

1.6: Constructing higher groups from simpler groups

A group that contains a large number of symmetry elements may often be constructed from simpler groups. This is probably best illustrated using an example. Consider the point groups C_2 and C_S . C_2 contains the elements E and C_2 , and has order 2, while C_S contains E and σ and also has order 2. We can use these two groups to construct the group C_{2v} by applying the symmetry operations of C_2 and C_S in sequence.

$$\begin{array}{llll} C_2 \text{ operation} & E & E & C_2 & C_2 \\ C_S \text{ operation} & E & \sigma(xz) & E & \sigma(xz) \\ \text{Result} & E & \sigma_v(xz) & C_2 & \sigma'_v(yz) \end{array} \quad (6.1)$$

Notice that C_{2v} has order 4, which is the product of the orders of the two lower-order groups. C_{2v} may be described as a direct product group of C_2 and C_S . The origin of this name should become obvious when we review the properties of matrices.

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