

## 1.22: Summary of the Steps Involved in Constructing Molecular Orbitals

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1. Choose a basis set of functions  $f_i$  consisting of the valence atomic orbitals on each atom in the system, or some chosen subset of these orbitals.
2. With the help of the appropriate character table, determine which irreducible representations are spanned by the basis set using Equation (15.20) to determine the number of times  $a_k$  that the  $k^{th}$  irreducible representation appears in the representation.

$$a_k = \frac{1}{h} \sum_C n_C \chi(g) \chi_k(g) \quad (1.22.1)$$

3. Construct the SALCs  $\phi_i$  that transform as each irreducible representation using Equation 16.1

$$\phi_i = \sum_g \chi_k(g) g f_i \quad (1.22.2)$$

4. Write down expressions for the molecular orbitals by taking linear combinations of all the irreducible representations of the same symmetry species.
  5. Write down the secular equations for the system.
  6. Solve the secular determinant to obtain the energies of the molecular orbitals.
  7. Substitute each energy in turn back into the secular equations and solve to obtain the coefficients appearing in your molecular orbital expressions in step 4.
  8. Normalize the orbitals.
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