*Symmetry Point Group Character Tables:*

Compiled By: Matthew Rowley

**[Point Group Identification Flow Chart:](#_Hlk280002251" \s "1,3648,3686,0,,Point Group Identification Flow )**

[**Non-Axial:**](#_Hlk280002267) [CS](#_Hlk279056064), and [Ci](#_Hlk279056075)

[**Cn**](#_Hlk279141207)[**:**](#Cn) [C2](#_Hlk279055677), [C3](#_Hlk279056146), [C4](#_Hlk279056152), [C5](#_Hlk279056168), and [C6](#_Hlk279056184)

[**Cnv**](#_Hlk279141232)**:** [C2v](#_Hlk279057226), [C3v](#_Hlk279057234), [C4v](#_Hlk279057243), [C5v](#_Hlk279057251), and [C6v](#_Hlk279057259)

[**Cnh:**](#_Hlk279141263) [C2h](#_Hlk279059212), [C3h](#_Hlk279059208), [C4h](#_Hlk279059201), [C5h](#_Hlk279059192), and [C](#_Hlk279059176" \s "1,5958,5961,0,,C6h)[6h](#_Hlk279059176" \s "1,5958,5961,0,,C6h)

[**Dn:**](#_Hlk279141293) [D2](#_Hlk279060140), [D3](#_Hlk279060136), [D4](#_Hlk279060132), [D5](#_Hlk279060122), and [D6](#_Hlk279060111)

[**Dnh:**](#_Hlk279141340)[D2h](#_Hlk279062742), [D3h](#_Hlk279062738), [D4h](#_Hlk279062733), [D5h](#_Hlk279062727), and [D](#_Hlk279062716" \s "1,10809,10812,0,,D6h)[6h](#_Hlk279062716" \s "1,10809,10812,0,,D6h)

[**Dnd:**](#_Hlk279141375)[D2d](#_Hlk279063174), [D3d](#_Hlk279063523), [D4d](#_Hlk279063445), [D5d](#_Hlk279063285), and [D6d](#_Hlk279063165)

[**Sn:**](#_Hlk279141399)[S4](#_Hlk279064593), [S6](#_Hlk279064464), [S8](#_Hlk279064330), and [S10](#_Hlk279064176)

[**High Symmetry:**](#_Hlk279141423)[Td](#_Hlk279065442), [Oh](#_Hlk279065291), and [Ih](#_Hlk279065130)

[**Linear:**](#_Hlk279141448)[C∞v, and](#_Hlk279065803) [D∞h](#_Hlk279065890)

**[Partial Correlation Tables for Linear Groups:](#_Hlk279416793" \s "1,27666,27710,0,,Correspondence Tables for Linear)** [[C](#_Hlk279416793" \s "1,27666,27710,0,,Correspondence Tables for Linear)[∞v](#_Hlk279416793" \s "1,27666,27710,0,,Correspondence Tables for Linear) [→ C](#_Hlk279416793" \s "1,27666,27710,0,,Correspondence Tables for Linear)[2v,](#_Hlk279416793" \s "1,27666,27710,0,,Correspondence Tables for Linear)](#_Hlk279416880) [D](#_Hlk279416866" \s "1,27862,27872,0,,D∞h → D2h)[∞h](#_Hlk279416866" \s "1,27862,27872,0,,D∞h → D2h) [→ D](#_Hlk279416866" \s "1,27862,27872,0,,D∞h → D2h)[2h](#_Hlk279416866" \s "1,27862,27872,0,,D∞h → D2h)

**[Notes and Acknowledgements:](#_Hlk279416939" \s "1,28073,28101,0,,Notes and Acknowledgements:)**

**Point Group Identification Flow Chart**

**Non-Axial:** [C](#Cs)[S](#Cs), and [Ci](#Ci)

CS– Abelian; h = 2 ; Subgroups = {Ø}

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***CS*** | **E** | **σh** | **linear, rotations** | **quadratic** |
| **A'** | 1 | 1 | x, y, Rz | x2, y2, z2, xy |
| **A''** | 1 | -1 | z, Rx, Ry | yz, xz |

Ci  – Abelian; h = 2 ; Subgroups = {Ø}

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Ci*** | **E** | **i** | **linear, rotations** | **quadratic** |
| **Ag** | 1 | 1 | Rx, Ry, Rz | x2, y2, z2, xy, xz, yz |
| **Au** | 1 | -1 | x, y, z |  |

**Cn:** [C2](#_Hlk279055677), [C3](#_Hlk279056146), [C4](#_Hlk279056152), [C5](#_Hlk279056168), and [C6](#_Hlk279056184)

C2 – Abelian; h = 2; Subgroups = {Ø}

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***C2*** | **E** | **C2** | **linear, rot****ations** | **quadratic** |
| **A** | 1 | 1 | z, Rz | x2, y2, z2, xy |
| **B** | 1 | -1 | x, y, Rx, Ry | yz, xz |

C3 – Abelian; h = 3; ; Subgroups = {Ø}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***C3*** | **E** | **C3** | **(C3)2** | **linear, rotations** | **quadratic** |
| **A** | 1 | 1 | 1 | z, Rz | x2+y2, z2 |
| **E** | 1 1 | ε ε\* | ε\* ε | (x,y), (Rx,Ry) | (x2-y2, xy), (yz, xz) |

C4 – Abelian; h = 4; Subgroups = {[C](#_Hlk279055677" \s "1,1042,1044,0,,C2)[2](#_Hlk279055677" \s "1,1042,1044,0,,C2)}

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***C4*** | **E** | **C4** | **C2** | **(C4)3** | **linear, rotations** | **quadratic** |
| **A** | 1 | 1 | 1 | 1 | z, Rz | x2+y2, z2 |
| **B** | 1 | -1 | 1 | -1 |  | x2-y2, xy |
| **E** | 1 1 | i -i | -1 -1 | -i i | (x,y), (Rx,Ry) | (yz, xz) |

C5 – Abelian; h=5; ; Subgroups = {Ø}

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***C5*** | **E** | **C5** | **(C5)2** | **(C5)3** | **(C5)4** | **linear, rotations** | **quadratic** |
| **A** | 1 | 1 | 1 | 1 | 1 | z, Rz | x2+y2, z2 |
| **E1** | 1 1 | ε ε\* | ε2 ε2\* | ε2\* ε2 | ε\* ε | (x,y), (Rx,Ry) | (yz, xz) |
| **E2** | 1 1 | ε2 ε2\* | ε\* ε | ε ε\* | ε2\* ε2 |  | (x2-y2, xy) |

