

## Appendix 10

### DOUBLE GROUP CHARACTER TABLES

The complete character table for the double group  $T_d^*$  and  $O^*$  is given. From this table, the character table for the double group  $O_h^*$  can be immediately obtained. Shortened version of the double group character tables are given for some other point groups. These shortened versions only show the new irreducible representations, the symmetry operations, and the characters. These shortened tables should be added to the bottom of the appropriate single group character table in Appendix 3. The discussion in Chapter 8 or the observation of the complete double group character table for  $O^*$  shown here, demonstrates exactly how this shortened version should be adjoined to the single group character table in Appendix 3. Note that there are many different notations for the irreducible representations of the double groups, so care should be taken when reading other sources.

$T_d^*$		E	R	$4C_3$	$4C_3^2$	$3C_2$	$3S_4$	$3S_4^3$	$6\sigma_d$	
				$4C_3R$	$4C_3^2R$	$3C_2R$	$3S_4R$	$3S_4^3R$	$6\sigma_dR$	
$O^*$		E	R	$4C_3$	$4C_3^2$	$3C_2$	$3C_4$	$3C_4^3$	$6C_2$	
				$4C_3^2R$	$4C_3R$	$3C_2R$	$3C_4^3R$	$3C_4R$	$6C_2R$	
		E	R	$8C_3$	$8C_3R$	$6C_2$	$6C_4$	$6C_4R$	$12C_2$	
$(\Gamma_1)$	$A_1$	1	1	1	1	1	1	1	1	
$(\Gamma_2)$	$A_2$	1	1	1	1	1	-1	-1	-1	
$(\Gamma_3)$	$E_1$	2	2	-1	-1	2	0	0	0	
$(\Gamma_4)$	$T_1$	3	3	0	0	-1	1	1	-1	
$(\Gamma_5)$	$T_2$	3	3	0	0	-1	-1	-1	1	
$(\Gamma_6)$	$E_{1/2}$	2	-2	1	-1	0	$\sqrt{2}$	$-\sqrt{2}$	0	
$(\Gamma_7)$	$E_{5/2}$	2	-2	1	-1	0	$-\sqrt{2}$	$\sqrt{2}$	0	
$(\Gamma_8)$	G	4	-4	-1	1	0	0	0	0	
$T^*$		E	R	$4C_3$	$4C_3R$	$4C_3^2$	$4C_3^2R$	$3C_2$	$\epsilon = \exp(2\pi i/3)$	
								$3C_2R$		
$(\Gamma_4)$	$E_{1/2}$	2	-2	1	-1	-1	1	0		
$(\Gamma_5)$	G	2	-2	$\epsilon$	$-\epsilon$	$-\epsilon^*$	$\epsilon^*$	0	}	
		2	-2	$\epsilon^*$	$-\epsilon^*$	$-\epsilon$	$\epsilon$	0		
$D_{3h}^*$		E	R	$S_3$	$S_3^5$	$C_3$	$C_3^2$	$\sigma_h$	$3C_2$	$3\sigma_v$
				$S_3^5R$	$S_3R$	$C_3^2R$	$C_3R$	$\sigma_hR$	$3C_2R$	$3\sigma_vR$
$C_{6v}^*$		E	R	$C_6$	$C_6^5$	$C_3$	$C_3^2$	$C_2$	$3\sigma_v$	$3\sigma_d$
				$C_6^5R$	$C_6R$	$C_3^2R$	$C_3R$	$C_2R$	$3\sigma_vR$	$3\sigma_dR$
$D_6^*$		E	R	$C_6$	$C_6^5$	$C_3$	$C_3^2$	$C_2$	$3C_2$	$3C_2'$
				$C_6^5R$	$C_6R$	$C_3^2R$	$C_3R$	$C_2R$	$3C_2R$	$3C_2''R$
$(\Gamma_7)$	$E_{1/2}$	2	-2	$\sqrt{3}$	$-\sqrt{3}$	1	-1	0	0	0
$(\Gamma_8)$	$E_{3/2}$	2	-2	0	0	-2	2	0	0	0
$(\Gamma_9)$	$E_{5/2}$	2	-2	$-\sqrt{3}$	$\sqrt{3}$	1	-1	0	0	0

$D_{2d}^*$	E	R	$S_4$	$S_4^3$	$C_2$	$2C_2'$	$2\sigma_d$
			$S_4^3R$	$S_4R$	$C_2R$	$2C_2'R$	$2\sigma_dR$
$C_{4v}^*$	E	R	$C_4$	$C_4^3$	$C_2$	$2\sigma_v$	$2\sigma_d$
			$C_4^3R$	$C_4R$	$C_2R$	$2\sigma_vR$	$2\sigma_dR$
$D_4^*$	E	R	$C_4$	$C_4^3$	$C_2$	$2C_2'$	$2C_2''$
			$C_4^3R$	$C_4R$	$C_2R$	$2C_2'R$	$2C_2''R$
$(\Gamma_6)$	$E_{1/2}$	2	-2	$\sqrt{2}$	$-\sqrt{2}$	0	0
$(\Gamma_7)$	$E_{3/2}$	2	-2	$-\sqrt{2}$	$\sqrt{2}$	0	0

$C_{3v}^*$	E	R	$C_3$	$C_3^2$	$3\sigma_v$	$3\sigma_vR$
			$C_3^2R$	$C_3R$		
$D_3^*$	E	R	$C_3$	$C_3^2$	$3C_2$	$3C_2R$
			$C_3^2R$	$C_3R$		
$(\Gamma_4)$	$E_{1/2}$	2	-2	1	-1	0
$(\Gamma_5)$	$E_{3/2}$	$\left\{ \begin{array}{l} 1 \quad -1 \quad -1 \quad 1 \quad 1 \quad -1 \\ 1 \quad -1 \quad -1 \quad 1 \quad -1 \quad 1 \end{array} \right\}$				

$C_{2v}^*$	E	R	$C_2$	$\sigma_v$	$\sigma_d$
			$C_2R$	$\sigma_vR$	$\sigma_dR$
$D_2^*$	E	R	$C_2$	$C_2(y)$	$C_2(x)$
			$C_2R$	$C_2(y)R$	$C_2(x)R$
$(\Gamma_5)$	$E_{1/2}$	2	-2	0	0

$C_{\infty v}^*$	E	$2C_{\infty}(\phi)$	$2C_{\infty}(2\phi)$	...	$\infty\sigma_v$	R	$2C_{\infty}(\phi)R$	...
$A_1\Sigma^+$	1	1	1	...	1	1	1	...
$A_2\Sigma^-$	1	1	1	...	-1	1	1	...
$E_1\Pi$	2	$2\cos\phi$	$2\cos 2\phi$	...	0	2	$2\cos\phi$	...
$E_2\Delta$	2	$2\cos 2\phi$	$2\cos 2\cdot 2\phi$	...	0	2	$2\cos 2\phi$	...
$E_3\phi$	2	$2\cos 3\phi$	$2\cos 2\cdot 3\phi$	...	0	2	$2\cos 3\phi$	...
...	...	...	...	...	...	...	...	...
$E_{1/2}$	2	$2\cos \phi/2$	$2\cos\phi$	...	0	-2	$-2\cos \phi/2$	...
$E_{3/2}$	2	$2\cos 3\phi/2$	$2\cos 3\phi$	...	0	-2	$-2\cos 3\phi/2$	...
$E_{5/2}$	2	$2\cos 5\phi/2$	$2\cos 5\phi$	...	0	-2	$-2\cos 5\phi/2$	...

$[D_{\infty h} = C_{\infty v} \times C_i]$