

## Applications of Group Theory

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Lectures

H33, Mondays, 14:15

H34, Thursdays, 14:15

Exercises

5.0.21, Wednesdays, 13:15

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**Sheet 5**

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**1. Relations between groups**

Consider the following set of point symmetry groups:  $C_3$ ,  $C_{3v}$ ,  $C_{3h}$ ,  $S_3$ ,  $D_3$ , and  $D_{3h}$ . Draw the stereogram associated to each of these groups and conclude which is the relation between the different sets of point symmetry operations.

**2. Character of a class**

The character of a matrix representative for a group element is nothing else than the trace of that matrix. The character is in reality associated to a class of symmetry operations thanks to the invariance of the trace under similarity transformations. Prove the latter statement.

**3. Reduce a representation**

Suppose that you have the following set of characters:  $\chi(E) = 4$ ,  $\chi(\sigma_h) = 2$ ,  $\chi(C_3) = 1$ ,  $\chi(S_3) = -1$ ,  $\chi(C'_2) = 2$ ,  $\chi(\sigma_v) = 0$ .

1. Do these characters correspond to a representation of the point group  $D_{3h}$ ? Is it irreducible?
2. If the representation is reducible, find the irreducible representations contained therein.
3. Give an example of molecule with  $D_{3h}$  symmetry.

**Frohes Schaffen!**