C6 – Abelian; h=6; ; Subgroups = {[C2](#_Hlk279055677), [C3](#_Hlk279056146)}

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***C6*** | **E** | **C6** | **C3** | **C2** | **(C3)2** | **(C6)5** | **linear, rotations** | **quadratic** |
| **A** | 1 | 1 | 1 | 1 | 1 | 1 | z, Rz | x2+y2, z2 |
| **B** | 1 | -1 | 1 | -1 | 1 | -1 |  |  |
| **E1** | 1 1 | ε ε\* | -ε\* -ε | -1 -1 | -ε -ε\* | ε\* ε | (x,y), (Rx,Ry) | (xz, yz) |
| **E2** | 1 1 | -ε\* -ε | -ε -ε\* | 1 1 | -ε\* -ε | -ε -ε\* |  | (x2-y2, xy) |

**Cnv:** [C2v](#_Hlk279057226), [C3v](#_Hlk279057234), [C4v](#_Hlk279057243), [C5v](#_Hlk279057251), and [C6v](#_Hlk279057259)

C2v – Abelian; h = 4; Subgroups = {[CS](#_Hlk279056064), [C2](#_Hlk279055677)}

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***C2v*** | **E** | **C2 (z)** | **σv(xz)** | **σv(yz)** | **linear, rotations** | **quadratic** |
| **A1** | 1 | 1 | 1 | 1 | z | x2, y2, z2 |
| **A2** | 1 | 1 | -1 | -1 | Rz | xy |
| **B1** | 1 | -1 | 1 | -1 | x, Ry | xz |
| **B2** | 1 | -1 | -1 | 1 | y, Rx | yz |

C3v – Not Abelian; h = 6; Subgroups = {[CS](#_Hlk279056064), [C3](#_Hlk279056146)}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***C3v*** | **E** | **2C3 (z)** | **3σv** | **linear, rotations** | **quadratic** |
| **A1** | 1 | 1 | 1 | z | x2+y2, z2 |
| **A2** | 1 | 1 | -1 | Rz |  |
| **E** | 2 | -1 | 0 | (x, y), (Rx, Ry) | (x2-y2, xy), (xz, yz) |

C4v – Not Abelian; h = 8; Subgroups = {[CS](#_Hlk279056064), [C2](#_Hlk279055677), [C4](#_Hlk279056152), [C2v](#_Hlk279057226)}

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***C4v*** | **E** | **2C4 (z)** | **C2** | **2σv** | **2σd** | **linear, rotations** | **quadratic** |
| **A1** | 1 | 1 | 1 | 1 | 1 | z | x2+y2, z2 |
| **A2** | 1 | 1 | 1 | -1 | -1 | Rz |  |
| **B1** | 1 | -1 | 1 | 1 | -1 |  | x2-y2 |
| **B2** | 1 | -1 | 1 | -1 | 1 |  | xy |
| **E** | 2 | 0 | -2 | 0 | 0 | (x, y), (Rx, Ry) | (xz, yz) |

C5v – Not Abelian; h = 10; Subgroups = {[CS](#_Hlk279056064), [C5](#_Hlk279056168)}

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***C5v*** | **E** | **2C5 (z)** | **2(C5)2** | **5σv** | **linear, rotations** | **quadratic** |
| **A1** | 1 | 1 | 1 | 1 | z | x2+y2, z2 |
| **A2** | 1 | 1 | 1 | -1 | Rz |  |
| **E1** | 2 | 2 | 2 | 0 | (x, y), (Rx, Ry) | (xz, yz) |
| **E2** | 2 | 2 | 2 | 0 |  | (x2-y2, xy) |

C6v – Not Abelian; h = 12; Subgroups = {[CS](#_Hlk279056064), [C2](#_Hlk279055677), [C3](#_Hlk279056146), [C6](#_Hlk279056184), [C2v](#_Hlk279057226), [C3v](#_Hlk279057234)}

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***C6v*** | **E** | **2C6 (z)** | **2C3 (z)** | **C2 (z)** | **3σv** | **3σd** | **linear, rotations** | **quadratic** |
| **A1** | 1 | 1 | 1 | 1 | 1 | 1 | z | x2+y2, z2 |
| **A2** | 1 | 1 | 1 | 1 | -1 | -1 | Rz |  |
| **B1** | 1 | -1 | 1 | -1 | 1 | -1 |  |  |
| **B2** | 1 | -1 | 1 | -1 | -1 | 1 |  |  |
| **E1** | 2 | 1 | -1 | -2 | 0 | 0 | (x, y), (Rx, Ry) | (xz, yz) |
| **E2** | 2 | -1 | -1 | 2 | 0 | 0 |  | (x2-y2, xy) |

**Cnh:** [C2h](#_Hlk279059212), [C3h](#_Hlk279059208), [C4h](#_Hlk279059201), [C5h](#_Hlk279059192), and [C](#_Hlk279059176" \s "1,5958,5961,0,,C6h)[6h](#_Hlk279059176" \s "1,5958,5961,0,,C6h)

C2h – Abelian; h = 4; Subgroups = { [CS](#_Hlk279056064), [Ci](#_Hlk279056075), [C2](#_Hlk279055677)}

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***C2h*** | **E** | **C2 (z)** | **i** | **σh** | **linear, rotations** | **quadratic** |
| **Ag** | 1 | 1 | 1 | 1 | Rz | x2, y2, z2, xy |
| **Bg** | 1 | -1 | 1 | -1 | Rx, Ry | xz, yz |
| **Au** | 1 | 1 | -1 | -1 | z |  |
| **Bu** | 1 | -1 | -1 | 1 | x, y |  |

C3h – Abelian; h = 6; ; Subgroups = {[C](#_Hlk279056064" \s "1,3277,3279,0,,CS)[S](#_Hlk279056064" \s "1,3277,3279,0,,CS), [C3](#_Hlk279056146)}

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***C3h*** | **E** | **C3(z)** | **(C3)2** | **σh** | **S3** | **(S3)5** | **linear, rotations** | **quadratic functions** |
| **A'** | 1 | 1 | 1 | 1 | 1 | 1 | Rz | x2+y2, z2 |
| **E'** | 1 1 | ε ε\* | ε\* ε | 1 1 | ε ε\* | ε\* ε | (x, y) | (x2-y2, xy) |
| **A''** | 1 | 1 | 1 | -1 | -1 | -1 | z |  |
| **E''** | 1 1 | ε ε\* | ε\* ε | -1 -1 | -ε -ε\* | -ε\* -ε | (Rx, Ry) | (xz, yz) |

