

## 12.2: Appendix II – Selected Character Tables

### Nonaxial Groups

$C_1$	E
A	1

$C_s$	E	$\sigma$		
A'	1	1	$x, y, R_z$	$x^2, y^2, z^2, xy$
A''	1	-1	$z, R_x, R_y$	$xz, yz$

$C_i$	E	i		
$A_g$	1	1	$R_x, R_y, R_z$	$x^2, y^2, z^2, xy, xz, yz$
$A_u$	1	-1	$x, y, z$	

### $C_n$ groups

$C_2$	E	$C_2$		
A	1	1	$z, R_z$	$x^2, y^2, z^2, xy$
B	1	-1	$x, y, R_x, R_y$	$xz, yz$

$C_3$	E	$C_3$	$C_3^2$		
A	1	1	1	$z, R_z$	$x^2 + y^2, z^2$
E	1	$\epsilon$	$\epsilon^*$	$x + iy; R_x + iR_y$	$(x^2 - y^2, xy)$
	1	$\epsilon^*$	$\epsilon$	$x - iy; R_x - iR_y$	$(xz, yz)$

$C_4$	E	$C_4$	$C_2$	$C_4^3$		
A	1	1	1	1	$z, R_z$	$x^2 + y^2, z^2$
B	1	-1	1	-1		$x^2 - y^2, xy$
E	1	$i$	-1	$-i$	$x + iy; R_x + iR_y$	$(xz, yz)$
	1	$-i$	-1	$i$	$x - iy; R_x - iR_y$	

$C_5$	E	$C_5$	$C_5^2$	$C_5^3$	$C_5^4$		
A	1	1	1	1	1	$z, R_z$	$x^2 + y^2, z^2$
$E_1$	1	$\epsilon$	$\epsilon^2$	$\epsilon^{2*}$	$\epsilon^*$	$x + iy, R_x + iR_y$	$(xz, yz)$
	1	$\epsilon^*$	$\epsilon^{2*}$	$\epsilon^2$	$\epsilon$	$x - iy, R_x - iR_y$	
$E_2$	1	$\epsilon^2$	$\epsilon^*$	$\epsilon$	$\epsilon^{2*}$		$(x^2 - y^2, xy)$
	1	$\epsilon^{2*}$	$\epsilon$	$\epsilon^*$	$\epsilon^2$		

$C_6$	E	$C_6$	$C_6^2$	$C_6^3$	$C_6^4$	$C_6^5$		
A	1	1	1	1	1	1	$z, R_z$	$x^2 + y^2, z^2$
B	1	-1	1	-1	1	-1		

$C_6$	E	$C_6$	$C_6^2$	$C_6^3$	$C_6^4$	$C_6^5$		
$E_1$	1	$\varepsilon$	$-\varepsilon^*$	-1	$-\varepsilon$	$\varepsilon^*$	$x + iy, R_x + iR_y$ $x - iy, R_x - iR_y$	$(xz, yz)$
	1	$\varepsilon^*$	$\varepsilon$	-1	$-\varepsilon^*$	$\varepsilon$		
$E_2$	1	$-\varepsilon^*$	$-\varepsilon$	1	$-\varepsilon^*$	$-\varepsilon$		$(x^2 - y^2, xy)$
	1	$-\varepsilon$	$-\varepsilon^*$	1	$-\varepsilon$	$-\varepsilon^*$		

### $D_n$ groups

$D_2$	E	$C_2(z)$	$C_2(y)$	$C_2(x)$		
$A_1$	1	1	1	1		$x^2, y^2, z^2$
$B_1$	1	1	-1	-1	$z, R_z$	$xy$
$B_2$	1	-1	1	-1	$y, R_y$	$xz$
$B_3$	1	-1	-1	1	$x, R_x$	$yz$

$D_3$	E	$2 C_2$	$3 C_2'$		
$A_1$	1	1	1		$x^2 + y^2, z^2$
$A_2$	1	1	-1	$z, R_z$	
E	2	-1	0	$(x, y) (R_x, R_y)$	$(x^2 - y^2, xy)$ $(xz, yz)$

$D_4$	E	$2 C_4$	$C_2$	$2 C_2'$	$2 C_2''$		
$A_1$	1	1	1	1	1		$x^2 + y^2, z^2$
$A_2$	1	1	1	-1	-1	$z, R_z$	
$B_1$	1	-1	1	1	-1		$x^2 - y^2$
$B_2$	1	-1	1	-1	1		$xy$
E	2	0	-2	0	0	$(x, y)$ $(R_x, R_y)$	$(xz, yz)$

