

### D. The $D_{nh}$ Groups

$D_{2h}$	$E$	$C_2(z)$	$C_2(y)$	$C_2(x)$	$i$	$\sigma(xy)$	$\sigma(xz)$	$\sigma(yz)$			
$A_g$	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			$xyz$
$B_{1u}$	1	1	-1	-1	-1	-1	1	1			$z^3, z(x^2 - y^2)$
$B_{2u}$	1	-1	1	-1	-1	1	-1	1		$y$	$yz^2, y(3x^2 - y^2)$
$B_{3u}$	1	-1	-1	1	-1	1	1	-1		$x$	$xz^2, x(x^2 - 3y^2)$

  

$D_{3h}$	$E$	$2C_3$	$3C_2$	$\sigma_h$	$2S_3$	$3\sigma_v$	(x axis coincident with $C_2$ )					
$A'_1$	1	1	1	1	1	1					$x^2 + y^2, z^2$	$x(x^2 - 3y^2)$
$A'_2$	1	1	-1	1	1	-1	$R_z$					$y(3x^2 - y^2)$
$E'$	2	-1	0	2	-1	0	$(x, y)$				$(x^2 - y^2, xy)$	$(xz^2, yz^2)$
$A''_1$	1	1	1	-1	-1	-1						$z^3$
$A''_2$	1	1	-1	-1	-1	1	$z$					$[xyz, z(x^2 - y^2)]$
$E''$	2	-1	0	-2	1	0	$(R_x, R_y)$				$(xz, yz)$	

  

$D_{4h}$	$E$	$2C_4$	$C_2$	$2C'_2$	$2C''_2$	$i$	$2S_4$	$\sigma_h$	$2\sigma_v$	$2\sigma_d$	(x axis coincident with $C'_2$ )			
$A_{1g}$	1	1	1	1	1	1	1	1	1	1				
$A_{2g}$	1	1	1	-1	-1	1	1	1	-1	-1	$R_z$		$x^2 + y^2, z^2$	
$B_{1g}$	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	$(R_x, R_y)$		$xy$	
$E_g$	2	0	-2	0	0	2	0	-2	0	0			$(xz, yz)$	
$A_{1u}$	1	1	1	1	1	-1	-1	-1	-1	-1				$z^3$
$A_{2u}$	1	1	1	-1	-1	-1	-1	-1	1	1	$z$			$xyz$
$B_{1u}$	1	-1	1	1	-1	-1	1	-1	-1	1			$z(x^2 - y^2)$	
$B_{2u}$	1	-1	1	-1	1	-1	1	-1	1	-1				$(xz^2, yz^2), [x(x^2 - 3y^2), y(3x^2 - y^2)]$
$E_u$	2	0	-2	0	0	-2	0	2	0	0	$(x, y)$			

  

$D_{5h}$	$E$	$2C_5$	$2C_5^2$	$5C_2$	$\sigma_h$	$2S_5$	$2S_5^3$	$5\sigma_v$	(x axis coincident with $C_2$ )			
$A'_1$	1	1	1	1	1	1	1	1				$x^2 + y^2, z^2$
$A'_2$	1	1	1	-1	1	1	1	-1	$R_z$			
$E'_1$	2	$2 \cos 72^\circ$	$2 \cos 144^\circ$	0	2	$2 \cos 72^\circ$	$2 \cos 144^\circ$	0	$(x, y)$			$(xz^2, yz^2)$
$E'_2$	2	$2 \cos 144^\circ$	$2 \cos 72^\circ$	0	2	$2 \cos 144^\circ$	$2 \cos 72^\circ$	0				$(x^2 - y^2, xy)$
$A''_1$	1	1	1	1	-1	-1	-1	-1				
$A''_2$	1	1	1	-1	-1	-1	-1	1	$z$			$z^3$
$E''_1$	2	$2 \cos 72^\circ$	$2 \cos 144^\circ$	0	-2	$-2 \cos 72^\circ$	$-2 \cos 144^\circ$	0	$(R_x, R_y)$			$(xz, yz)$
$E''_2$	2	$2 \cos 144^\circ$	$2 \cos 72^\circ$	0	-2	$-2 \cos 144^\circ$	$-2 \cos 72^\circ$	0				$[xyz, z(x^2 - y^2)]$

  

$D_{6h}$	$E$	$2C_6$	$2C_3$	$C_2$	$3C'_2$	$3C''_2$	$i$	$2S_3$	$2S_6$	$\sigma_h$	$3\sigma_d$	$3\sigma_v$	(x axis coincident with $C'_2$ )		
$A_{1g}$	1	1	1	1	1	1	1	1	1	1	1	1			
$A_{2g}$	1	1	1	1	-1	-1	1	1	1	1	-1	-1	$R_z$		$x^2 + y^2, z^2$
$B_{1g}$	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			$(x^2 - y^2, xy)$
$A_{1u}$	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1			$z^3$
$A_{2u}$	1	1	1	-1	-1	-1	-1	-1	-1	-1	1	1	$z$		$x(x^2 - 3y^2)$
$B_{1u}$	1	-1	1	-1	1	-1	-1	1	-1	1	-1	1			$y(3x^2 - y^2)$
$B_{2u}$	1	-1	1	-1	-1	1	-1	1	-1	1	1	-1			$(xz^2, yz^2)$
$E_{1u}$	2	1	-1	-2	0	0	-2	-1	1	2	0	0	$(x, y)$		$[xyz, z(x^2 - y^2)]$
$E_{2u}$	2	-1	-1	2	0	0	-2	1	1	-2	0	0			

### The $D_{nh}$ Groups (continued)

$D_{8h}$	$E$	$2C_8$	$2C_8^3$	$2C_4$	$C_2$	$4C_2'$	$4C_2''$	$i$	$2S_8^3$	$2S_8$	$2S_4$	$\sigma_h$	$4\sigma_v$	$4\sigma_d$	(x axis coincident with $C_2'$ )		
$A_{1g}$	1	1	1	1	1	1	1	1	1	1	1	1	1	1	$R_z$	$x^2 + y^2, z^2$	
$A_{2g}$	1	1	1	1	1	-1	-1	1	1	1	1	1	-1	-1			
$B_{1g}$	1	-1	-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	-1	1			
$E_{1g}$	2	$\sqrt{2}$	$-\sqrt{2}$	0	-2	0	0	2	$\sqrt{2}$	$-\sqrt{2}$	0	-2	0	0	$(R_x, R_y)$	$(xz, yz)$ $(x^2 - y^2, xy)$	
$E_{2g}$	2	0	0	-2	2	0	0	2	0	0	-2	2	0	0			
$E_{3g}$	2	$-\sqrt{2}$	$\sqrt{2}$	0	-2	0	0	2	$-\sqrt{2}$	$\sqrt{2}$	0	-2	0	0			
$A_{1u}$	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	$z$	$z^3$	
$A_{2u}$	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	1	1			
$B_{1u}$	1	-1	-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	1	-1			
$E_{1u}$	2	$\sqrt{2}$	$-\sqrt{2}$	0	-2	0	0	-2	$-\sqrt{2}$	$\sqrt{2}$	0	2	0	0	$(x, y)$	$(xz^2, yz^2)$ $[xyz, z(x^2 - y^2)]$ $[x(x^2 - 3y^2), y(3x^2 - y^2)]$	
$E_{2u}$	2	0	0	-2	2	0	0	-2	0	0	2	-2	0	0			
$E_{3u}$	2	$-\sqrt{2}$	$\sqrt{2}$	0	-2	0	0	-2	$\sqrt{2}$	$-\sqrt{2}$	0	2	0	0			