C4h – Abelian; h = 8; Subgroups = {[C](#_Hlk279056064" \s "1,3277,3279,0,,CS)[S](#_Hlk279056064" \s "1,3277,3279,0,,CS), [Ci](#_Hlk279056075), [C2](#_Hlk279055677), [C4](#_Hlk279056152), [C2h](#_Hlk279059212), [S4](#_Hlk279064593)}

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***C4h*** | **E** | **C4(z)** | **C2** | **(C4)3** | **i** | **(S4)3** | **σh** | **S4** | **linear, rotations** | **quadratic** |
| **Ag** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Rz | x2+y2, z2 |
| **Bg** | 1 | -1 | 1 | -1 | 1 | -1 | 1 | -1 |  | x2-y2, xy |
| **Eg** | 1 1 | i -i | -1 -1 | -i i | 1 1 | i -i | -1 -1 | -i i | (Rx, Ry) | (xz, yz) |
| **Au** | 1 | 1 | 1 | 1 | -1 | -1 | -1 | -1 | z |  |
| **Bu** | 1 | -1 | 1 | -1 | -1 | 1 | -1 | 1 |  |  |
| **Eu** | 1 1 | i -i | -1 -1 | -i i | -1 -1 | -i i | 1 1 | i -i | (x, y) |  |

C5h – Abelian; h = 10; ; Subgroups = {[C](#_Hlk279056064" \s "1,3277,3279,0,,CS)[S](#_Hlk279056064" \s "1,3277,3279,0,,CS), [C5](#_Hlk279056168)}

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***C5h*** | **E** | **C5** | **(C5)2** | **(C5)3** | **(C5)4** | **σh** | **S5** | **(S5)7** | **(S5)3** | **(S5)9** | **linear, rotations** | **quadratic** |
| **A'** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Rz | x2+y2, z2 |
| **E'1** | 1 1 | ε ε\* | ε2 ε2\* | ε2\* ε2 | ε\* ε | 1 1 | ε ε\* | ε2 ε2\* | ε2\* ε2 | ε\* ε | (x, y) |  |
| **E'2** | 1 1 | ε2 ε2\* | ε\* ε | ε ε\* | ε2\* ε2 | 1 1 | ε2 ε2\* | ε\* ε | ε ε\* | ε2\* ε2 |  | (x2-y2, xy) |
| **A''** | 1 | 1 | 1 | 1 | 1 | -1 | -1 | -1 | -1 | -1 | z |  |
| **E''1** | 1 1 | ε ε\* | ε2 ε2\* | ε2\* ε2 | ε\* ε | -1 -1 | -ε -ε\* | -ε2 -ε2\* | -ε2\* -ε2 | -ε\* -ε | (Rx, Ry) | (xz, yz) |
| **E''2** | 1 1 | ε2 ε2\* | ε\* ε | ε ε\* | ε2\* ε2 | -1 -1 | -ε2 -ε2\* | -ε\* -ε | -ε -ε\* | -ε2\* -ε2 |  |  |

C6h – Abelian; h = 12; ; Subgroups = {[C](#_Hlk279056064" \s "1,3277,3279,0,,CS)[S](#_Hlk279056064" \s "1,3277,3279,0,,CS), [Ci](#_Hlk279056075), [C2](#_Hlk279055677), [C3](#_Hlk279056146), [C6](#_Hlk279056184), [C2h](#_Hlk279059212), [C3h](#_Hlk279059208), [S6](#_Hlk279064464)}

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***C6h*** | **E** | **C6(z)** | **C3** | **C2** | **(C3)2** | **(C6)5** | **i** | **(S3)5** | **(S6)5** | **σh** | **S6** | **S3** | **linear, rotations** | **quadratic** |
| **Ag** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Rz | x2+y2, z2 |  |
| **Bg** | 1 | -1 | 1 | -1 | 1 | -1 | 1 | -1 | 1 | -1 | 1 | -1 |  |  |
| **E1g** | 1 1 | ε ε\* | -ε\* -ε | -1 -1 | -ε -ε\* | ε\* ε | 1 1 | ε ε\* | -ε\* -ε | -1 -1 | -ε -ε\* | ε\* ε | (Rx, Ry) | (xz, yz) |
| **E2g** | 1 1 | -ε\* -ε | -ε -ε\* | 1 1 | -ε\* -ε | -ε -ε\* | 1 1 | -ε\* -ε | -ε -ε\* | 1 1 | -ε\* -ε | -ε -ε\* |  | (x2-y2, xy) |
| **Au** | 1 | 1 | 1 | 1 | 1 | 1 | -1 | -1 | -1 | -1 | -1 | -1 | Z |  |
| **Bu** | 1 | -1 | 1 | -1 | 1 | -1 | -1 | 1 | -1 | 1 | -1 | 1 |  |  |
| **E1u** | 1 1 | ε ε\* | -ε\* -ε | -1 -1 | -ε -ε\* | ε\* ε | -1 -1 | -ε -ε\* | ε\* ε | 1 1 | ε ε\* | -ε\* -ε | (x, y) |  |
| **E2u** | 1 1 | -ε\* -ε | -ε -ε\* | 1 1 | -ε\* -ε | -ε -ε\* | -1 -1 | ε\* ε | ε ε\* | -1 -1 | ε\* ε | ε ε\* |  |  |

**Dn:** [D](#_Hlk279060140" \s "1,7514,7516,0,,D2)[2](#_Hlk279060140" \s "1,7514,7516,0,,D2), [D3](#_Hlk279060136), [D4](#_Hlk279060132), [D5](#_Hlk279060122), and [D6](#_Hlk279060111)

D2 – Abelian; h = 4; Subgroups = {[C](#_Hlk279055677" \s "1,1042,1044,0,,C2)[2](#_Hlk279055677" \s "1,1042,1044,0,,C2)}

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***D2*** | **E** | **C2 (z)** | **C2 (y)** | **C2 (x)** | **linear, rotations** | **quadratic** |
| **A** | 1 | 1 | 1 | 1 |  | x2, y2, z2 |
| **B1** | 1 | 1 | -1 | -1 | z, Rz | xy |
| **B2** | 1 | -1 | 1 | -1 | y, Ry | xz |
| **B3** | 1 | -1 | -1 | 1 | x, Rx | yz |

