h00: h=2n; 0k0: k=2n; hk0: h=2n; 0kl: k=2n; h0l: l=2n |
| | | 62 | $P \frac{2_1 2_1 2_1}{n m a}$ | Pnma | 00l: l=2n; h00: h=2n; 0k0: k=2n; hk0: h=2n; 0kl: k+l=2n |
| | | 63 | $C \frac{2 2 2_1}{m c m}$ | Cmcm | hkl: h+k=2n; 00l: l=2n; h0l: l=2n |
| | | 64 | $C \frac{2 2 2_1}{m c a}$ | Cmca | hkl: h+k=2n; 00l: l=2n; hk0: h=2n; h0l: l=2n |
| | | 65 | $C \frac{2 2 2}{m m m}$ | Cmmm | hkl: h+k=2n |
| | | 66 | $C \frac{2 2 2}{c c m}$ | Cccm | hkl: h+k=2n; 0kl: l=2n; h0l: l=2n |
| | | 67 | $C \frac{2 2 2}{m m a}$ | Cmma | hkl: h+k=2n; hk0: h=2n |
| | | 68 | $C \frac{2 2 2}{c c a}$ | Ccca | hkl: h+k=2n; h00: h=2n; hk0: h=2n; 0kl: l=2n; h0l: l=2n |
| | | 69 | $F \frac{2 2 2}{m m m}$ | Fmmm | hkl: k+l=2n, h+l=2n, h+k=2n |
| | | 70 | $F \frac{2 2 2}{d d d}$ | Fddd | hkl: k+l=2n, h+l=2n, h+k=2n; hk0: h+k=4n; 0kl: k+l=4n; h0l: h+l=4n |
| | | 71 | $I \frac{2 2 2}{m m m}$ | Immm | hkl: h+k+l=2n |
| | | 72 | $I \frac{2 2 2}{b a m}$ | Ibam | hkl: h+k+l=2n; 0kl: l=2n; h0l: l=2n |
| | | 73 | $I \frac{2_1 2_1 2_1}{b c a}$ | Ibca | hkl: h+k+l=2n; hk0: k=2n; 0kl: l=2n; h0l: h=2n |
| | | 74 | $I \frac{2_1 2_1 2_1}{m m a}$ | Imma | hkl: h+k+l=2n; 0k0: k=2n; hk0: k=2n |

| Tetragonal | | | | | |
|-------------|-----------|-------------|-----------------|-----------------|--------------------------|
| Point Group | | Space Group | | | |
| Long | Short | # | Long | Short | Special Conditions |
| 4 | 4 | 75 | P4 | P4 | None |
| | | 76 | P4 ₁ | P4 ₁ | 00l: l=4n |
| | | 77 | P4 ₂ | P4 ₂ | 00l: l=2n |
| | | 78 | P4 ₃ | P4 ₃ | 00l: l=4n |
| | | 79 | I4 | I4 | hkl: h+k+l=2n |
| | | 80 | I4 ₁ | I4 ₁ | hkl: h+k+l=2n; 00l: l=4n |
| $\bar{4}$ | $\bar{4}$ | 81 | P $\bar{4}$ | P $\bar{4}$ | P4 ₂ 22 |
| | | 82 | I $\bar{4}$ | I $\bar{4}$ | hkl: h+k+l=2n |

| Tetragonal | | | | | |
|------------------|------------------|-----|---------------------|---------------------|---|
| $\frac{4}{m}$ | $\frac{4}{m}$ | 83 | $P\frac{4}{m}$ | $P\frac{4}{m}$ | None |
| | | 84 | $P\frac{4_2}{m}$ | $P\frac{4_2}{m}$ | 00l: l=2n |
| | | 85 | $P\frac{4}{n}$ | $P\frac{4}{n}$ | $P4_22_12$ |
| | | 86 | $P\frac{4_2}{n}$ | $P\frac{4_2}{n}$ | 00l: l=2n; hk0: h+k=2n |
