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Point gr | (5)

$C_{\infty v}$ = Linear molecu
HCl, CO (high symmetry)

(1) C_{nh} point gr →

formula $\boxed{C_{nh} = C_n + 1\sigma_h}$

Total No of elements / operation = $2n$

(2) C_{nv} point gr →

$$C_{nv} = C_n + n\sigma_v$$

(as C_{3v} – NH_3)

Total No of operations = $2n$

As if $n=2$, then $C_{2v} = 4 = \underset{1}{C_2} + \underset{2}{2\sigma_v} + \underset{1}{E}$

(3) D_{nh} point gr →

formula → $C_n + nC_2 + n\sigma_v + 1\sigma_h$

No. of operation = $4n$

$\boxed{D_{\infty h} = CO_2}$

As if ($n=2$) then →

$8 = D_{2h} = \underset{1}{C_2} + \underset{2}{2C_2} + \underset{2}{2\sigma_v} + \underset{1}{1\sigma_h} + \underset{1}{E} + \underset{1}{S_n}$

as $\boxed{BF_3 \text{ है } D_{3h}}$

↳ $C_3 + 3\sigma_v + 1\sigma_h + 3C_2$

(4) D_{nd} point gr → $C_n + nC_2 + n\sigma_d$

No of operations = $4n$

As → $8 = D_{2d} = \underset{1}{C_2} + \underset{2}{2C_2} + \underset{2}{2\sigma_d} + \underset{1}{E} + \underset{2}{S_4}$

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(5) C_n point gr → $\boxed{C_n + E}$ (6)

No of operations $= n$

(as) $C_2 = C_2 + E$

$C_3 = C_3 + E$

(6) S_{2n} point gr

→ $S_{2n} + C_n + E$

→ No of operation $= 2n$

→ (AS) $S_4 = \underset{(2)}{S_4} + \underset{(1)}{C_2} + \underset{(1)}{E} = 4$

(7) D_n pointgr →

$C_n + nC_2$

→ No of operations $= 2n$

(ay) $6 = D_3 = \underset{(2)}{C_3} + \underset{(3)}{3C_2} + \underset{(1)}{E}$

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Method 7A 2Dec

(9) Reducible & irreducible char...

Each molecular point gr के matrix representation 2 तरीके से करते हैं

① Irreducible → इसे character (χ) कहते हैं

② Reducible

↳ एक molecular point gr के जितने class (symmetry elements) होंगे, उतने ही character or irreducible representation होंगे।

as E का matrix representation होता है →

$$E = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$ → इसमें upper left से lower right में चलने पर जो elements होते उनके addition को ही character कहते हैं

↓

$$\begin{bmatrix} 1 & 0 & 0 \\ \hline 0 & 1 & 0 \\ \hline 0 & 0 & 1 \end{bmatrix}$$

→ so, Block method से,

→ E के irreducible representation होंगे 1, 1, 1

$$C_2 \rightarrow \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \rightarrow -1 \quad -1 \quad 1$$

$$\sigma_{xz} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \rightarrow 1 \quad -1 \quad 1$$

$$\sigma_{yz} = \begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = -1 \quad 1 \quad 1$$

↳ किसी भी molecular point gr के उतने ही character होंगे, जितने class (symmetry element) होंगे

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(6)

(10) चूँकि C_{2v} point group में 4 class हैं, so 4 ही character होंगे।

C_{2v} → block method से प्राप्त value लिख लेते हैं

	E	C_2	σ_{xz}	σ_{yz}
Γ_1	1	-1	1	-1
Γ_2	1	-1	-1	1
Γ_3	1	-1	1	1
Γ_4				

→ ये एक type का representation

ie IE की 4 value हो सकती हैं उनमें से Γ_1, Γ_2, Γ_3 को हम Block method (Matrix) से निकाल सकते हैं & चौथी value को GOT Theorem से निकालते हैं।

ग ~ ॥

(11)

Reducible Matrix representation
(2 तरीको से)

① Irred.
बहुत लम्बी Matrix को छोटे-2 block मे represent करते है)

II) Reduce
जब छोटे-2 block को अब और छोटे-2 part मे न हो सकते है)

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order = NO of symmetry element

(14)

rule No 4 → The character of symmetry opera gama

~~of class~~

$\boxed{\text{GOT}}$ Theorm (1)

If $\Gamma_1, \Gamma_2, \Gamma_3 \rightarrow$ irreduciples representations of gr

$l_1, l_2, l_3 \cdots \longrightarrow$ dimensions

(1) The NO of irreducible representations in a gr = NO of classes in the group.

C_{2V}	E	$C_2(z)$	$\sigma_V(xz)$	$\sigma_V(yz)$
Γ_1				
Γ_2				
Γ_3				
Γ_3				

where E, $C_2(z)$, $\sigma_V(xz)$ & $\sigma_V(yz)$ are 4 classes of C_{2V} point gr

(2) (13)

one operation associated

C_{2v}	E	$C_2(z)$	$\sigma_v(xz)$	$\sigma_v(yz)$
Γ_1	1	1	1	1
Γ_2	1	1	-1	-1
Γ_3	1	-1	1	-1
Γ_4	1	-1	-1	1

These are different irreducible represent

Rule II → The sum of squares of characters of the identity operation in the irreducible is equal to h

$$\Sigma[\chi_i(E)]^2 = h$$

$$1^2+1^2+1^2+1^2 = 4$$

$$\text{Order of this character table} = 4$$

$\boxed{\text{Rule III}}$ → The sum of square of dimensions of the irreps of a a gr is equal to h

$$\sum_{l=0}^{k} l^2 = h$$

ie each element के साथ जितने operation associated है each के साथ one है C_2 ऊपर table के C_2v point gr के each के dimension one है So $1^2+1^2+1^2+1^2 = 4$

order = No of symmetry element

(14)

Rule No 4 → The character of symmetry operat in two different irreps are orthogon to each other

$$\sum [g_p \chi_i(R) \chi_j(R)] = 0$$

$g_p = 1$ $\quad 1(1)(1) + 1(1)(1) + 1(1)(-1) + 1(1)(-1) = 0$

E के

(5) The characters of all the matrices belonging to the symmetry operations in the same class are identical

C_{2v} point gr के each class or symmetry operation है element का एक है

so $g_p = 1$

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