$D_5$	E	$2 C_5$	$2 C_5'$	$5 C_2$		
$A_1$	1	1	1	1		$x^2 + y^2, z^2$
$A_2$	1	1	1	-1	$z, R_z$	
$E_1$	2	$2 \cos(72^\circ)$	$2 \cos(144^\circ)$	0	$(x, y) (R_x, R_y)$	$(xz, yz)$
$E_2$	2	$2 \cos(144^\circ)$	$2 \cos(72^\circ)$	0		$(x^2 - y^2, xy)$

$D_6$	E	$2 C_6$	$2 C_3$	$C_2$	$3 C_2'$	$3 C_2''$		
$A_1$	1	1	1	1	1	1		$x^2 + y^2, z^2$
$A_2$	1	1	1	1	-1	-1	$z, R_z$	
$B_1$	1	-1	1	-1	1	-1		
$B_2$	1	-1	1	-1	-1	1		

$D_6$	E	$2 C_6$	$2 C_3$	$C_2$	$3 C_2'$	$3 C_2''$		
$E_1$	2	-1	1	-2	0	0	$(x, y)$ $(R_x, R_y)$	$(xz, yz)$
$E_2$	2	-1	-1	2	0	0		$(x^2 - y^2, xy)$

### $C_{nv}$ groups

$C_{2v}$	E	$C_2$	$\sigma_v$	$\sigma_v'$			
$A_1$	1	1	1	1	$z$		$x^2, y^2, z^2$
$A_2$	1	1	-1	-1		$R_z$	$xy$
$B_1$	1	-1	1	-1	$x$	$R_y$	$xz$
$B_2$	1	-1	-1	1	$y$	$R_x$	$yz$

$C_{3v}$	E	$2 C_2$	$3 \sigma_v$			
$A_1$	1	1	1	$z$		$x^2 + y^2, z^2$
$A_2$	1	1	-1	$R_z$		
E	2	-1	0	$(x, y) (R_x, R_y)$		$x^2 - y^2, xy (xz, yz)$

$C_{4v}$	E	$2 C_4$	$C_2$	$2 \sigma_v$	$2 \sigma_d$		
$A_1$	1	1	1	1	1	$z$	$x^2 + y^2, z^2$
$A_2$	1	1	1	-1	-1	$R_z$	
$B_1$	1	-1	1	1	-1		$x^2 - y^2$
$B_2$	1	-1	1	-1	1		$xy$
E	2	0	-2	0	0	$(x, y) (R_x, R_y)$	$(xz, yz)$

$C_{5v}$	E	$2 C_5$	$C_5^2$	$5 \sigma_v$		
$A_1$	1	1	1	1	$z$	$x^2 + y^2, z^2$
$A_2$	1	1	1	-1	$R_z$	
$E_1$	2	$2 \cos(72^\circ)$	$2 \cos(144^\circ)$	0		$(xz, yz)$
$E_2$	2	$2 \cos(144^\circ)$	$2 \cos(72^\circ)$	0	$(x, y) (R_x, R_y)$	$(x^2 - y^2, xy)$

$C_{6v}$	E	$2 C_6$	$2 C_3$	$C_2$	$3 \sigma_v$	$3 \sigma_d$		
$A_1$	1	1	1	1	1	1	$z$	$x^2 + y^2, z^2$
$A_2$	1	1	1	1	-1	-1	$R_z$	
$B_1$	1	-1	1	-1	1	-1		
$B_2$	1	-1	1	-1	-1	1		
$E_1$	2	1	-1	-2	0	0	$(x, y) (R_x, R_y)$	$(xz, yz)$
$E_2$	2	-1	-1	2	0	0		$(x^2 - y^2, xy)$

## $C_{nh}$ Groups

$C_{2h}$	E	$C_2$	i	$\sigma_h$		
$A_g$	1	1	1	1	$R_z$	$x^2, y^2, z^2$
$A_u$	1	1	-1	-1	$z$	
$B_g$	1	-1	1	-1	$R_x, R_y$	$xz, xy, yz$
$B_u$	1	-1	-1	1	$x, y$	