| | | 87 | $I\frac{4}{m}$ | $I\frac{4}{m}$ | hkl: h+k+l=2n |
| | | 88 | $I\frac{4_1}{a}$ | $I\frac{4_1}{a}$ | hkl: h+k+l=2n; 00l: l=4n; hk0: k=2n |
| 422 | 42 | 89 | $P422$ | $P42$ | None |
| | | 90 | $P42_12$ | $P42_1$ | h00: h=2n; 0k0: k=2n |
| | | 91 | $P4_122$ | $P4_12$ | 00l: l=4n |
| | | 92 | $P4_12_12$ | $P4_12_1$ | 00l: l=4n; h00: h=2n; 0k0: k=2n |
| | | 93 | $P4_222$ | $P4_22$ | 00l: l=2n |
| | | 94 | $P4_22_12$ | $P4_22_1$ | h00: h=2n; 0k0: k=2n; 00l: l=2n |
| | | 95 | $P4_322$ | $P4_32$ | 00l: l=4n |
| | | 96 | $P4_32_12$ | $P4_32_1$ | 00l: l=4n; h00: h=2n; 0k0: k=2n |
| | | 97 | $I422$ | $I422$ | hkl: h+k+l=2n |
| | | 98 | $I4_122$ | $I4_12$ | hkl: h+k+l=2n; 0k0: k=2n; 00l: l=4n |
| 4mm | 4mm | 99 | $P4mm$ | $P4mm$ | None |
| | | 100 | $P4bm$ | $P4bm$ | 0kl: k=2n; h0l: h=2n |
| | | 101 | $P4_2cm$ | $P4cm$ | 00l: l=2n; 0kl: l=2n; h0l: l=2n |
| | | 102 | $P4_2nm$ | $P4nm$ | 00l: l=2n; 0kl: k+l=2n; h0l: h+l=2n |
| | | 103 | $P4cc$ | $P4cc$ | 0kl: l=2n; h0l: l=2n; hhl: l=2n; h-hl: l=2n |
| | | 104 | $P4nc$ | $P4nc$ | 0kl: k+l=2n; h0l: h+l=2n; hhl: l=2n; h-hl: l=2n |
| | | 105 | $P4_2mc$ | $P4mc$ | 00l: l=2n; hhl: l=2n; h-hl: l=2n |
| | | 106 | $P4_2bc$ | $P4bc$ | 00l: l=2n; 0kl: k=2n; h0l: h=2n; hhl: l=2n; h-hl: l=2n |
| | | 107 | $I4mm$ | $I4mm$ | hkl: h+k+l=2n |
| | | 108 | $I4cm$ | $I4cm$ | hkl: h+k+l=2n; 0kl: l=2n; h0l: l=2n; hhl: l=2n; h-hl: l=2n |
| | | 109 | $I4_1md$ | $I4md$ | hkl: h+k+l=2n; 00l: l=4n; hhl: 2h+l=4n; h-hl: 2h+l=4n |
| | | 110 | $I4_1cd$ | $I4cd$ | hkl: h+k+l=2n; 00l: l=4n; 0kl: l=2n; h0l: l=2n; hhl: 2h+l=4n; h-hl: 2h+l=4n |
| $\overline{4}2m$ | $\overline{4}2m$ | 111 | $P\overline{4}2m$ | $P\overline{4}2m$ | None |
| | | 112 | $P\overline{4}2c$ | $P\overline{4}2c$ | hhl: l=2n; h-hl: l=2n |
| | | 113 | $P\overline{4}2_1m$ | $P\overline{4}2_1m$ | h00: h=2n; 0k0: k=2n |
| | | 114 | $P\overline{4}2_1c$ | $P\overline{4}2_1c$ | h00: h=2n; 0k0: k=2n; hhl: l=2n; h-hl: l=2n |

| Tetragonal | | | | | |
|---------------------------------------|---------|-----|--|--------------|--|
| | | 115 | $P\bar{4}m2$ | $P\bar{4}m2$ | None |
| | | 116 | $P\bar{4}c2$ | $P\bar{4}c2$ | 0kl: l=2n; h0l: l=2n |