D3 – Not Abelian; h = 6; Subgroups = {[C2](#_Hlk279055677), [C3](#_Hlk279056146)}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***D3*** | **E** | **2C3 (z)** | **3C'2** | **linear, rotations** | **quadratic** |
| **A1** | 1 | 1 | 1 |  | x2+y2, z2 |
| **A2** | 1 | 1 | -1 | z, Rz |  |
| **E** | 2 | -1 | 0 | (x, y), (Rx, Ry) | (x2-y2, xy), (xz, yz) |

D4 – Not Abelian; h = 8; Subgroups = {[C2](#_Hlk279055677), [C4](#_Hlk279056152), [D2](#_Hlk279060140)}

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***D4*** | **E** | **2C4 (z)** | **C2 (z)** | **2C'2** | **2C''2** | **linear, rotations** | **quadratic** |
| **A1** | 1 | 1 | 1 | 1 | 1 |  | x2+y2, z2 |
| **A2** | 1 | 1 | 1 | -1 | -1 | z, Rz |  |
| **B1** | 1 | -1 | 1 | 1 | -1 |  | x2-y2 |
| **B2** | 1 | -1 | 1 | -1 | 1 |  | xy |
| **E** | 2 | 0 | -2 | 0 | 0 | (x, y), (Rx, Ry) | (xz, yz) |

D5 – Not Abelian; h = 10; Subgroups = {[C2](#_Hlk279055677), [C5](#_Hlk279056168)}

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***D5*** | **E** | **2C5 (z)** | **2(C5)2** | **5C'2** | **linear, rotations** | **quadratic** |
| **A1** | 1 | 1 | 1 | 1 |  | x2+y2, z2 |
| **A2** | 1 | 1 | 1 | -1 | z, Rz |  |
| **E1** | 2 | 2 | 2 | 0 | (x, y), (Rx, Ry) | (xz, yz) |
| **E2** | 2 | 2 | 2 | 0 |  |  |

D6 – Not Abelian; h = 12; Subgroups = {[C2](#_Hlk279055677), [C3](#_Hlk279056146), [C6](#_Hlk279056184), [D2](#_Hlk279060140), [D3](#_Hlk279060136)}

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***D6*** | **E** | **2C6 (z)** | **2C3 (z)** | **C2 (z)** | **3C'2** | **3C''2** | **linear, rotations** | **quadratic** |
| **A1** | 1 | 1 | 1 | 1 | 1 | 1 |  | x2+y2, z2 |
| **A2** | 1 | 1 | 1 | 1 | -1 | -1 | z, Rz |  |
| **B1** | 1 | -1 | 1 | -1 | 1 | -1 |  |  |
| **B2** | 1 | -1 | 1 | -1 | -1 | 1 |  |  |
| **E1** | 2 | 1 | -1 | -2 | 0 | 0 | (x, y), (Rx, Ry) | (xz, yz) |
| **E2** | 2 | -1 | -1 | 2 | 0 | 0 |  | (x2-y2, xy) |

**Dnh:** [D2h](#_Hlk279062742), [D3h](#_Hlk279062738), [D4h](#_Hlk279062733), [D5h](#_Hlk279062727), and [D](#_Hlk279062716" \s "1,10809,10812,0,,D6h)[6h](#_Hlk279062716" \s "1,10809,10812,0,,D6h)

D2h – Abelian; h = 8; Subgroups = {[C](#_Hlk279056064" \s "1,3277,3279,0,,CS)[S](#_Hlk279056064" \s "1,3277,3279,0,,CS), [Ci](#_Hlk279056075), [C2](#_Hlk279055677), [C2v](#_Hlk279057226), [C2h](#_Hlk279059212)}

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***D2h*** | **E** | **C2 (z)** | **C2 (y)** | **C2 (x)** | **i** | **σ (xy)** | **σ (xz)** | **σ (yz)** | **linear, rotations** | **quadratic** |
| **Ag** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  | x2, y2, z2 |
| **B1g** | 1 | 1 | -1 | -1 | 1 | 1 | -1 | -1 | Rz | xy |
| **B2g** | 1 | -1 | 1 | -1 | 1 | -1 | 1 | -1 | Ry | xz |
| **B3g** | 1 | -1 | -1 | 1 | 1 | -1 | -1 | 1 | Rx | yz |
| **Au** | 1 | 1 | 1 | 1 | -1 | -1 | -1 | -1 |  |  |
| **B1u** | 1 | 1 | -1 | -1 | -1 | -1 | 1 | 1 | z |  |
| **B2u** | 1 | -1 | 1 | -1 | -1 | 1 | -1 | 1 | y |  |
| **B3u** | 1 | -1 | -1 | 1 | -1 | 1 | 1 | -1 | x |  |

D3h – Not Abelian; h = 12; Subgroups = {[CS](#_Hlk279056064), [C2](#_Hlk279055677), [C3](#_Hlk279056146), [C2v](#_Hlk279057226), [C3v](#_Hlk279057234), [C3h](#_Hlk279059208), [D3](#_Hlk279060136)}

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***D3h*** | **E** | **2C3** | **3C'2** | **σh** | **2S3** | **3σv** | **linear, rotations** | **quadratic** |
| **A'1** | 1 | 1 | 1 | 1 | 1 | 1 |  | x2+y2, z2 |
| **A'2** | 1 | 1 | -1 | 1 | 1 | -1 | Rz |  |
| **E'** | 2 | -1 | 0 | 2 | -1 | 0 | (x, y) | (x2-y2, xy) |
| **A''1** | 1 | 1 | 1 | -1 | -1 | -1 |  |  |
| **A''2** | 1 | 1 | -1 | -1 | -1 | 1 | z |  |
| **E''** | 2 | -1 | 0 | -2 | 1 | 0 | (Rx, Ry) | (xz, yz) |

D4h – Not Abelian; h = 16; Subgroups = {[C](#_Hlk279056064" \s "1,3277,3279,0,,CS)[S](#_Hlk279056064" \s "1,3277,3279,0,,CS), [Ci](#_Hlk279056075), [C2](#_Hlk279055677), [C4](#_Hlk279056152), [C2v](#_Hlk279057226), [C4v](#_Hlk279057243), [C2h](#_Hlk279059212), [C4h](#_Hlk279059201), [D2](#_Hlk279060140), [D4](#_Hlk279060132), [D2h](#_Hlk279062742), [D2d](#_Hlk279063174), [S4](#_Hlk279064593)}

