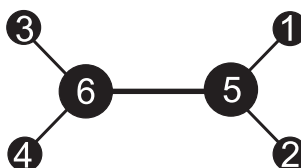


*Fundamentals of Molecular Symmetry*  
 Week 7/11

*Exercises*

7.1 For the ethylene molecule  $C_2H_4$



we use the molecular symmetry group  $D_{2h}(M)$  with the character table

$R :$	$E$	$(12)(34)$	$(13)(24)(56)$	$(14)(23)(56)$	$E^*$	$(12)(34)^*$	$(13)(24)(56)^*$	$(14)(23)(56)^*$
$A_g :$	1	1	1	1	1	1	1	1
$A_u :$	1	1	1	1	-1	-1	-1	-1
$B_{1g} :$	1	1	-1	-1	-1	-1	1	1
$B_{1u} :$	1	1	-1	-1	1	1	-1	-1
$B_{2g} :$	1	-1	1	-1	-1	1	-1	1
$B_{2u} :$	1	-1	1	-1	1	-1	1	-1
$B_{3g} :$	1	-1	-1	1	1	-1	-1	1
$B_{3u} :$	1	-1	-1	1	-1	1	1	-1

Determine the spin statistical weight factors for  $^{12}C_2H_4$ .

7.2 Symmetrical linear molecules ABC...CBA have the MS-Group  $C_{2v}(M) = \{E, (p), E^*, (p)^*\}$ . Here  $(p)$  is the permutation that simultaneous interchanges the two A nuclei, the two B nuclei, the two C nuclei, ...

Determine the spin statistical weight factors for the molecules  $^{14}N^{12}C^{12}C^{14}N$ ,  $^{15}N^{12}C^{12}C^{15}N$ ,  $^{14}N^{13}C^{13}C^{14}N$ , and  $^{15}N^{12}C^{12}C^{14}N$  which were discussed in the lecture.