| | | 117 | $P\bar{4}b2$ | $P\bar{4}b2$ | 0kl: k=2n; h0l: h=2n |
| | | 118 | $P\bar{4}n2$ | $P\bar{4}n2$ | 0kl: k+l=2n; h0l: h+l=2n |
| | | 119 | $I\bar{4}m2$ | $I\bar{4}m2$ | hkl: h+k+l=2n |
| | | 120 | $I\bar{4}c2$ | $I\bar{4}c2$ | hkl: h+k+l=2n; 0kl: l=2n; h0l: l=2n |
| | | 121 | $I\bar{4}2m$ | $I\bar{4}2m$ | hkl: h+k+l=2n |
| | | 122 | $I\bar{4}2d$ | $I\bar{4}2d$ | hkl: h+k+l=2n; 0k0: k=2n; hhl: 2h+l=4n; h-hl: 2h+l=4n |
| $\frac{4}{m} \frac{2}{m} \frac{2}{m}$ | $4/mmm$ | 123 | $P\frac{4}{m} \frac{2}{m} \frac{2}{m}$ | $P4/mmm$ | None |
| | | 124 | $P\frac{4}{m} \frac{2}{c} \frac{2}{c}$ | $P4/mcc$ | 0kl: l=2n; h0l: l=2n |
| | | 125 | $P\frac{4}{n} \frac{2}{b} \frac{2}{m}$ | $P4/nbm$ | hk0: h+k=2n; 0kl: k=2n; h0l: h=2n |
| | | 126 | $P\frac{4}{n} \frac{2}{n} \frac{2}{c}$ | $P4/nnc$ | hk0: h+k=2n; 0kl: k+l=2n; h0l: h+l=2n; hhl: l=2n; h-hl: l=2n |
| | | 127 | $P\frac{4}{m} \frac{2}{b} \frac{2}{m}$ | $P4/mbm$ | h00: h=2n; 0k0: k=2n; 0kl: k=2n; h0l: h=2n |
| | | 128 | $P\frac{4}{m} \frac{2}{n} \frac{2}{c}$ | $P4/mnc$ | h00: h=2n; 0k0: k=2n; 0kl: k+l=2n; h0l: h+l=2n; hhl: l=2n; h-hl: l=2n |
| | | 129 | $P\frac{4}{n} \frac{2}{m} \frac{2}{m}$ | $P4/nmm$ | h00: h=2n; 0k0: k=2n; hk0: h+k=2n |
| | | 130 | $P\frac{4}{n} \frac{2}{c} \frac{2}{c}$ | $P4/ncc$ | h00: h=2n; 0k0: k=2n; hk0: h+k=2n; 0kl: l=2n; h0l: l=2n; hhl: l=2n; h-hl: l=2n |
| | | 131 | $P\frac{4}{m} \frac{2}{m} \frac{2}{c}$ | $P4/mmc$ | 00l: l=2n; hhl: l=2n; h-hl: l=2n |
| | | 132 | $P\frac{4}{m} \frac{2}{c} \frac{2}{m}$ | $P4/mcm$ | 00l: l=2n; 0kl: l=2n; h0l: l=2n |
| | | 133 | $P\frac{4}{n} \frac{2}{b} \frac{2}{c}$ | $P4/nbc$ | 00l: l=2n; hk0: h+k=2n; 0kl: k=2n; h0l: h=2n; hhl: l=2n; h-hl: l=2n |
| | | 134 | $P\frac{4}{n} \frac{2}{n} \frac{2}{m}$ | $P4/nnm$ | 00l: l=2n; hk0: h+k=2n; 0kl: k+l=2n; h0l: h+l=2n |
| | | 135 | $P\frac{4}{m} \frac{2}{b} \frac{2}{c}$ | $P4/mbc$ | h00: h=2n; 0k0: k=2n; 00l: l=2n; 0kl: k=2n; h0l: h=2n; hhl: l=2n; h-hl: l=2n |
| | | 136 | $P\frac{4}{m} \frac{2}{n} \frac{2}{m}$ | $P4/mnm$ | h00: h=2n; 0k0: k=2n; 00l: l=2n; 0kl: k+l=2n; h0l: h+l=2n |
| | | 137 | $P\frac{4}{n} \frac{2}{m} \frac{2}{c}$ | $P4/nmc$ | h00: h=2n; 0k0: k=2n; 00l: l=2n; hk0: h+k=2n; hhl: l=2n; h-hl: l=2n |