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***D4h*** | **E** | **2C4 (z)** | **C2** | **2C'2** | **2C''2** | **i** | **2S4** | **σh** | **2σv** | **2σd** | **linears, rotations** | **quadratic** |
| **A1g** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  | x2+y2, z2 |
| **A2g** | 1 | 1 | 1 | -1 | -1 | 1 | 1 | 1 | -1 | -1 | Rz |  |
| **B1g** | 1 | -1 | 1 | 1 | -1 | 1 | -1 | 1 | 1 | -1 |  | x2-y2 |
| **B2g** | 1 | -1 | 1 | -1 | 1 | 1 | -1 | 1 | -1 | 1 |  | xy |
| **Eg** | 2 | 0 | -2 | 0 | 0 | 2 | 0 | -2 | 0 | 0 | (Rx, Ry) | (xz, yz) |
| **A1u** | 1 | 1 | 1 | 1 | 1 | -1 | -1 | -1 | -1 | -1 |  |  |
| **A2u** | 1 | 1 | 1 | -1 | -1 | -1 | -1 | -1 | 1 | 1 | z |  |
| **B1u** | 1 | -1 | 1 | 1 | -1 | -1 | 1 | -1 | -1 | 1 |  |  |
| **B2u** | 1 | -1 | 1 | -1 | 1 | -1 | 1 | -1 | 1 | -1 |  |  |
| **Eu** | 2 | 0 | -2 | 0 | 0 | -2 | 0 | 2 | 0 | 0 | (x, y) |  |

D5h – Abelian; h = 20; Subgroups = {[C](#_Hlk279056064" \s "1,3277,3279,0,,CS)[S](#_Hlk279056064" \s "1,3277,3279,0,,CS), [C2](#_Hlk279055677), [C5](#_Hlk279056168), [C2v](#_Hlk279057226), [C5v](#_Hlk279057251), [C5h](#_Hlk279059192), [D5](#_Hlk279060122)}

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***D5h*** | **E** | **2C5** | **2(C5)2** | **5C'2** | **h** | **2S5** | **2(S5)3** | **5σv** | **linear, rotations** | **quadratic** |
| **A'1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  | x2+y2, z2 |
| **A'2** | 1 | 1 | 1 | -1 | 1 | 1 | 1 | -1 | Rz |  |
| **E'1** | 2 | 2 | 2 | 0 | 2 | 2 | 2 | 0 | (x, y) |  |
| **E'2** | 2 | 2 | 2 | 0 | 2 | 2 | 2 | 0 |  | (x2-y2, xy) |
| **A''1** | 1 | 1 | 1 | 1 | -1 | -1 | -1 | -1 |  |  |
| **A''2** | 1 | 1 | 1 | -1 | -1 | -1 | -1 | 1 | z |  |
| **E''1** | 2 | 2 | 2 | 0 | -2 | -2 | -2 | 0 | (Rx, Ry) | (xz, yz) |
| **E''2** | 2 | 2 | 2 | 0 | -2 | -2 | -2 | 0 |  |  |

D6h – Abelian; h = 24

Subgroups = { [CS](#_Hlk279056064), [Ci](#_Hlk279056075), [C2](#_Hlk279055677), [C3](#_Hlk279056146), [C6](#_Hlk279056184), [C2v](#_Hlk279057226), [C3v](#_Hlk279057234), [C6v](#_Hlk279057259), [C2h](#_Hlk279059212), [C3h](#_Hlk279059208), [C6h](#_Hlk279059176), [D2](#_Hlk279060140), [D3](#_Hlk279060136), [D6](#_Hlk279060111), [D2h](#_Hlk279062742), [D3h](#_Hlk279062738), [D3d](#_Hlk279063523), [S6](#_Hlk279064464)}

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***D6h*** | **E** | **2C6** | **2C3** | **C2** | **3C'2** | **3C''2** | **i** | **2S3** | **2S6** | **σh** | **3σd** | **3σv** | **Linear, rotations** | **Quadratic** |
| **A1g** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  | x2+y2, z2 |
| **A2g** | 1 | 1 | 1 | 1 | -1 | -1 | 1 | 1 | 1 | 1 | -1 | -1 | Rz |  |
| **B1g** | 1 | -1 | 1 | -1 | 1 | -1 | 1 | -1 | 1 | -1 | 1 | -1 |  |  |
| **B2g** | 1 | -1 | 1 | -1 | -1 | 1 | 1 | -1 | 1 | -1 | -1 | 1 |  |  |
| **E1g** | 2 | 1 | -1 | -2 | 0 | 0 | 2 | 1 | -1 | -2 | 0 | 0 | (Rx, Ry) | (xz, yz) |
| **E2g** | 2 | -1 | -1 | 2 | 0 | 0 | 2 | -1 | -1 | 2 | 0 | 0 |  | (x2-y2, xy) |
| **A1u** | 1 | 1 | 1 | 1 | 1 | 1 | -1 | -1 | -1 | -1 | -1 | -1 |  |  |
| **A2u** | 1 | 1 | 1 | 1 | -1 | -1 | -1 | -1 | -1 | -1 | 1 | 1 | z |  |
| **B1u** | 1 | -1 | 1 | -1 | 1 | -1 | -1 | 1 | -1 | 1 | -1 | 1 |  |  |
| **B2u** | 1 | -1 | 1 | -1 | -1 | 1 | -1 | 1 | -1 | 1 | 1 | -1 |  |  |
| **E1u** | 2 | 1 | -1 | -2 | 0 | 0 | -2 | -1 | 1 | 2 | 0 | 0 | (x, y) |  |
| **E2u** | 2 | -1 | -1 | 2 | 0 | 0 | -2 | 1 | 1 | -2 | 0 | 0 |  |  |

**Dnd:** [D](#_Hlk279063174" \s "1,12400,12403,0,,D2d)[2d](#_Hlk279063174" \s "1,12400,12403,0,,D2d), [D3d](#_Hlk279063523), [D4d](#_Hlk279063445), [D5d](#_Hlk279063285), and [D6d](#_Hlk279063165)

