

Molecular Geometry

Van Koppes/Offen

Formal Charge (FC)	# of bonded atoms	# of lone pairs	Geometry	Bond Angle (°)	Hybridization	Example	Hybridization
0	2	0	Linear	180	sp	CO_2 $BeCl_2$	sp
0	3	0	Trigonal Planar	120	sp^2	BF_3 SO_3	sp^2
0	3	1	Trigonal Planar	120	sp^2	NO_2	sp^2
0	4	0	Tetrahedral	109.5	sp^3	CH_4 CCl_4	sp^3
0	4	1	Trigonal Bipyramidal	90, 120	sp^3d	PCl_5	sp^3d
0	5	0	Trigonal Bipyramidal	90, 120	sp^3d	PF_5	sp^3d
0	5	1	Trigonal Bipyramidal	90, 120	sp^3d	ClF_3	sp^3d
0	6	0	Octahedral	90	sp^3d^2	SF_6	sp^3d^2
0	6	1	Octahedral	90	sp^3d^2	BrF_5	sp^3d^2
0	6	2	Octahedral	90	sp^3d^2	IF_6^+	sp^3d^2
0	7	0	Pentagonal Bipyramidal	90, 120	sp^3d^2	IF_7	sp^3d^2

Example: Draw Lewis Structures, Molecular Formulas, Hybridization, Molecular Geometry and Hybridization for CO_2 , SO_3 , NO_2 , PCl_5 , ClF_3 , SF_6 , BrF_5 , IF_6^+ , IF_7 . Be sure to include all lone pairs and formal charges. (10)

Tip: If two substituents are electronegative, they have one sp^3 hybrid orbital. The number of orbitals is determined by the number of substituents, and it can also be related to hybridization. The other number of sp^3 hybrid orbitals is determined by the number of lone pairs.

Tip: If you have a central atom with 6 bonds, it is sp^3d^2 hybridized and a single bond counts as one sp^3 hybrid orbital or bond. If you have 7 bonds, it is sp^3d^2 hybridized and a single bond counts as one sp^3 hybrid orbital or bond.