

Question #61800, Chemistry, Other

Calculate the number of normal modes of vibration of BrF_5 and XeF_2 .

Answer:

BrF_5

$$[3n_1-5] + [3n_2-6]$$

$3n-5$ is the formula for number of modes of vibration in linear molecule

$3n-6$ is the formula for number of modes of vibration in non-linear

combined both because the given molecule is complex (BrF_5)

where n = no. of electrons

where n_1 = no of electrons in linear (i.e., F & Lonepair in axial)

where n_2 = no of electrons in non-linear {4 F's in sq.plane}

F has 6e's

$$\Rightarrow 3 \cdot (2 \cdot 6) - 5 + 3 \cdot (4 \cdot 6) - 6 = 3 \cdot 8 + 3 \cdot 24 - 11 = 24 + 72 - 11 = 85$$

Modes of Vibration in $\text{BrF}_5 = 85$

XeF_2 {also a complex} trigonal bipyramidal shape

lone pairs occupying a triangular plane

F's in axial because they're more EN than Lone Pair

$$\Rightarrow 3 \cdot (2 \cdot 6) - 5 + 3 \cdot (3 \cdot 2) - 6 = 3 \cdot 12 + 3 \cdot 6 - 11 = 36 + 18 - 11 = 63$$

Modes of Vibration in $\text{XeF}_2 = 63$

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