D2d – Not Abelian; h = 8; Subgroups = {[CS](#_Hlk279056064), [C2](#_Hlk279055677), [C2v](#_Hlk279057226), [D2](#_Hlk279060140), [S4](#_Hlk279064593)}

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***D2d*** | **E** | **2S4** | **C2 (z)** | **2C'2** | **2σd** | **linear, rotations** | **quadratic** |
| **A1** | 1 | 1 | 1 | 1 | 1 |  | x2+y2, z2 |
| **A2** | 1 | 1 | 1 | -1 | -1 | Rz |  |
| **B1** | 1 | -1 | 1 | 1 | -1 |  | x2-y2 |
| **B2** | 1 | -1 | 1 | -1 | 1 | z | xy |
| **E** | 2 | 0 | -2 | 0 | 0 | (x, y) (Rx, Ry) | (xz, yz) |

D3d – Not Abelian; h = 12; Subgroups = {[CS](#_Hlk279056064), [Ci](#_Hlk279056075), [C2](#_Hlk279055677), [C3](#_Hlk279056146), [C3v](#_Hlk279057234), [D3](#_Hlk279060136), [S6](#_Hlk279064464)}

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***D3d*** | **E** | **2C3** | **3C'2** | **i** | **2S6** | **3σd** | **linear, rotations** | **quadratic** |
| **A1g** | 1 | 1 | 1 | 1 | 1 | 1 |  | x2+y2, z2 |
| **A2g** | 1 | 1 | -1 | 1 | 1 | -1 | Rz |  |
| **Eg** | 2 | -1 | 0 | 2 | -1 | 0 | (Rx, Ry) | (x2-y2, xy) (xz, yz) |
| **A1u** | 1 | 1 | 1 | -1 | -1 | -1 |  |  |
| **A2u** | 1 | 1 | -1 | -1 | -1 | 1 | z |  |
| **Eu** | 2 | -1 | 0 | -2 | 1 | 0 | (x, y) |  |

D4d – Not Abelian; h = 16; Subgroups = {[CS](#_Hlk279056064), [C2](#_Hlk279055677), [C4](#_Hlk279056152), [C2v](#_Hlk279057226), [C4v](#_Hlk279057243), [D2](#_Hlk279060140), [D4](#_Hlk279060132), [S8](#_Hlk279064330)}

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***D4d*** | **E** | **2S8** | **2C4** | **2(S8)3** | **C2** | **4C'2** | **4σd** | **linear, rotations** | **quadratic** |
| **A1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  | x2+y2, z2 |
| **A2** | 1 | 1 | 1 | 1 | 1 | -1 | -1 | Rz |  |
| **B1** | 1 | -1 | 1 | -1 | 1 | 1 | -1 |  |  |
| **B2** | 1 | -1 | 1 | -1 | 1 | -1 | 1 | z |  |
| **E1** | 2 |  | 0 | - | -2 | 0 | 0 | (x, y) |  |
| **E2** | 2 | 0 | -2 | 0 | 2 | 0 | 0 |  | (x2-y2, xy) |
| **E3** | 2 | - | 0 |  | -2 | 0 | 0 | (Rx, Ry) | (xz, yz) |

D5d – Not Abelian; h = 20; Subgroups = {[CS](#_Hlk279056064), [Ci](#_Hlk279056075), [C2](#_Hlk279055677), [C5](#_Hlk279056168), [C5v](#_Hlk279057251), [D5](#_Hlk279060122), [S10](#_Hlk279064176)}

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***D5d*** | **E** | **2C5** | **2(C5)2** | **5C'2** | **i** | **2(S10)3** | **2S10** | **5σd** | **linear, rotations** | **quadratic** |
| A1g | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  | x2+y2, z2 |
| A2g | 1 | 1 | 1 | -1 | 1 | 1 | 1 | -1 | Rz |  |
| E1g | 2 | 2 | 2 | 0 | 2 | 2 | 2 | 0 | (Rx, Ry) | (xz, yz) |
| E2g | 2 | 2 | 2 | 0 | 2 | 2 | 2 | 0 |  | (x2-y2, xy) |
| A1u | 1 | 1 | 1 | 1 | -1 | -1 | -1 | -1 |  |  |
| A2u | 1 | 1 | 1 | -1 | -1 | -1 | -1 | 1 | z |  |
| E1u | 2 | 2 | 2 | 0 | -2 | -2 | -2 | 0 | (x, y) |  |
| E2u | 2 | 2 | 2 | 0 | -2 | -2 | -2 | 0 |  |  |

D6d – Not Abelian; h = 24; Subgroups = {[CS](#_Hlk279056064), [C2](#_Hlk279055677), [C3](#_Hlk279056146), [C6](#_Hlk279056184), [C2v](#_Hlk279057226), [C3v](#_Hlk279057234), [C6v](#_Hlk279057259), [D2](#_Hlk279060140), [D3](#_Hlk279060136), [D6](#_Hlk279060111), [S4](#_Hlk279064593), S12}

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***D6d*** | **E** | **2S12** | **2C6** | **2S4** | **2C3** | **2(S12)5** | **C2** | **6C'2** | **6σd** | **linear, rotations** | **quadratic** |
| **A1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  | x2+y2, z2 |
| **A2** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | -1 | -1 | Rz |  |
| **B1** | 1 | -1 | 1 | -1 | 1 | -1 | 1 | 1 | -1 |  |  |
| **B2** | 1 | -1 | 1 | -1 | 1 | -1 | 1 | -1 | 1 | z |  |
| **E1** | 2 |  | 1 | 0 | -1 | - | -2 | 0 | 0 | (x, y) |  |
| **E2** | 2 | 1 | -1 | -2 | -1 | 1 | 2 | 0 | 0 |  | (x2-y2, xy) |
| **E3** | 2 | 0 | -2 | 0 | 2 | 0 | -2 | 0 | 0 |  |  |
| **E4** | 2 | -1 | -1 | 2 | -1 | -1 | 2 | 0 | 0 |  |  |
| **E5** | 2 | - | 1 | 0 | -1 |  | -2 | 0 | 0 | (Rx, Ry) | (xz, yz) |

**Sn:** [S4](#_Hlk279064593), [S6](#_Hlk279064464), [S8](#_Hlk279064330), and [S10](#_Hlk279064176)

S4 – Abelian; h = 4; Subgroups = {[C](#_Hlk279055677" \s "1,1042,1044,0,,C2)[2](#_Hlk279055677" \s "1,1042,1044,0,,C2)}