| | | 138 | $P\frac{4}{n} \frac{2}{c} \frac{2}{m}$ | $P4/ncm$ | h00: h=2n; 0k0: k=2n; 00l: l=2n; hk0: h+k=2n; 0kl: l=2n; h0l: l=2n |

| Tetragonal | | | | | |
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| | | 139 | $I\frac{4}{m}\frac{2}{m}\frac{2}{m}$ | $I4/mmm$ | hkl: h+k+l=2n |
| | | 140 | $I\frac{4}{m}\frac{2}{c}\frac{2}{m}$ | $I4/mcm$ | hkl: h+k+l=2n; Okl: l=2n; h0l: l=2n; hhl: l=2n; h-hl: l=2n |
| | | 141 | $I\frac{4_1}{a}\frac{2}{m}\frac{2}{d}$ | $I4_1/amd$ | hkl: h+k+l=2n; Ok0: k=2n; 00l: l=4n; hk0: k=2n; hhl: 2h-l=4n; h-hl: 2h+l=4n |
| | | 142 | $I\frac{4_1}{a}\frac{2}{c}\frac{2}{d}$ | $I4_1/acd$ | hkl: h+k+l=2n; 00l: l=4n; hk0: k=2n; Okl: l=2n; h0l: h=2n; hhl: 2h+l=4n; h-hl: 2h+l=4n |

| Trigonal (Rhombohedral) | | | | | |
|-------------------------|------------|-------------|-------------------------|--------------------|---|
| Point Group | | Space Group | | | |
| Long | Short | # | Long | Short | Special Conditions |
| 3 | 3 | 143 | P3 | P3 | None |
| | | 144 | P3 ₁ | P3 ₁ | 00l: l=3n |
| | | 145 | P3 ₂ | P3 ₂ | 00l: l=3n |
| | | 146 | R3 | R3 | hkl: -h+k+l=3n |
| $\bar{3}$ | $\bar{3}$ | 147 | P $\bar{3}$ | P $\bar{3}$ | None |
| | | 148 | R $\bar{3}$ | R $\bar{3}$ | hkl: -h+k+l=3n |
| 312 | 32 | 149 | P312 | P312 | None |
| | | 150 | P321 | P321 | None |
| | | 151 | P3 ₁ 12 | P3 ₁ 12 | 00l: l=3n |
| | | 152 | P3 ₁ 21 | P3 ₁ 21 | 00l: l=3n |
| | | 153 | P3 ₂ 12 | P3 ₂ 12 | 00l: l=3n |
| | | 154 | P3 ₂ 21 | P3 ₂ 21 | 00l: l=3n |
| | | 155 | R32 | R32 | hkl: -h+k+l=3n |
| 31m | 3m | 156 | P3m1 | P3m1 | None |
| | | 157 | P31m | P31m | None |
| | | 158 | P3c1 | P3c1 | Okkl: l=2n; h0l: l=2n; h-hl: l=2n |
| | | 159 | P31c | P31c | hhl: l=2n; h-2hl: l=2n; h-0.5hl: l=2n |
| | | 160 | R3m | R3m | hkl: -h+k+l=3n |
| | | 161 | R3c | R3c | hkl: -h+k+l=3n; Okkl: l=2n; h0l: l=2n; h-hl: l=2n |
| $\bar{3}1\frac{2}{m}$ | $\bar{3}m$ | 162 | P $\bar{3}1\frac{2}{m}$ | P $\bar{3}1m$ | None |
| | | 163 | P $\bar{3}1\frac{2}{c}$ | P $\bar{3}1c$ | hhl: l=2n; h-2hl: l=2n |
| | | 164 | P $\bar{3}\frac{2}{m}1$ | P $\bar{3}m1$ | None |
| | | 165 | P $\bar{3}\frac{2}{c}1$ | P $\bar{3}c1$ | Okkl: l=2n; h0l: l=2n |
