

Molecular Geometry

Van Koppes/Offin

Central Atom, AX _n E _m	# of bonded atoms	# of lone pairs	Electron Geometry	Bond Angle(s)	Molecular Geometry	Example	Hybridization
AX	1	0	Linear	180°	Linear	HCl	sp
AX ₂	2	0	Linear	180°	Linear	CO ₂	sp
AX ₂ E	2	1	Trigonal Planar	120°	Bent	SO ₂	sp ²
AX ₃	3	0	Trigonal Planar	120°	Trigonal Planar	BF ₃	sp ²
AX ₃ E	3	1	Tetrahedral	109.5°	Trigonal Pyramidal	NH ₃	sp ³
AX ₄	4	0	Tetrahedral	109.5°	Tetrahedral	CH ₄	sp ³
AX ₄ E	4	1	Trigonal Bipyramidal	90°, 120°	See-saw	SF ₄	sp ³ d
AX ₅	5	0	Trigonal Bipyramidal	90°, 120°	Trigonal Bipyramidal	PCl ₅	sp ³ d
AX ₅ E	5	1	Octahedral	90°	Square Pyramidal	BrF ₅	sp ³ d ²
AX ₆	6	0	Octahedral	90°	Octahedral	SF ₆	sp ³ d ²
AX ₆ E	6	1	Octahedral	90°	Square Planar	XeF ₄	sp ³ d ²
AX ₇	7	0	Pentagonal Bipyramidal	90°, 120°	Pentagonal Bipyramidal	IF ₇	sp ³ d ³

Example: Draw Lewis Structures, Molecular Formulas, Electron GE, Molecular Geometry and Hybridization for 1-10 of the following molecules. Indicate the hybridization (sp, sp², sp³, sp³d, sp³d², sp³d³) for the central atom(s) of all atoms (non-hydrogen) in each.

Tip: If two central atoms are highlighted, they have one sp hybrid orbital. The number of orbitals is always equal to the hybridization, and it can also be related to the number of sp hybrid orbitals. The other orbitals (p, d) are not hybridized in these two situations of sp hybrid orbitals. The other orbitals (p, d) are not hybridized in these two situations.

How do you know if a central atom is sp, sp², sp³, sp³d, sp³d², or sp³d³?

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