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***S4*** | **E** | **S4** | **C2** | **(S4)3** | **linear, rotations** | **quadratic** |
| **A** | 1 | 1 | 1 | 1 | Rz | x2+y2, z2 |
| **B** | 1 | -1 | 1 | -1 | z | x2-y2, xy |
| **E** | 1 1 | i -i | -1 -1 | -i i | (x, y), (Rx, Ry) | (xz, yz) |

S6 – Abelian; h = 6; ; Subgroups = {[C](#_Hlk279056075" \s "1,939,941,0,,Ci)[i](#_Hlk279056075" \s "1,939,941,0,,Ci), [C](#_Hlk279056146" \s "1,1218,1220,0,,C3)[3](#_Hlk279056146" \s "1,1218,1220,0,,C3)}

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***S6*** | **E** | **C3(z)** | **(C3)2** | **i** | **(S6)5** | **S6** | **linear, rotations** | **quadratic** |
| **Ag** | 1 | 1 | 1 | 1 | 1 | 1 | Rz | x2+y2, z2 |
| **Eg** | 1 1 | ε ε\* | ε\* ε | 1 1 | ε ε\* | ε\* ε | (Rx, Ry) | (x2-y2, xy) (xz, yz) |
| **Au** | 1 | 1 | 1 | -1 | -1 | -1 | Z |  |
| **Eu** | 1 1 | ε ε\* | ε\* ε | -1 -1 | ε ε\* | ε\* ε | (x, y) |  |

S8 – Abelian; h = 8; ; Subgroups = {[C2](#_Hlk279055677), [C4](#_Hlk279056152)}

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***S8*** | **E** | **S8** | **C4 (z)** | **(S8)3** | **C2** | **(S8)5** | **(C4)3** | **(S8)7** | **linear, rotations** | **quadratic** |
| **A** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Rz | x2+y2, z2 |
| **B** | 1 | -1 | 1 | -1 | 1 | -1 | 1 | -1 | z |  |
| **E1** | 1 1 | ε ε\* | i -i | -ε\* -ε | -1 -1 | -ε -ε\* | -i i | ε\* ε | (x, y) |  |
| **E2** | 1 1 | i -i | -1 -1 | -i i | 1 1 | i -i | -1 -1 | -i i |  | (x2-y2, xy) |
| **E3** | 1 1 | -ε -ε\* | i -i | ε\* ε | -1 -1 | ε ε\* | -i i | -ε\* -ε | (Rx, Ry) | (xz, yz) |

S10 – Abelian; h = 10; ; Subgroups = {[C](#_Hlk279056075" \s "1,939,941,0,,Ci)[i](#_Hlk279056075" \s "1,939,941,0,,Ci), [C](#_Hlk279056168" \s "1,1664,1666,0,,C5)[5](#_Hlk279056168" \s "1,1664,1666,0,,C5)}

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***S10*** | **E** | **C5** | **(C5)2** | **(C5)3** | **(C5)4** | **i** | **(S10)7** | **(S10)9** | **S10** | **(S10)3** | **linear, rotations** | **quadratic** |
| **Ag** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Rz | z2, x2+y2 |
| **E1g** | 1 1 | ε ε\* | ε2 ε2\* | ε2\* ε2 | ε\* ε | +1 1 | +ε ε\* | +ε2 ε2\* | +ε2\* ε2 | +ε\* ε+ | (Rx,Ry) | (xz, yz) |
| **E2g** | 1 1 | ε2 ε2\* | ε\* ε | ε ε\* | ε2\* ε2 | 1 1 | +ε2 ε2\* | +ε\* ε+ | +ε ε\* | +ε2\* ε2 |  | (x2-y2, xy) |
| **Au** | 1 | 1 | 1 | 1 | 1 | -1 | -1 | -1 | -1 | -1 | Z |  |
| **E1u** | 1 1 | ε ε\* | ε2 ε2\* | ε2\* ε2 | ε\* ε | -1 -1 | -ε -ε\* | -ε2 -ε2\* | -ε2\* -ε2 | -ε\* ε- | (x, y) |  |
| **E2u** | 1 1 | ε2 ε2\* | ε\* ε | ε ε\* | ε2\* ε2 | -1 -1 | -ε2 -ε2\* | -ε\* -ε | -ε -ε\* | -ε2\* -ε2 |  |  |

**High Symmetry:** [Td](#_Hlk279065442), [Oh](#_Hlk279065291), and [Ih](#_Hlk279065130)

Td – Abelian; h = 24; Subgroups = {Many}

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***Td*** | **E** | **8C3** | **3C2** | **6S4** | **6σd** | **linear, rotations** | **quadratic** |
| **A1** | 1 | 1 | 1 | 1 | 1 |  | x2+y2+z2 |
| **A2** | 1 | 1 | 1 | -1 | -1 |  |  |
| **E** | 2 | -1 | 2 | 0 | 0 |  | (2z2-x2-y2, x2-y2) |
| **T1** | 3 | 0 | -1 | 1 | -1 | (Rx, Ry, Rz) |  |
| **T2** | 3 | 0 | -1 | -1 | 1 | (x, y, z) | (xy, xz, yz) |

Oh – Not Abelian; h = 48; Subgroups = {Many}

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Oh*** | **E** | **8C3** | **6C2** | **6C4** | **3C2 =(C4)2** | **i** | **6S4** | **8S6** | **3σh** | **6σd** | **linear, rotations** | **quadratic** |
| **A1g** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  | x2+y2+z2 |
| **A2g** | 1 | 1 | -1 | -1 | 1 | 1 | -1 | 1 | 1 | -1 |  |  |
| **Eg** | 2 | -1 | 0 | 0 | 2 | 2 | 0 | -1 | 2 | 0 |  | (2z2-x2-y2, x2-y2) |
| **T1g** | 3 | 0 | -1 | 1 | -1 | 3 | 1 | 0 | -1 | -1 | (Rx, Ry, Rz) |  |
| **T2g** | 3 | 0 | 1 | -1 | -1 | 3 | -1 | 0 | -1 | 1 |  | (xz, yz, xy) |
| **A1u** | 1 | 1 | 1 | 1 | 1 | -1 | -1 | -1 | -1 | -1 |  |  |
| **A2u** | 1 | 1 | -1 | -1 | 1 | -1 | 1 | -1 | -1 | 1 |  |  |
| **Eu** | 2 | -1 | 0 | 0 | 2 | -2 | 0 | 1 | -2 | 0 |  |  |
| **T1u** | 3 | 0 | -1 | 1 | -1 | -3 | -1 | 0 | 1 | 1 | (x, y, z) |  |
| **T2u** | 3 | 0 | 1 | -1 | -1 | -3 | 1 | 0 | 1 | -1 |  |  |

