Exercise 7.1

Given the characters χ of a reducible representation Γ of the indicated point group $\mathscr{G}$ for the various classes of $\mathscr{G}$ in the order in which these classes appear in the character table, find the number of times irreducible representation occurs in Γ.

1. $\mathscr{C}_{2v}$ $\chi = 4, -2, 0, -2,$

2. $\mathscr{C}_{3h}$ $\chi = 4, 1, 1, 2, -1, -1,$

3. $\mathscr{D}_{4d}$ $\chi = 6, 0, -2, 0, -2, 0, 0,$

4. $\mathscr{O}_h$ $\chi = 15, 0, -1, 1, 1, -3, 0, 5, -1, 3.$

Solution 7.1

Exercise 7.2

Consider the four functions of Problem 5.2 which form a basis for a reducible representation Γ of $\mathscr{D}_4$. Using projection operators find the orthonormal basis functions which reduce Γ. Assume $(f_i, f_j) = \delta_{ij}$.

Solution 7.2

Exercise 7.3

Show that the characters of $\mathscr{C}_{4v}$ obey the orthogonality rules of eqns (7.3-5) and (A.7-3.10).

Solution 7.3

Exercise 7.4

How many times does each irreducible representation of the $\mathscr{C}_{2v}$ point group occur in the nine-dimentional representation found in Problem 5.3?

Solution 7.4

Exercise 7.5

Consider the group whose group table is

	E	A	B	C
E	E	A	B	C
A	A	C	E	B
B	B	E	C	E
C	C	B	A	A

Solution 7.5

Exercise 7.6

Determine the irreducible representation to which the following real orbitals belong for the indicated point group:

1. p_1, p_2, p_3 in $\mathscr{D}_4$ and $\mathscr{D}_{2h}$,

2. d_1, d_2, d_3, d_4, d_5 in $\mathscr{O}_h$,

3. d_1, d_2, d_3, d_4, d_5 in $\mathscr{D}_{3h}$,

4. d_1, d_2, d_3, d_4, d_5 in $\mathscr{T}_d$.

Solution 7.6