$C_{3h}$	E	$C_3$	$C_3^2$	$\sigma_h$	$S_3$	$S_3^2$		
$A'$	1	1	1	1	1	1	$R_z$	$x^2 + y^2, z^2$
$E'$	1	$\epsilon$	$\epsilon^*$	1	$\epsilon$	$\epsilon^*$	$x + iy$ $x - iy$	$(x^2 - y^2, xy)$
	1	$\epsilon^*$	$\epsilon$	1	$\epsilon^*$	$\epsilon$		
$A''$	1	1	1	-1	-1	-1	$z$	
$E''$	1	$\epsilon$	$\epsilon^*$	-1	$-\epsilon$	$-\epsilon^*$	$R_x + iR_y$ $R_x - iR_y$	$(xz, yz)$
	1	$\epsilon^*$	$\epsilon$	-1	$-\epsilon^*$	$-\epsilon$		

$C_{4h}$	E	$C_4$	$C_2$	$C_4^3$	i	$S_4$	$\sigma_h$	$S_4^3$		
$A_g$	1	1	1	1	1	1	1	1	$R_z$	$x^2 + y^2, z^2$
$B_g$	1	-1	1	-1	1	-1	1	-1		$x^2 - y^2, xy$
$E_g$	1	$i$	-1	$-i$	1	$i$	-1	$-i$	$R_x + iR_y$	$(xz, yz)$
	1	$-i$	-1	$i$	1	$-i$	-1	$i$	$R_x - iR_y$	
$A_u$	1	1	1	1	-1	-1	-1	-1	$z$	
$B_u$	1	-1	1	-1	-1	1	-1	1		
$E_u$	1	$i$	-1	$-i$	-1	$i$	1	$-i$	$x + iy$	
	1	$-i$	-1	$i$	-1	$-i$	1	$i$	$x - iy$	

$C_{5h}$	E	$C_5$	$C_5^2$	$C_5^3$	$C_5^4$	$\sigma_h$	$S_5$	$S_5^2$	$S_5^3$	$S_5^4$		
$A'$	1	1	1	1	1	1	1	1	1	1	$R_z$	$x^2 + y^2, z^2$
$E_1'$	1	$\epsilon$	$\epsilon^2$	$\epsilon^{2*}$	$\epsilon^*$	1	$\epsilon$	$\epsilon^2$	$\epsilon^{2*}$	$\epsilon^*$	$x + iy$ $x - iy$	
	1	$\epsilon^*$	$\epsilon^{2*}$	$\epsilon^2$	$\epsilon$	1	$\epsilon^*$	$\epsilon^{2*}$	$\epsilon^2$	$\epsilon$		
$E_2'$	1	$\epsilon^2$	$\epsilon^*$	$\epsilon$	$\epsilon^{2*}$	1	$\epsilon^2$	$\epsilon^*$	$\epsilon$	$\epsilon^{2*}$		$(x^2 - y^2, xy)$
	1	$\epsilon^{2*}$	$\epsilon$	$\epsilon^*$	$\epsilon^2$	1	$\epsilon^{2*}$	$\epsilon$	$\epsilon^*$	$\epsilon^2$		
$A''$	1	1	1	1	1	-1	-1	-1	-1	-1	$z$	
$E_1''$	-1	$\epsilon$	$\epsilon^2$	$\epsilon^{2*}$	$\epsilon^*$	-1	$-\epsilon$	$-\epsilon^2$	$-\epsilon^{2*}$	$-\epsilon^*$	$R_x + iR_y$ $R_x - iR_y$	$(xz, yz)$
	-1	$\epsilon^*$	$\epsilon^{2*}$	$\epsilon^2$	$\epsilon$	-1	$-\epsilon^*$	$-\epsilon^{2*}$	$-\epsilon^2$	$-\epsilon$		
$E_2''$	-1	$\epsilon$	$\epsilon^2$	$\epsilon^{2*}$	$\epsilon^*$	-1	$-\epsilon^2$	$-\epsilon^*$	$-\epsilon$	$-\epsilon^{2*}$		

$C_{5h}$	E	$C_5$	$C_5^2$	$C_5^3$	$C_5^4$	$\sigma_h$	$S_5$	$S_5^2$	$S_5^3$	$S_5^4$		
	-1	$\varepsilon^*$	$\varepsilon^{2*}$	$\varepsilon^2$	$\varepsilon$	-1	$-\varepsilon^{2*}$	$-\varepsilon$	$-\varepsilon^*$	$-\varepsilon^2$		