| | | 166 | R $\bar{3}\frac{2}{m}$ | R $\bar{3}m$ | hkl: -h+k+l=3n |

| Trigonal (Rhombohedral) | | | | | |
|-------------------------|--|-----|-----------------------|-------------|--|
| | | 167 | $R\bar{3}\frac{2}{c}$ | $R\bar{3}c$ | $hkl: -h+k+l=3n; 0kl: l=2n; h0l: l=2n$ |

| Hexagonal | | | | | |
|---------------------------------------|-------------|-------------|--|--------------|---|
| Point Group | | Space Group | | | |
| Long | Short | # | Long | Short | Special Conditions |
| 6 | 6 | 168 | P6 | P6 | None |
| | | 169 | $P6_1$ | $P6_1$ | 00l: l=6n |
| | | 170 | $P6_5$ | $P6_5$ | 00l: l=6n |
| | | 171 | $P6_2$ | $P6_2$ | 00l: l=3n |
| | | 172 | $P6_4$ | $P6_4$ | 00l: l=3n |
| | | 173 | $P6_3$ | $P6_3$ | 00l: l=2n |
| $\bar{6}$ | $\bar{6}$ | 174 | $P\bar{6}$ | $P\bar{6}$ | None |
| $\frac{6}{m}$ | $6/m$ | 175 | $P\frac{6}{m}$ | $P6/m$ | None |
| | | 176 | $P\frac{6_3}{m}$ | $P6_3/m$ | 00l: l=2n |
| 622 | 62 | 177 | $P622$ | $P62$ | None |
| | | 178 | $P6_122$ | $P6_12$ | 00l: l=6n |
| | | 179 | $P6_522$ | $P6_52$ | 00l: l=6n |
| | | 180 | $P6_222$ | $P6_22$ | 00l: l=3n |
| | | 181 | $P6_422$ | $P6_42$ | 00l: l=3n |
| | | 182 | $P6_322$ | $P6_32$ | 00l: l=2n |
| 6mm | 6mm | 183 | $P6mm$ | $P6mm$ | None |
| | | 184 | $P6cc$ | $P6cc$ | 0kl: l=2n; h0l: l=2n; h-hl: l=2n; hhl: l=2n; h-2hl: l=2n; h-0.5hl: l=2n |
| | | 185 | $P6_3cm$ | $P6_3cm$ | 00l: l=2n; 0kl: l=2n; h0l: l=2n; h-hl: l=2n |
| | | 186 | $P6_3mc$ | $P6_3mc$ | 00l: l=2n; hhl: l=2n; h-2hl: l=2n; h-0.5hl: l=2n |
| $\bar{6}m2$ | $\bar{6}m2$ | 187 | $P\bar{6}m2$ | $P\bar{6}m2$ | None |
| | | 188 | $P\bar{6}c2$ | $P\bar{6}c2$ | 0kl: l=2n; h0l: l=2n; h-hl: l=2n |
| | | 189 | $P\bar{6}2m$ | $P\bar{6}2m$ | None |
| | | 190 | $P\bar{6}2c$ | $P\bar{6}2c$ | hhl: l=2n; h-2hl: l=2n; h-0.5hl: l=2n |
| $\frac{6}{m} \frac{2}{m} \frac{2}{m}$ | $6/mmm$ | 191 | $P\frac{6}{m} \frac{2}{m} \frac{2}{m}$ | $P6/mmm$ | None |
| | | 192 | $P\frac{6}{m} \frac{2}{c} \frac{2}{c}$ | $P6/mcc$ | 0kl: l=2n; h0l: l=2n; h-hl: l=2n; hhl: l=2n; h-2hl: l=2n; h-0.5hl: l=2n |
| | | 193 | $P\frac{6_3}{m} \frac{2}{c} \frac{2}{m}$ | $P6_3/mcm$ | 00l: l=2n; 0kl: l=2n; h0l: l=2n; h-hl: l=2n |
