

3.11: Problems

1. Find the symmetry elements and point groups for the following molecules

- SF_4
- $CHCl_3$
- Pyridine
- Naphthalene
- ICl_5
- PCl_5

2. Consider diazine, which has three isomers. Determine which isomer(s) has/have C_{2v} symmetry and which has/have D_{2h} symmetry.

3. Complete the following character table.

	E	2 A	2 B	C	3 D	3 F
A_1	1	1	1	1	1	1
A_2	1	1	1	1	-1	-1
B_1			1			
B_2	1	-1	1	-1	-1	1
E_1			1			
E_2			-1			

4. Complete the following direct product table.

C_{4h}	A_g	B_g	E_g	A_u	B_u	E_u
A_g	A_g	B_g	E_g	A_u	B_u	E_u
B_g	B_g					
E_g	E_g		$A_g + B_g + E_g$			$A_u + B_u + E_u$
A_u	A_u			A_g		
B_u	B_u					
E_u	E_u					

5. Consider the following group multiplication table. Separate the operations into classes.

	E	A	B	C	D	F
E	E	A	B	C	D	F
A	A	B	E	F	C	D
B	B	E	A	D	F	C
C	C	D	F	E	A	B
D	D	F	C	B	E	A
F	F	C	D	A	B	E

6. Demonstrate that the A_2 , B_1 , B_2 and E irreducible representations are orthogonal to the A_1 irreducible representation under the point group C_{4v} .

7. A point group has 8 operations which fall into five classes. How many irreducible representations will it have? How many will be singly degenerate? How many will be doubly degenerate?
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