### $D_{nh}$ Groups

$D_{2h}$	E	$C_2(z)$	$C_2(y)$	$C_2(x)$	$i$	$\sigma_{xy}$	$\sigma_{xx}$	$\sigma_{yz}$		
$A_g$	1	1	1	1	1	1	1	1		$x^2, y^2, z^2$
$B_{1g}$	1	1	-1	-1	1	1	-1	-1	$R_z$	$xy$
$B_{2g}$	1	-1	1	-1	1	-1	1	-1	$R_y$	$xz$
$B_{3g}$	1	-1	-1	1	1	-1	-1	1	$R_x$	$yz$
$A_u$	1	1	1	1	-1	-1	-1	-1		
$B_{1u}$	1	1	-1	-1	-1	-1	1	1	$z$	
$B_{2u}$	1	-1	1	-1	-1	1	-1	1	$y$	
$B_{3u}$	1	-1	-1	1	-1	1	1	-1	$x$	

$D_{3h}$	E	$2 C_3$	$3 C_2'$	$\sigma_h$	$2 S_3$	$3 \sigma_v$		
$A_1'$	1	1	1	1	1	1		$x^2 + y^2, z^2$
$A_2'$	1	1	-1	1	1	-1	$R_z$	
$E'$	2	-1	0	2	-1	0	$(R_x, R_y)$	$x^2 - y^2, xy$
$A_1''$	1	1	1	-1	-1	-1		
$A_2''$	1	1	-1	-1	-1	1	$z$	
$E''$	2	-1	0	-2	1	0	$(x, y)$	$(xz, yz)$

$D_{4h}$	E	$2 C_4$	$C_2$	$2 C_2'$	$2 C_2''$	$i$	$2 S_4$	$\sigma_h$	$2 \sigma_v$	$2 \sigma_d$		
$A_{1g}$	1	1	1	1	1	1	1	1	1	1		$x^2 + y^2, z^2$
$A_{2g}$	1	1	1	-1	-1	1	1	1	-1	-1	$R_z$	
$B_{1g}$	1	-1	1	1	-1	1	-1	1	1	-1		$x^2 - y^2$
$B_{2g}$	1	-1	1	-1	1	1	-1	1	-1	1		$xy$
$E_g$	2	0	-2	0	0	2	0	-2	0	0	$(R_x, R_y)$	$(xz, yz)$
$A_{1u}$	1	1	1	1	1	-1	-1	-1	-1	-1		
$A_{2u}$	1	1	1	-1	-1	-1	-1	-1	1	1	$z$	
$B_{1u}$	1	-1	1	1	-1	-1	1	-1	-1	1		
$B_{2u}$	1	-1	1	-1	1	-1	1	-1	1	-1		
$E_u$	2	0	-2	0	0	-2	0	2	0	0	$(x, y)$	

$D_{6h}$	E	$2 C_6$	$2 C_3$	$C_2$	$3 C_2'$	$3 C_2''$	$i$	$2 S_3$	$2 S_6$	$\sigma_h$	$3 \sigma_v$	$3 \sigma_d$		
$A_{1g}$	1	1	1	1	1	1	1	1	1	1	1	1		$x^2 + y^2, z^2$

$D_{6h}$	E	$2 C_6$	$2 C_3$	$C_2$	$3 C_2'$	$3 C_2''$	$i$	$2 S_3$	$2 S_6$	$\sigma_h$	$3 \sigma_v$	$3 \sigma_d$		
$A_{2g}$	1	1	1	1	-1	-1	1	1	1	1	-1	-1	$R_z$	
$B_{1g}$	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1		
$B_{2g}$	1	-1	1	-1	-1	1	1	-1	1	-1	-1	1		
$E_{1g}$	2	-1	1	-2	0	0	2	-1	1	-2	0	0	$(R_x, R_y)$	$(xz, yz)$
$E_{2g}$	2	-1	-1	2	0	0	2	-1	-1	2	0	0		$(x^2 - y^2,)$
$A_{1u}$	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1		
$A_{2u}$	1	1	1	1	-1	-1	-1	-1	-1	-1	1	1	$z$	
$B_{1u}$	1	-1	1	-1	1	-1	-1	1	-1	1	-1	1		
$B_{2u}$	1	-1	1	-1	-1	1	-1	1	-1	1	1	-1		
$E_{1u}$	2	-1	1	-2	0	0	-2	-1	1	2	0	0	$(x, y)$	
$E_{2u}$	2	-1	-1	2	0	0	-2	1	1	-2	0	0		

