Exercise 12.1

Determine the qualitative form of the molecular orbitals for the square-planar complex $[Ni(CN)_4]^{2-}$. (Assume that each CN ligand provides one σ-type and two π-type orbitals to the system.)

Solution 12.1

Exercise 12.2

Determine the qualitative form of the molecular orbitals for the tetrahedral molecule MnO_4^-. [Assume that each oxygen atom provides just three p-orbitals (set these up so that one points towards the Mn and the other two are perpendicular to each other and to the Mn—O axis) and that the Mn atom provides 4s and 3d orbitals.] You will be on the right track if you find that

$$\Gamma^{\sigma} = \Gamma^{A_1} \oplus \Gamma^{T_2},$$
$$\Gamma^{\pi} = \Gamma^{E} \oplus \Gamma^{T_1} \oplus \Gamma^{T_2}.$$

Solution 12.2

Exercise 12.3

Determine the qualitative form of the molecular orbitals for the eclipsed conformation of ferrocene.

Solution 12.3

Exercise 12.4

For an octahedral environment the d-orbitals are split into two sets (d_{e_g} and $d_{t_{2g}}$); how would they be split for a square-planar environment?

Solution 12.4

Exercise 12.5

Set up s qualitative correlation diagram for the d^3 configuration in an octahedral environment.

Solution 12.5