Ih – Not Abelian; h = 120; Subgroups = {Many}

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Ih*** | **E** | **12C5** | **12(C5)2** | **20C3** | **15C2** | **i** | **12S10** | **12(S10)3** | **20S6** | **15σ** | **linear, rotations** | **quadratic** |
| **Ag** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  | x2+y2+z2 |
| **T1g** | 3 | -2 | -2 | 0 | -1 | 3 | -2 | -2 | 0 | -1 | (Rx, Ry, Rz) |  |
| **T2g** | 3 | -2 | -2 | 0 | -1 | 3 | -2 | -2 | 0 | -1 |  |  |
| **Gg** | 4 | -1 | -1 | 1 | 0 | 4 | -1 | -1 | 1 | 0 |  |  |
| **Hg** | 5 | 0 | 0 | -1 | 1 | 5 | 0 | 0 | -1 | 1 |  | (2z2-x2-y2, x2-y2,  xy, xz, yz) |
| **Au** | 1 | 1 | 1 | 1 | 1 | -1 | -1 | -1 | -1 | -1 |  |  |
| **T1u** | 3 | -2 | -2 | 0 | -1 | -3 | 2 | 2 | 0 | 1 | (x, y, z) |  |
| **T2u** | 3 | -2 | -2 | 0 | -1 | -3 | 2 | 2 | 0 | 1 |  |  |
| **Gu** | 4 | -1 | -1 | 1 | 0 | -4 | 1 | 1 | -1 | 0 |  |  |
| **Hu** | 5 | 0 | 0 | -1 | 1 | -5 | 0 | 0 | 1 | -1 |  |  |

**Linear:** [C∞v, and](#_Hlk279065803) [D∞h](#_Hlk279065890)

C∞v – Not Abelian; h = ∞; Subgroups = {Many}

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***C∞v*** | **E** | **2C∞** | **...** | **∞ σv** | **linear, rotations** | **quadratic** |
| **A1=Σ+** | 1 | 1 | ... | 1 | z | x2+y2, z2 |
| **A2=Σ-** | 1 | 1 | ... | -1 | Rz |  |
| **E1=Π** | 2 |  | ... | 0 | (x, y), (Rx, Ry) | (xz, yz) |
| **E2=Δ** | 2 |  | ... | 0 |  | (x2-y2, xy) |
| **E3=Φ** | 2 |  | ... | 0 |  |  |
| **...** | ... | ... | ... | ... |  |  |

D∞h – Not Abelian; h = ∞; Subgroups = {Many}

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***D∞h*** | **E** | **2C∞** | **...** | **∞σv** | **i** | **2S∞** | **...** | **∞C'2** | **linear functions, rotations** | **quadratic** |
| **A1g=Σ+g** | 1 | 1 | ... | 1 | 1 | 1 | ... | 1 |  | x2+y2, z2 |
| **A2g=Σ-g** | 1 | 1 | ... | -1 | 1 | 1 | ... | -1 | Rz |  |
| **E1g=Πg** | 2 |  | ... | 0 | 2 | - | ... | 0 | (Rx, Ry) | (xz, yz) |
| **E2g=Δg** | 2 |  | ... | 0 | 2 |  | ... | 0 |  | (x2-y2, xy) |
| **E3g=Φg** | 2 |  | ... | 0 | 2 | - | ... | 0 |  |  |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... |  |  |
| **A1u=Σ+u** | 1 | 1 | ... | 1 | -1 | -1 | ... | -1 | z |  |
| **A2u=Σ-u** | 1 | 1 | ... | -1 | -1 | -1 | ... | 1 |  |  |
| **E1u=Πu** | 2 |  | ... | 0 | -2 |  | ... | 0 | (x, y) |  |
| **E2u=Δu** | 2 |  | ... | 0 | -2 | - | ... | 0 |  |  |
| **E3u=Φu** | 2 |  | ... | 0 | -2 |  | ... | 0 |  |  |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... |  |  |

**Partial Correlation Tables for Linear Groups:** [C∞v → C2v,](#_Hlk279416880) [D](#_Hlk279416866" \s "1,27862,27872,0,,D∞h → D2h)[∞h](#_Hlk279416866" \s "1,27862,27872,0,,D∞h → D2h) [→ D](#_Hlk279416866" \s "1,27862,27872,0,,D∞h → D2h)[2h](#_Hlk279416866" \s "1,27862,27872,0,,D∞h → D2h)

C∞v → C2v

|  |  |
| --- | --- |
| **C∞v** | **C2v** |
| A1=Σ+ | A1 |
| A2=Σ- | A2 |
| E1=Π | B1 + B2 |
| E2=Δ | A1 + A2 |

D∞h → D2h

|  |  |
| --- | --- |
| **D∞h** | **D2h** |
| A1g=Σ+g | Ag |
| A2g=Σ-g | B1g |
| E1g=Πg | B2g + B3g |
| E2g=Δg | Ag + B1g |
| ... |  |
| A1u=Σ+u | B1u |
| A2u=Σ-u | Au |
| E1u=Πu | B2u + B3u |
| E2u=Δu | Au + B1u |
| ... |  |

**Notes and Acknowledgements:**

1. Linear functions x, y, and z can represent translational degrees of freedom. Linear functions Rx, Ry, and Rz can represent rotational degrees of freedom.
2. Vibrational modes which share a symmetry species with one of the three linear functions x, y, or z will be infrared active. Vibrational modes which share a symmetry species with one of the quadratic functions will be Raman active.
3. Degenerate functions (x ± iy) and (Rx ± iRy) are represented as simply (x, y) and (Rx, Ry).
4. While I have worked hard to ensure that this document is correct, I assume no responsibility for the accuracy of the information here.

This document was compiled with the help of these references:

1. <http://www.webqc.org/symmetry.php>
2. <http://en.wikipedia.org/wiki/List_of_character_tables_for_chemically_important_3D_point_groups>
3. Carter, Robert L. *Molecular Symmetry and Group Theory.* John Wiley and Sons, Inc. (Hoboken, NJ) 1998.