| | | 194 | $P\frac{6_3}{m} \frac{2}{m} \frac{2}{c}$ | $P6_3/mmc$ | 00l: l=2n; hhl: l=2n; h-2hl: l=2n; h-0.5hl: l=2n |

| Cubic | | | | | |
|----------------------|-------------|-------------|------------------------|-------------------|---|
| Point Group | | Space Group | | | |
| Long | Short | # | Long | Short | Special Conditions |
| 23 | 23 | 195 | P23 | P23 | None |
| | | 196 | F23 | F23 | hkl: k+l=2n, h+l=2n, h+k=2n |
| | | 197 | I23 | I23 | hkl: h+k+l=2n |
| | | 198 | P2 ₁ 3 | P2 ₁ 3 | 00l: l=2n; h00: h=2n; 0k0: k=2n |
| | | 199 | I2 ₁ 3 | I2 ₁ 3 | hkl: h+k+l=2n; h-h-h: h=2n; h-hh: h=2n; hh-h: h=2n |
| $\frac{2}{m}\bar{3}$ | m3 | 200 | P $\frac{2}{m}\bar{3}$ | Pm3 | None |
| | | 201 | P $\frac{2}{n}\bar{3}$ | Pn3 | hk0: h+k=2n; 0kl: k+l=2n; h0l: h+l=2n |
| | | 202 | F $\frac{2}{m}\bar{3}$ | Fm3 | hkl: k+l=2n, h+l=2n, h+k=2n |
| | | 203 | F $\frac{2}{d}\bar{3}$ | Fd3 | hkl: k+l=2n, h+l=2n, h+k=2n; hk0: h+k=4n; 0kl: k+l=4n; h0l: h+l=4n |
| | | 204 | I $\frac{2}{m}\bar{3}$ | Im3 | hkl: h+k+l=2n |
| | | 205 | P $\frac{2}{a}\bar{3}$ | Pa3 | 00l: l=2n; h00: h=2n; 0k0: k=2n; hk0: h=2n; 0kl: k=2n; h0l: l=2n |
| | | 206 | I $\frac{2}{a}\bar{3}$ | Ia3 | hkl: h+k+l=2n; h-h-h: h=2n; h-hh: h=2n; hh-h: h=2n; hk0: k=2n; 0kl: l=2n; h0l: h=2n |
| 432 | 43 | 207 | P432 | P43 | None |
| | | 208 | P4 ₂ 32 | P4 ₂ 3 | 00l: l=2n; h00: h=2n; 0k0: k=2n |
| | | 209 | F432 | F43 | hkl: k+l=2n, h+l=2n, h+k=2n |
| | | 210 | F4 ₁ 32 | F4 ₁ 3 | hkl: k+l=2n, h+l=2n, h+k=2n; hh0: h=2n; 00l: l=4n; h00: h=4n; 0k0: k=4n; 0kk: k=2n; h0h: h=2n |
| | | 211 | I432 | I43 | hkl: h+k+l=2n |
| | | 212 | P4 ₃ 32 | P4 ₃ 3 | 00l: l=4n; h00: h=4n; 0k0: k=4n |
| | | 213 | P4 ₁ 32 | P4 ₁ 3 | 00l: l=4n; h00: h=4n; 0k0: k=4n |
| | | 214 | I4 ₁ 32 | I4 ₁ 3 | hkl: h+k+l=2n; h-h-h: h=2n; h-hh: h=2n; hh-h: h=2n; 00l: l=4n; h00: h=4n; 0k0: k=4n |
| $\bar{4}3m$ | $\bar{4}3m$ | 215 | P $\bar{4}3m$ | P $\bar{4}3m$ | None |
| | | 216 | F $\bar{4}3m$ | F $\bar{4}3m$ | hkl: k+l=2n, h+l=2n, h+k=2n |
| | | 217 | I $\bar{4}3m$ | I $\bar{4}3m$ | hkl: h+k+l=2n |
| | | 218 | P $\bar{4}3n$ | P $\bar{4}3n$ | hhl: l=2n; h-hl: l=2n; hkk: h=2n; hkh: k=2n; hk-k: h=2n; hk-h: k=2n |