### $D_{nd}$ Groups

$D_{2d}$	E	$2 S_4$	$C_2$	$2 C_2'$	$2 \sigma_d$		
$A_1$	1	1	1	1	1		$x^2 + y^2, z^2$
$A_2$	1	1	1	-1	-1	$R_z$	
$B_1$	1	-1	1	1	-1		$x^2 - y^2$
$B_2$	1	-1	1	-1	1	$z$	$xy$
E	2	0	-2	0	0	$(x, y) (R_x, R_y)$	$(xz, yz)$

$D_{3d}$	E	$2 C_3$	$3 C_2'$	$i$	$2 S_6$	$3 \sigma_d$		
$A_{1g}$	1	1	1	1	1	1		$x^2 + y^2, z^2$
$A_{2g}$	1	1	-1	1	1	-1	$R_z$	
$E_g$	2	-1	0	2	-1	0	$(R_x, R_y)$	$x^2 - y^2, xy), (xz, yz)$
$A_{1u}$	1	1	1	-1	-1	-1		
$A_{2u}$	1	1	-1	-1	-1	1	$z$	
$E_u$	2	-1	0	-2	1	0	$(x, y)$	

$D_{4d}$	E	$2 S_8$	$2 C_4$	$2 S_8^3$	$C_2$	$4 C_2'$	$4 \sigma_d$		
$A_1$	1	1	1	1	1	1	1		$x^2 + y^2, z^2$
$A_2$	1	1	1	1	1	-1	-1	$R_z$	
$B_1$	1	-1	1	-1	1	1	-1		
$B_2$	1	-1	1	-1	1	-1	1	$z$	
$E_1$	2	$\sqrt{2}$	0	$-\sqrt{2}$	-2	0	0	$(x, y)$	

$D_{4d}$	E	$2 S_8$	$2 C_4$	$2 S_8^3$	$C_2$	$4 C_2'$	$4 \sigma_d$		
$E_2$	2	0	-2	0	2	0	0		$x^2 - y^2, xy$
$E_3$	2	$-\sqrt{2}$	0	$\sqrt{2}$	-2	0	0	$(R_x, R_y)$	$(xz, yz)$

## $S_n$ Groups

### Cubic Groups

$T_d$	E	$8 C_3$	$3 C_2$	$6 S_4$	$6 \sigma_d$		
$A_1$	1	1	1	1	1		$x^2 + y^2 + z^2$
$A_2$	1	1	1	-1	-1		
E	2	-1	2	0	0		$(2z^2 - x^2 - y^2, x^2 - y^2)$
$T_1$	3	0	-1	1	-1	$(R_x, R_y, R_z)$	
$T_2$	3	0	-1	-1	1	$(x, y, z)$	$(xy, xz, yz)$

$O_h$	E	$8 C_3$	$6 C_2$	$6 C_4$	$3 C_2$	$i$	$6 S_4$	$8 S_6$	$3 \sigma_h$	$6 \sigma_d$		
$A_{1g}$	1	1	1	1	1	1	1	1	1	1		$x^2 + y^2 + z^2$
$A_{2g}$	1	1	-1	-1	1	1	-1	1	1	-1		
$E_g$	2	-1	0	0	2	2	0	-1	-2	0		$(2z^2 - x^2 - y^2, x^2 - y^2)$
$T_{1g}$	3	0	-1	1	-1	3	1	0	-1	-1	$(R_x, R_y, R_z)$	
$T_{2g}$	3	0	1	-1	-1	3	-1	0	-1	1		$(xy, xz, yz)$
$A_{1u}$	1	1	1	1	1	-1	-1	-1	-1	-1		
$A_{2u}$	1	1	-1	-1	1	-1	1	-1	-1	1		
$E_u$	2	-1	0	0	2	-2	0	1	-2	0		
$T_{1u}$	3	0	-1	1	-1	-3	-1	0	1	1	$(x, y, z)$	
$T_{2u}$	3	0	1	-1	-1	-3	1	0	1	-1		

## Icosahedral Group

### Linear Groups

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