| | | 219 | F $\bar{4}3c$ | F $\bar{4}3c$ | hkl: k+l=2n, h+l=2n, h+k=2n; hhl: h=2n; h-hl: l=2n; hkk: h=2n; hkh: h=2n; hk=k: h=2n; hk-h: k=2n |
| | | 220 | I $\bar{4}3d$ | I $\bar{4}3d$ | hkl: h+k+l=2n; h-h-h: h=2n; h-hh: h=2n; hh-h: h=2n; hhl: 2h+l=4n; h-hl: 2h+l=4n; hkk: h+2k=4n; hkh: 2h+k=4n; hk-k: h+2k=4n; hk-h: 2h+k=4n |

| Cubic | | | | | |
|-----------------------------------|-----|-----|---------------------------------------|------|---|
| $\frac{4}{m} \bar{3} \frac{2}{m}$ | m3m | 221 | $P \frac{4}{m} \bar{3} \frac{2}{m}$ | Pm3m | None |
| | | 222 | $P \frac{4}{n} \bar{3} \frac{2}{n}$ | Pn3n | hk0: h+k=2n; 0kl: k+l=2n; h0l: h+l=2n; hhl: l=2n; h-hl: l=2n; hkk: h=2n; hkh: k=2n; hk-k: h=2n; hk-h: k=2n |
| | | 223 | $P \frac{4_2}{m} \bar{3} \frac{2}{n}$ | Pm3n | 00l: l=2n; h00: h=2n; 0k0: k=2n; hhl: l=2n; h-hl: l=2n; hkk: h=2n; hkh: k=2n; hk-k: h=2n; hk-h: k=2n |
| | | 224 | $P \frac{4_2}{n} \bar{3} \frac{2}{m}$ | Pn3m | 00l: l=2n; h00: h=2n; 0k0: k=2n; hk0: h+k=2n; 0kl: k+l=2n; h0l: h+l=2n |
| | | 225 | $F \frac{4}{m} \bar{3} \frac{2}{m}$ | Fm3m | hkl: k+l=2n, h+l=2n, h+k=2n |
| | | 226 | $F \frac{4}{m} \bar{3} \frac{2}{c}$ | Fm3c | hkl: k+l=2n, h+l=2n, h+k=2n; 00l: l=2n; 0k-k: k=2n; h0-h: h=2n; 0kk: k=2n; h0h: h=2n; hhl: l=2n; h-hl: l=2n; hkk: k=2n; hkh: h=2n; hk-k: k=2n; hk-k: h=2n |
| | | 227 | $F \frac{4_1}{d} \bar{3} \frac{2}{m}$ | Fd3m | hkl: k+l=2n, h+l=2n, h+k=2n; hh0: h=2n; 00l: l=4n; h00: h=4n; 0k0: k=4n; 0kk: k=2n; h0h: h=2n; hk0: h+k=4n; 0kl: k+l=4n; h0l: h+l=4n |
| | | 228 | $F \frac{4_1}{d} \bar{3} \frac{2}{c}$ | Fd3c | hkl: k+l=2n, h+l=2n, h+k=2n; h-h0: h=2n; hh0: h=2n; 00l: l=4n; 0k-k: k=2n; h0-h: h=2n; h00: h=4n; 0k0: k=4n; hk0: h+k=4n; 0kl: k+l=4n; h0l: h+l=4n; hhl: l=2n; h-hl: h=2n; hkk: k=2n; hkh: h=2n; hk-k: h=2n; hk-h: h=2n |
| | | 229 | $I \frac{4}{m} \bar{3} \frac{2}{m}$ | Im3m | hkl: h+k+l=2n |
| | | 230 | $I \frac{4}{a} \bar{3} \frac{2}{d}$ | Ia3d | hkl: h+k+l=2n; h-h-h: h=2n; h-hh: h=2n; hh-h: h=2n; 00l: l=4n; h00: h=4n; 0k0: k=4n; hk0: k=2n; 0kl: l=2n; h0l: h=2n; hhl: 2h+l=4n; h-hl: 2h+l=4n; hkk: h+2k=4n; hkh: 2h+k=4n; hk-k: h+2k=4n; hk-h: 2h+k=4n |